SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

FIELD OF THE INVENTION

The present invention relates to the field of secondary batteries, in particular to a secondary battery cell and winding formation system thereof.

BACKGROUND OF THE INVENTION

The lithium ion battery (one kind of secondary batteries) is widely used in the fields of electronic products, automobiles, electric vehicles, aerospace, micro-electromechanical systems, energy storage and the like. As the application environment and conditions tend to be more complex and rigorous, high requirements are proposed to the usage safety performance, energy density and manufacturing cost of the lithium-ion battery.

In the prior art, the purpose of improving energy density is achieved by configuring a groove on an electrode plate and welding anelectrode tabin the groove. However, the process is realized by independent laser cleaning device and welding-winding device respectively at the present stage. The comprehensive cost of the devices is high, and the factory buildings occupy large space, with the result the manufacturing cost of the entire lithium battery is high. Furthermore, the laser cleaned groove on the electrode plate has an overheated perforation or a burned hole on the edge due to focal length fluctuation and deviation, such that a plenty of burrs are formed on a current collector on the edge of the groove; if the electrode plate with burrs is directly manufactured into a cell without processing, then the burrs will pierce theseparator to cause internal short circuit, a fire disaster and other severe potential safety hazards. In the prior art, a thick adhesive tape is stuck in the groove to prevent the burrs from piercing the separator. However, sticking an adhesive tape in the groove will certainly increase the thickness of the cell, thus causing loss to energy density.

SUMMARY OF THE INVENTION

To solve the problems in the prior art, the object of the present invention is to provide a secondary battery cell, which can prevent the secondary battery cell from generating internal short circuit while improving the energy density of the secondary battery cell, thus improving the safety performance of the secondary battery cell.

Another object of the present invention is to provide a secondary battery cell winding formation system, which can reduce the volume of the secondary battery cell winding formation system, save the floor area of a factory building, reduce the manufacturing cost of the secondary battery cell, and improve the energy density and safety performance of the manufactured secondary battery cell.

To achieve the above objects, in a first aspect, the present invention provides a secondary battery cell, comprising an anode electrode plate, an anode electrode tab, a cathode electrode plate, a cathode electrode tab and a separator.

The anode electrode plate comprises: an anode current collector; and an anode slurry layer disposed on the surface of the anode current collector.

The cathode electrode plate comprises: a cathode current collector; and a cathode slurry layerdisposed on the surface of the cathode current collector.

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The separator is disposed between the anode electrode plate and the cathode electrode plate.

The anode electrode plate is formed with: an anode electrode tab receiving groove, provided with the anode current collector at the bottom and the anode slurry layer on the periphery, the anode electrode tabis received in the anode electrode tabreceiving grooveand is electrically connected to the anode current collector at the anode electrode tab receiving groove.

The cathode electrode plate is formed with: a cathode electrode tab receiving groove, provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery, the cathode electrode tabis received in the cathode electrode tabreceiving grooveand is electrically connected to the cathode current collector at the cathode electrode tab receiving groove.

The anode electrode plate is further formed with: an anode electrode plate notch, located on the side edge of the anode electrode tab receiving groove and extending through the anode electrode plate.

The cathode electrode plate is further formed with: a cathode electrode plate notch, located on the side edge of the cathode electrode tab receiving groove and extending through the cathode electrode plate.

To achieve the above object, in a second aspect, the present invention provides a secondary battery cell winding formation system, comprising a working platform, a winding mechanism, an anode electrode plate unwinding roller, an anode electrode plate cleaning mechanism, an anode electrode plate die-cutting mechanism, an anode electrode tab supply mechanism, an anode electrode tab connection mechanism, an anode electrode plate convey mechanism, a cathode electrode plate unwinding roller, a cathode electrode plate cleaning mechanism, a cathode electrode plate die-cutting mechanism, a cathode electrode tab supply mechanism, a cathode electrode tab connection mechanism, a cathode electrode plate convey mechanism, a first separator unwinding roller, a second separator unwinding roller, a first separator convey mechanism and a second separator convey mechanism.

The working platform is fixed immovably.

The winding mechanism is disposed on the working platform.

The anode electrode plate unwinding roller is disposed on the working platform, and is wound with an anode electrode plate, wherein the anode electrode plate comprises: an anode current collector; and an anode slurry layer disposed on the surface of the anode current collector.

The anode electrode plate cleaning mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate unwinding roller, and is used for cleaning out, on the anode electrode plate, an anode electrode tab receiving groove provided with the anode current collector at the bottom and the anode slurry layer on the periphery.

The anode electrode plate die-cutting mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate cleaning mechanism, and is used for, on the side edge of the anode electrode tab receiving groove, die-cutting the anode electrode plate to form an anode electrode plate notch extending through the anode electrode plate.

The anode electrode tab supply mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate die-cutting mechanism, is wound with an anode electrode tab, and is used for supplying the anode electrode tab to the anode electrode tab receiving groove of the anode electrode plate of the anode electrode plate notch, such thatthe anode electrode tabis received in the anode electrode tab receiving groove.

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The anode electrode tab connection mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate die-cutting mechanism, and is used for electrically connecting and fixing the anode electrode tab received in the anode electrode tab receiving groove with the anode current collector at the anode electrode tab receiving groove.

The anode electrode plate convey mechanism is disposed on the working platform, and is used for conveying the anode electrode plate unwound from the anode electrode plate unwinding roller to the winding mechanism sequentially via the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanism and the anode electrode tab connection mechanism.

The cathode electrode plate unwinding roller is disposed on the working platform, and is wound with a cathode electrode plate, wherein the cathode electrode plate comprises: a cathode current collector; and a cathode slurry layer disposed on the surface of the cathode current collector.

The cathode electrode plate cleaning mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate unwinding roller, and is used for cleaning out, on the cathode electrode plate, a cathode electrode tab receiving groove provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery.

The cathode electrode plate die-cutting mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate cleaning mechanism, and is used for, on the side edge of the cathode electrode tab receiving groove, die-cutting the cathode electrode plate to form a cathode electrode plate die-cut notch extending through the cathode electrode plate.

The cathode electrode tab supply mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate die-cutting mechanism, is wound with a cathode electrode tab, and is used for supplying the cathode electrode tab to the cathode electrode tab receiving groove of the cathode electrode plate having out the cathode electrode plate notch, such that the cathode electrode tabis received in the cathode electrode tab receiving groove.

The cathode electrode tab connection mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate die-cutting mechanism, and is used for electrically connecting and fixing the cathode electrode tab received in the cathode electrode tab receiving groove with the cathode current collector at the cathode electrode tab receiving groove.

The cathode electrode plate convey mechanism is disposed on the working platform, and is used for conveying the cathode electrode plate unwound from the cathode electrode plate unwinding roller to the winding mechanism sequentially via the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism and the cathode electrode tab connection mechanism.

The first separator unwinding roller is disposed on the working platform, and is wound with a separator.

The second separator unwinding roller is disposed on the working platform, and is wound with another separator.

The first separator convey mechanism is disposed on the working platform, and is used for conveying the corresponding separator unwound from the first separator unwinding roller to the winding mechanism, and enabling the corresponding separator to be configured between the anode electrode plate and the cathode electrode plate after the secondary battery cell is wound and formed.

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The second separator convey mechanism is disposed on the working platform, and is used for conveying the corresponding separator unwound from the second separator unwinding roller to the winding mechanism, and enabling the corresponding separator to be configured between the anode electrode plate and the cathode electrode plate after the secondary battery cell is wound and formed.

The beneficial effects of the present invention are as follows:

In the secondary battery cell according to the present invention, the anode electrode tab is received in the anode electrode tab receiving groove, and the cathode electrode tab is received in the cathode electrode tab receiving groove, thus effectively improving the energy density of the secondary battery cell; the anode electrode plate notch can remove the burrs formed on the current collector on the edge part of the anode electrode tab receiving groove during formation, and the cathode electrode plate notch can effectively remove the burrs formed on the current collector on the edge part of the cathode electrode tab receiving groove during formation, thus effectively preventing the secondary battery cell from generating internal short circuit, and improving the safety performance of the secondary battery cell while ensuring a high energy density.

In the secondary battery cell winding formation system according to the present invention, the winding mechanism, the anode electrode plate unwinding roller, the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanism, the anode electrode tab supply mechanism, the anode electrode tab connection mechanism, the anode electrode plate convey mechanism, the cathode electrode plate unwinding roller, the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism, the cathode electrode tab supply mechanism, the cathode electrode tab connection mechanism, the cathode electrode plate convey mechanism, the first separator unwinding roller, the second separator unwinding roller, the first separator convey mechanism and the second separator convey mechanism are integrated on one working platform, thus reducing the volume of the secondary battery cell winding formation system, saving the floor area of a factory building, and reducing the manufacturing cost of the secondary battery cell; the anode electrode plate die-cutting mechanism can remove burrs cleaned out by the anode electrode plate cleaning mechanism and located on the current collector on the edge part of the anode electrode tab receiving groove, and the cathode electrode plate die-cutting mechanism can remove burrs cleaned out by the cathode electrode plate cleaning mechanism and located on the current collector on the edge part of the cathode electrode tab receiving groove, thus effectively preventing the manufactured secondary battery cell from generating internal short circuit, and improving the safety performance of the manufactured secondary battery cell.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view of the secondary battery cell winding formation system of the present invention;

Fig. 2 is a schematic view of the welded anode electrode plate and electrode tab of the secondary battery cell of the present invention, wherein Fig. (a) is a sectional view of the welded anode electrode plate and electrode tab, and Fig. (b) is a top view of the anode electrode plate as shown in Fig. (a);

Fig. 3 is a schematic view of the welded cathode electrode plate and electrode tab of the secondary battery cell of the present invention, wherein Fig. (a) is a sectional view of the welded cathode electrode plate and electrode tab, and Fig. (b) is a bottom view of the cathode electrode

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plate as shown in Fig. (a);

Fig. 4 is a schematic view showing the die-cutting process of the electrode plates of the secondary battery cell of the present invention, wherein Fig. (a) is a schematic view showing the die-cutting process of the anode electrode plate, and Fig. (b) is a schematic view showing the die-cutting process of the cathode electrode plate;

Fig. 5 is a schematic view of the electrode plates of the secondary battery cell of the present invention, wherein Fig. (a) is a schematic view of the anode electrode plate, and Fig. (b) is a schematic view of the cathode electrode plate; and

Fig. 6 is a schematic view of the electrode platesof a secondary battery cell in the prior art, wherein Fig. (a) is a schematic view of the anode electrode plate, and Fig. (b) is a schematic view of the cathode electrode plate.

Wherein the reference numbers are described as follows:

1 Secondary battery cell
- 101 Anode electrode plate
  - 1011 Anode current collector
  - 1012 Anode slurry layer
  - 1013 Anode electrode tab receiving groove
  - 1014 Anode electrode plate notch
  - 1015 Anode paired recess
- 102 Anode electrode tab
- 103 Cathode electrode plate
  - 1031 Cathode current collector
  - 1032 Cathode slurry layer
  - 1033 Cathode electrode tab receiving groove
  - 1034 Cathode electrode plate notch
  - 1035 Cathode paired recess
- 104 Cathode electrode tab
- 105 Separator

2 Secondary battery cell winding formation system
- 201 Working platform
- 202 Winding mechanism
  - 2021 Dust remover
  - 2022 Winding device
- 203 Anode electrode plate unwinding roller
- 204 Anode electrode plate cleaning mechanism
  - 2041 Anode electrode plate laser cleaning system
  - 2042 Anode electrode plate dust removal mechanism
  - 2043 Anode electrode plate adsorption and cooling auxiliary platform
- 205 Anode electrode plate die-cutting mechanism
  - 2051 Anode electrode plate die-cutting male die mechanism
  - 2052 Anode electrode plate die-cutting female die mechanism
  - 2053 Anode electrode plate waste collection mechanism
- 206 Anode electrode tab supply mechanism

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207 Anode electrode tab connection mechanism
2071 Anode electrode tab welding head mechanism
2072 Anode electrode tab welding base mechanism
208 Anode electrode plate convey mechanism
2081 Fixed roller
2082 Main drive mechanism
2083 Main drive corrective mechanism
209 Cathode electrode plate unwinding roller
210 Cathode electrode plate cleaning mechanism
2101 Cathode electrode plate laser cleaning system
2102 Cathode electrode plate dust removal mechanism
2103 Cathode electrode plate adsorption and cooling auxiliary platform
211 Cathode electrode plate die-cutting mechanism
2111 Cathode electrode plate die-cutting male die mechanism
2112 Cathode electrode plate die-cutting female die mechanism
2113 Cathode electrode plate waste collection mechanism
212 Cathode electrode tab supply mechanism
213 Cathode electrode tab connection mechanism
2131 Cathode electrode tab welding head mechanism
2132 Cathode electrode tab welding base mechanism
214 Cathode electrode plate convey mechanism
2141 Fixed roller
2142 Main drive mechanism
2143 Main drive corrective mechanism
215A First separator unwinding roller
215B Second separator unwinding roller
216A First separator convey mechanism
216A1 Fixed roller
216B Second separator convey mechanism
216B1 Fixed roller
217 Central control mechanism
218A First cathode electrode plate sticking mechanism
218B Second cathode electrode plate sticking mechanism
219 Anode electrode plate sensing mechanism
220 Anode electrode plate correctivemechanism
221 Cathode electrode plate sensing mechanism
222 Cathode electrode plate correctivemechanism
223 Separator sensing mechanism
224 Anode electrode plate dust removal portion
225 Cathode electrode plate dust removal portion
T1 First insulating adhesive tape
T2 Second insulating adhesive tape
T3 Third insulating adhesive tape
T4 Fourth insulating adhesive tape

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L Length direction

W Width direction

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The secondary battery cell and winding formation system thereof of the present invention will be elaborated hereafter with reference to the drawings.

First, the secondary battery cell according to the first aspect of the present invention is elaborated.

With reference to Fig. 2-5, the secondary battery cell 1 according to the present invention comprises an anode electrode plate 101, an anode electrode tab 102, a cathode electrode plate 103, a cathode electrode tab 104 and a separator 105.

The anode electrode plate 101 comprises: an anode current collector 1011; and an anode slurry layer 1012 disposed on the surface of the anode current collector 1011.

The cathode electrode plate 103 comprises: a cathode current collector 1031; and a cathode slurry layer 1032 disposed on the surface of the cathode current collector 1031.

The separator 105 is disposed between the anode electrode plate 101 and the cathode electrode plate 103.

The anode electrode plate 101 is formed with: an anode electrode tab receiving groove 1013, provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery, and receiving the anode electrode tab 102 therein, wherein the anode electrode tab 102 is electrically connected to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

The cathode electrode plate 103 is formed with: a cathode electrode tab receiving groove 1033, provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery, and receiving the cathode electrode tab 104 therein, wherein the cathode electrode tab 104 is electrically connected to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

The anode electrode plate 101 is further formed with: an anode electrode plate notch 1014, located on the side edge of the anode electrode tab receiving groove 1013 and extending through the anode electrode plate 101;

The cathode electrode plate 103 is further formed with: a cathode electrode plate notch 1034, located on the side edge of the cathode electrode tab receiving groove 1033 and extending through the cathode electrode plate 103.

In the secondary battery cell 1 according to the present invention, the anode electrode tab 102 is received in the anode electrode tab receiving groove 1013, and the cathode electrode tab 104 is received in the cathode electrode tab receiving groove 1033, thus effectively improving the energy density of the secondary battery cell 1; the anode electrode plate notch 1014 can remove the burrs formed on the current collector 1011 ofthe edge part of the anode electrode tab receiving groove 1013 during formation, and the cathode electrode plate notch 1034 can effectively remove the burrs formed on the current collector 1031 of the edge part of the cathode electrode tab receiving groove 1033 during formation, thus effectively preventing the secondary battery cell 1 from generating internal short circuit, and in turn improving the safety performance of the secondary battery cell 1 while ensuring a high energy density.

In the secondary battery cell 1 according to the present invention, the secondary battery cell 1

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is a wound-type cell.

In the secondary battery cell 1 according to the present invention, with reference to Fig. 5(a), in one embodiment, the length of the anode electrode plate notch 1014 in the length direction L is 0.9-1.2 times of the length of the anode electrode tab receiving groove 1013; and the width of the anode electrode plate notch 1014 in the width direction W is 0.2-0.8 times of the width of the anode electrode tab receiving groove 1013.

In the secondary battery cell 1 according to the present invention, with reference to Fig. 5(b), in one embodiment, the length of the cathode electrode plate notch 1034 in the length direction L is 0.9-1.2 times of the length of the cathode electrode tab receiving groove 1033; and the width of the cathode electrode plate notch 1034 in the width direction W is 0.2-0.8 times of the width of the cathode electrode tab receiving groove 1033.

In the secondary battery cell 1 according to the present invention, with reference to Fig. 2, in one embodiment, the anode electrode plate 101 may not stick an insulating adhesive tape T. Sticking an insulating adhesive tape T on the anode electrode plate 101 could not improve the secondary battery cell 1, but on the contrary may probably increase the thickness of the secondary battery cell 1, and reduce the energy density of the secondary battery cell 1.

In the secondary battery cell 1 according to the present invention, with reference to Fig. 3, in one embodiment, the secondary battery cell 1 further comprises: a first insulating adhesive tape T1, stuck at the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; and a second insulating adhesive tape T2, stuck on the cathode slurry layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary battery cell 1 is wound and formed. Since the second insulating adhesive tape T2 is stuck, the cathode active substance of the cathode slurry layer 1032 dissociating to the anode electrode tab102 is reduced; the cathode active substance of the cathode slurry layer 1032 dissociating and diffusing to the aligned anode electrode tab 102 is reduced; further, the cathode active substance of the cathode slurry layer 1032 concentrating at the anode electrode tab 102 during the charging and discharging processes of the secondary battery is alleviated; and finally, the problem that the cathode active substance is separated out at the anode electrode tab 102 is alleviated, and in the meanwhile contacting and generating internal short circuit of the anode electrode tab 102 and the cathode electrode plate 103 is avoided when the burrs at the anode electrode tab 102 pierce the separator 105.

In the secondary battery cell 1 according to the present invention, with reference to Fig. 2(a), in one embodiment, the anode electrode plate 101 is further formed with an anode paired recess 1015, provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery, and located exactly on the back side of the anode electrode tab receiving groove 1013; and with reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary battery cell 1 further comprises: a third insulating adhesive tape T3, stuck on the cathode slurry layer 1032 at a position aligned with the anode paired recess 1015 after the secondary battery cell 1 is wound and formed.

In the secondary battery cell 1 according to the present invention, with reference to Fig. 3(a), in one embodiment, the cathode electrode plate 103 is further formed with a cathode paired recess 1035, provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove 1033; and with reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary

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battery cell 1 further comprises: a fourth insulating adhesive tape T4, stuck on the cathode paired recess 1035.

In the secondary battery cell 1 according to the present invention, in one embodiment, the anode electrode plate 101 is further formed with an anode paired recess 1015, provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery, and located exactly on the back side of the anode electrode tab receiving groove 1013, as shown in Fig. 2(a); and the cathode electrode plate 103 is further formed with a cathode paired recess 1035, provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove 1033, as shown in Fig. 3(a). With reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary battery cell 1 further comprises: a third insulating adhesive tape T3, stuck on the cathode slurry layer 1032 at a position aligned with the anode paired recess 1015 after the secondary battery cell 1 is wound and formed; and a fourth insulating adhesive tape T4, stuck on the cathode paired recess 1035.

In the secondary battery cell 1 according to the present invention, the first insulating adhesive tape T1, the second insulating adhesive tape T2, the third insulating adhesive tape T3 and the fourth insulating adhesive tape T4 are single-sided insulating adhesive tape or double-sided insulating adhesive tape. When double-sided insulating adhesive tapes are adopted, the double-sided insulating adhesive tape sticking areas are denser than the sticking areas when single-sided insulating adhesive tapes are used, such that the integrity of the secondary battery cell is enhanced, thus avoiding the area from protruding and becoming the largest deformation area after a reforming process of the secondary battery cell and the secondary battery cell expands due to charging and discharging.

Second, the secondary battery cell winding formation system according to the second aspect of the present invention is elaborated.

With reference to Fig. 1, the secondary battery cell winding formation system according to the present invention comprises a working platform 201, a winding mechanism 202, an anode electrode plate unwinding roller 203, an anode electrode plate cleaning mechanism 204, an anode electrode plate die-cutting mechanism 205, an anode electrode tab supply mechanism 206, an anode electrode tab connection mechanism 207, an anode electrode plate convey mechanism 208, a cathode electrode plate unwinding roller 209, a cathode electrode plate cleaning mechanism 210, a cathode electrode plate die-cutting mechanism 211, a cathode electrode tab supply mechanism 212, a cathode electrode tab connection mechanism 213, a cathode electrode plate convey mechanism 214, a first separator unwinding roller 215A, a second separator unwinding roller 215B, a first separator convey mechanism 216A and a second separator convey mechanism 216B.

The working platform 201 is fixed immovably.

The winding mechanism 202 is disposed on the working platform 201.

The anode electrode plate unwinding roller 203 is disposed on the working platform 201, and is wound with anode electrode plate 101, wherein the anode electrode plate 101 comprises: an anode current collector 1011; and an anode slurry layer 1012 disposed on the surface of the anode current collector 1011.

The anode electrode plate cleaning mechanism 204 is disposed on the working platform 201, is located at the downstream of the anode electrode plate unwinding roller 203, and is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013

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provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery.

The anode electrode plate die-cutting mechanism 205 is disposed on the working platform 201, is located at the downstream of the anode electrode plate cleaning mechanism 204, and is used for, at the side edge of the anode electrode tab receiving groove 1013, die-cutting the anode electrode plate 101 to form an anode electrode plate notch 1014 extending through the anode electrode plate 101.

The anode electrode tab supply mechanism 206 is disposed on the working platform 201, is located at the downstream of the anode electrode plate die-cutting mechanism 205, is wound with an anode electrode tab 102, and is used for supplying the anode electrode tab 102 to the anode electrode tab receiving groove 1013 of the anode electrode plate 101 of the anode electrode plate notch 1014, such thatthe anode electrode tab 102 is received in the anode electrode tab receiving groove 1013.

The anode electrode tab connection mechanism 207 is disposed on the working platform 201, is located at the downstream of the anode electrode plate die-cutting mechanism 205, and is used for electrically connecting and fixing the anode electrode tab 102 received in the anode electrode tab receiving groove 1013 to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

The anode electrode plate convey mechanism 208 is disposed on the working platform 201, and is used for conveying the anode electrode plate 101 unwound from the anode electrode plate unwinding roller 203 to the winding mechanism 202 sequentially via the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207. The cathode electrode plate unwinding roller 209 is disposed on the working platform 201, and is wound with a cathode electrode plate103, wherein the cathode electrode plate103 comprises: a cathode current collector 1031; and a cathode slurry layer 1032 disposed on the surface of the cathode current collector 1031.

The cathode electrode plate cleaning mechanism 210 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate unwinding roller 209, and is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery.

The cathode electrode plate die-cutting mechanism 211 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate cleaning mechanism 210, and is used for, on the side edge of the cathode electrode tab receiving groove 1033, die-cutting the cathode electrode plate 103 to form a cathode electrode plate notch 1034 extending through the cathode electrode plate 103.

The cathode electrode tab supply mechanism 212 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate die-cutting mechanism 211, is wound with a cathode electrode tab 104, and is used for supplying the cathode electrode tab 104 to the cathode electrode tab receiving groove 1033 of the cathode electrode plate 103 having die-cut out the cathode electrode plate notch 1034, such that the cathode electrode tab 104 is received in the cathode electrode tab receiving groove 1033.

The cathode electrode tab connection mechanism 213 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate die-cutting mechanism 211, and is

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used for electrically connecting and fixing the cathode electrode tab 104 received in the cathode electrode tab receiving groove 1033 to the cathode current collector 1031 at the cathode electrode tabreceiving groove 1033.

The cathode electrode plate convey mechanism 214 is disposed on the working platform 201, and is used for conveying the cathode electrode plate 103 unwound from the cathode electrode plate unwinding roller 209 to the winding mechanism 202 sequentially via the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213.

The first separator unwinding roller 215A is disposed on the working platform 201, and is wound with a separator105.

The second separator unwinding roller 215B is disposed on the working platform 201, and is wound with another separator 105.

The first separator convey mechanism 216A is disposed on the working platform 201, and is used for conveying the corresponding separator 105 unwound from the first separator unwinding roller 215A to the winding mechanism 202, such that the corresponding separator 105 is configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary battery cell is wound and formed.

The second separator convey mechanism 216B is disposed on the working platform 201, and is used for conveying the corresponding separator 105 unwound from the second separator unwinding roller 215B to the winding mechanism 202, such that the corresponding separator 105 is configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary battery cell is wound and formed.

In the secondary battery cell winding formation system 2 according to the present invention, the winding mechanism 202, the anode electrode plate unwinding roller 203, the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205, the anode electrode tab supply mechanism 206, the anode electrode tab connection mechanism 207, the anode electrode plate convey mechanism 208, the cathode electrode plate unwinding roller 209, the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211, the cathode electrode tab supply mechanism 212, the cathode electrode tab connection mechanism 213, the cathode electrode plate convey mechanism 214, the first separator unwinding roller 215A, the second separator unwinding roller 215B, the first separator convey mechanism 216A and the second separator convey mechanism 216B are integrated on one working platform 201, thus reducing the volume of the secondary battery cell winding formation system 2, saving the floor area of a factory building, and reducing the manufacturing cost of the secondary battery cell 1; the anode electrode plate die-cutting mechanism 205 can remove burrs cleaned out by the anode electrode plate cleaning mechanism 204 and located on the current collector 1011 on the edge part of the anode electrode tab receiving groove 1013, and the cathode electrode plate die-cutting mechanism 211 can remove burrs cleaned out by the cathode electrode plate cleaning mechanism 210 and located on the current collector 1031 on the edge part of the cathode electrode tab receiving groove 1033, thus effectively preventing the manufactured secondary battery cell 1 from generating internal short circuit, and improving the safety performance of the manufactured secondary battery cell 1.

In one embodiment, the anode electrode tab receiving groove 1013 and the anode paired recess 1015 are respectively cleaned out on the two surfaces of the anode electrode plate 101; and

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the anode electrode plate convey mechanism 208 can lead and change the convey direction of the anode electrode plate 101, thus realizing a double-side cleaning effect.

In one embodiment, the cathode electrode tab receiving groove 1033 and the cathode paired recess 1035 are respectively cleaned out on the two surfaces of the cathode electrode plate 103; and the cathode electrode plate convey mechanism 214 can lead and change the convey direction of the cathode electrode plate 103, thus realizing a double-side cleaning effect.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary battery cell winding formation system 2 further comprises a central control mechanism 217, in communication connection with and for controlling at least one selected from the anode electrode plate unwinding roller 203, the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205, the anode electrode tab supply mechanism 206, the anode electrode tab connection mechanism 207, the cathode electrode plate unwinding roller 209, the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211, the cathode electrode tab supply mechanism 212, the cathode electrode tab connection mechanism 213 and the winding mechanism 202.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1 and Fig. 3, in one embodiment, the secondary battery cell winding formation system 2 further comprises: a first cathode electrode plate sticking mechanism 218A, disposed on the working platform 201, located at the downstream of the cathode electrode tab connection mechanism 213, and used for sticking a first insulating adhesive tape T1 on the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; and a second cathode electrode plate sticking mechanism 218B, disposed on the working platform 201, located between the first cathode electrode plate sticking mechanism 218A and the winding mechanism 202, and used for sticking a second insulating adhesive tape T2 on the cathode slurry layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary battery cell 1 is wound and formed.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanisms 204 are two, wherein one anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery; and the other anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode paired recess 1015 provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery and located exactly on the back side of the anode electrode tab receiving groove 1013; and with reference to Fig. 1 and Fig. 3, in the present embodiment, the second cathode electrode plate sticking mechanism 218B is further used for sticking a third insulating adhesive tape T3 on the cathode slurry layer 1032 at a position aligned with the anode paired recess 1015.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate cleaning mechanisms 210 are two, wherein one cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery;

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and the other cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode paired recess 1035 provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery and located exactly on the back side of the cathode electrode tab receiving groove 1033; and with reference to Fig. 1 and Fig. 3, in the present embodiment, the first cathode electrode plate sticking mechanism 218A is further used for sticking a fourth insulating adhesive tape T4 on the cathode paired recess 1035.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanisms 204 are two, wherein one anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery; and the other anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode paired recess 1015 provided with the anode current collector 1011 at the bottom and the anode slurry layer 1012 on the periphery and located exactly on the back side of the anode electrode tab receiving groove 1013; with reference to Fig. 1, in the present embodiment, the cathode electrode plate cleaning mechanisms 210 are two, wherein one cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery; and the other cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode paired recess 1035 provided with the cathode current collector 1031 at the bottom and the cathode slurry layer 1032 on the periphery and located exactly on the back side of the cathode electrode tab receiving groove 1033; with reference to Fig. 1 and Fig. 3, in the present embodiment, the first cathode electrode plate sticking mechanism 218A is further used for sticking a fourth insulating adhesive tape T4 on the cathode paired recess 1035; and the second cathode electrode plate sticking mechanism 218B is further used for sticking a third insulating adhesive tape T3 on the cathode slurry layer 1032 at a position aligned with the anode paired recess 1015.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second battery cell winding formation system 2 further comprises: a plurality of anode electrode plate sensing mechanisms 219, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode 101 starting from the anode electrode plate unwinding roller 203 and passing through the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for sensing the position of the anode electrode plate 101 on the convey path; and a plurality of anode electrode plate corrective mechanisms 220, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode plate 101starting from the anode electrode plate unwinding roller 203 and passing through the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for correcting the anode electrode plate 101.

In the secondary battery cell winding formation system 2 according to the present invention,

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with reference to Fig. 1, in one embodiment, the second battery cell winding formation system 2 further comprises: a plurality of cathode electrode plate sensing mechanisms 221, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate unwinding roller 209 and passing through the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for sensing the position of the cathode electrode plate 103 on the convey path; and a plurality of cathode electrode plate corrective mechanisms 222, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate unwinding roller 209 and passing through the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for correcting the cathode electrode plate 103.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second battery cell winding formation system 2 further comprises: a plurality of separator sensing mechanisms 223, disposed on the working platform 201, in communication connection with the central control mechanism 217, respectively located on a convey path of the corresponding separator 105 from the first separator unwinding roller 215A to the winding mechanism 202 and another convey path from the second separator unwinding roller 215B to the winding mechanism 202, and used for sensing the position of the corresponding separator 105 on the convey path.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate unwinding roller 203, the cathode electrode plate unwinding roller 209, the first separator unwinding roller 215A and the second separator unwinding roller 215B can all extend and retract in a direction perpendicular to the working platform 201. The first separator unwinding roller 215A and the second separator unwinding roller 215B extending and retracting in a direction perpendicular to the working platform 201 may cooperate with the separator sensing mechanism 223 to realize deviation correction. Therefore, the feeding of the separator does not add an independent separatorcorrective mechanism.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanism 204 comprises: an anode electrode plate laser cleaning system 2041, for correspondingly cleaning the anode slurry layer 1012 of the passing anode electrode plate 101; an anode electrode plate dust removal mechanism 2042, for removing anode slurry layer 1012 particles generated when the anode electrode plate laser cleaning system 2041 performs cleaning; and an anode electrode plate adsorption and cooling auxiliary platform 2043, for adsorbing, fixing and cooling the anode electrode plate 101 passing through the anode electrode plate laser cleaning system 2041.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate adsorption and cooling auxiliary platform 2043 can be vacuum pumping adsorption.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate cleaning mechanism 210

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comprises: a cathode electrode platelaser cleaning system 2101, for correspondingly cleaning the cathode slurry layer 1032 of the passing cathode electrode plate 103; a cathode electrode plate dust removal mechanism 2102, for removing cathode slurry layer 1032 particles generated when the cathode electrode plate laser cleaning system 2101 performs cleaning; and a cathode electrode plate adsorption and cooling auxiliary platform 2103, for adsorbing, fixing and cooling the cathode electrode plate 103 passing through the cathode electrode plate laser cleaning system 2101.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate adsorption and cooling auxiliary platform 2103 can be vacuum pumping adsorption.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate die-cutting mechanism 205 comprises: an anode electrode plate die-cutting male die mechanism 2051; and an anode electrode plate die-cutting female die mechanism 2052, for cooperating with the anode electrode plate die-cutting male die mechanism 2051 to, when the anode electrode plate 101 passes through the anode electrode plate die-cutting mechanism 205, die-cut, on the side edge of the anode electrode tab receiving groove 1013, the anode electrode plate 101 to form an anode electrode plate notch 1014 extending through the anode electrode plate 101; and an anode electrode plate waste collection mechanism 2053, for collecting the wastes die-cut off from the anode electrode plate 101.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate die-cutting mechanism 211 comprises: a cathode electrode plate die-cutting male die mechanism 2111; and a cathode electrode plate die-cutting female die mechanism 2112, for cooperating with the cathode electrode plate die-cutting male die mechanism 2111 to, when the cathode electrode plate 103 passes through the cathode electrode plate die-cutting mechanism 211, die-cut, on the side edge of the cathode electrode tab receiving groove 1033, the cathode electrode plate 103 to form a cathode electrode plate notch 1034 extending through the cathode electrode plate 103; and a cathode electrode plate die-cut waste collection mechanism 2113, for collecting the wastes die-cut off from the cathode electrode plate 103.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode tab connection mechanism 207 comprises: an anode electrode tab welding head mechanism 2071; and an anode electrode tab welding base mechanism 2072, for cooperating with the anode electrode tab welding head mechanism 2071 to weld the anode electrode tab 102 to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode tab connection mechanism 213 comprises: a cathode electrode tab welding head mechanism 2131; and a cathode electrode tab welding base mechanism 2132, for cooperating with the cathode electrode tab welding head mechanism 2131 to weld the cathode electrode tab 104 to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the winding mechanism 202 comprises: a dust

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remover 2021, for removing the dust of the anode electrode plate 101, the cathode electrode plate 103 and the two separators 105 conveyed to the winding mechanism 202; and a winding device 2022, for stacking up the anode electrode plate 101, the cathode electrode plate 103 and the two separators 105 conveyed to the winding mechanism 202, and enabling the corresponding separator 105 to be configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary battery cell is wound and formed by the winding mechanism 202.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate convey mechanism 208 comprises: a fixed roller 2081, for passivelyenabling the anode electrode plate 101 to pass thereon; a main drive mechanism 2082, for actively driving and conveying the anode electrode plate 101; and a main drive corrective mechanism 2083, located at the upstream of the winding mechanism 202 and used for correcting the anode electrode plate 101 having entered the winding mechanism 202.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate convey mechanism 214 comprises: a fixed roller 2141, for passivelyenabling the cathode electrode plate 103 to pass thereon; a main drive mechanism 2142, for actively driving and conveying the cathode electrode plate 103; and a main drive corrective mechanism 2143, located at the upstream of the winding mechanism 202 and used for correcting the cathode electrode plate 103 having entered the winding mechanism 202.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the first separator convey mechanism 216A comprises a fixed roller 216A1 for passively enabling the corresponding separator 105 to pass thereon and conveying to the winding mechanism 202; and the second separator convey mechanism 216B comprises a fixed roller 216B1 for passively enabling the corresponding separator 105 to pass thereon and conveying to the winding mechanism 202.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary battery cell winding formation system 2 further comprises: a plurality of anode electrode plate dust removal portions 224, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode plate 101 starting from the anode electrode plate cleaning mechanism 204 and passing through the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for removing the anode slurry layer 1012 particles generated after the anode electrode plate is cleaned and the electrode tab is welded.

In the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary battery cell winding formation system 2 further comprises: a plurality of cathode electrode plate dust removal portions 225, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate cleaning mechanism 210 and passing through the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for removing the cathode slurry layer 1032 particles generated after the cathode electrode plate is cleaned and the electrode tab is welded.

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A comparison is performed hereafter between the performance of the secondary battery cell manufactured by the secondary battery cell winding formation system 2 of the present invention and the performance of the secondary battery cell manufactured bythe prior art.

Embodiment 1 takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example. In the secondary battery cell 1 manufactured by the secondary battery cell winding formation system 2 according to the present invention, with reference to Fig. 2-5, the anode electrode plate cleaning mechanism 204 and the cathode electrode plate cleaning mechanism 210 are used to respectively clean out an anode electrode tab receiving groove 1013 and a cathode electrode tab receiving groove 1033 which are 12mm length (in the length direction L) and 8mm width (in the width direction W) at preset positions on the anode electrode plate 101 and the cathode electrode plate 103; the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 are die-cut by the anode electrode plate die-cutting mechanism 205 and the cathode electrode plate die-cutting mechanism 211 to form an anode electrode plate notch 1014 and a cathode electrode plate notch 1034 which are 12mm length and 3mm width; the long sides of the anode electrode plate notch 1014 and the cathode electrode plate notch are coincident with the corresponding long sides of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033; the anode electrode tab 102 and the cathode electrode tab 104 which are 6mm width are respectively welded in the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033. The first insulating adhesive tape T1 is stuck on the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; the second insulating adhesive tape T2 is stuck on the cathode slurry layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary battery cell 1 is wound and formed; the third insulating adhesive tape T3 is stuck on the cathode slurry layer 1032 at a position aligned with the anode paired recess 1015 after the secondary battery cell 1 is wound and formed; the fourth insulating adhesive tape T4 is stuck on the cathode paired recess 1035; and the insulating adhesive tapes T1-T4 are 10μm thickness, 15mm length and 24mm width. The insulating adhesive tape is not stuck on the anode electrode plate 101. The secondary battery cell structure according to one embodiment of the present invention is manufactured as above.

Comparison example 1 also takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example, and uses the conventional independent laser cleaning device, welding device and winding device in the prior art to manufacture a secondary battery cell. With reference to Fig. 6, except that the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 are not die-cut and removed and that T1-T4 adopt a 35μm thickness insulating adhesive tape, the others are the same as the embodiment 1.

Comparison example 2 also takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example, wherein except thatT1-T4 adopt a 10μm thickness insulating adhesive tape, the others are the same as the comparison example 1.

Twenty pouch cell lithium ion battery samples are respectively selected from the embodiment 1, the comparison example 1 and the comparison example 2 to perform capacity test and thickness measurement; and then the tested pouch cell lithium ion battery samples are dismantled to observe

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the internal short circuit situation of the cleaning grooves. The results are as shown in table 1.

Table 1:the test results of the embodiment 1 and the comparison examples 1-2

	Average capacity mAh	Average volume energy density Wh/L	Average thickness mm	The number of samples generating internal short circuit
Embodiment 1	3027.5	937	3.28	0
Comparison example 1	3027.3	925	3.32	0
Comparison example 2	3027.4	937	3.28	12

It can be seen from the above table 1 that: in the embodiment 1, the secondary battery cells manufactured by the secondary battery cell winding formation system 2 of the present invention ensure a high average volume energy density while none of the cells generates internal short circuit; in the comparison example 1, similarly, none of the cells generates the internal short circuit problem, however the average volume energy density is obviously reduced because a thick insulating adhesive tape is stuck; and in the comparison example 2, a high average volume energy density is ensured, however a high ratio of cells generate internal short circuit.

Therefore, in the embodiment 1, the electrode plate structure using die-cutting offthe burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 can completely solve the internal short circuit problem caused by the burrs, thus improving the safety use performance of the cell; furthermore, the secondary battery cell winding formation system 2 can reduce the comprehensive manufacturing cost of the cell.

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WHAT IS CLAIMED IS:

1. A secondary battery cell, comprising:

afirst electrode tab;

afirst electrode plate, comprising:

afirst current collector; and

afirstslurry layer, disposed on the surface of thefirst current collector;

wherein,

thefirstelectrode platefurthercomprising,:

afirstelectrode tab receiving groove, provided with the firstcurrent collector at the bottom and the firstslurry layer on the periphery, the firstelectrode tabis received in thefirstelectrode tab receiving groove andthe firstelectrode tabis electrically connected to the firstcurrent collector;

afirstelectrode plate notch, located on the edge of the firstelectrode tab receiving groove and extending through the firstelectrode plate;

2. The secondary battery cell according to claim 1,comprising:

a second electrode plate, comprising:

asecond current collector; and

asecond slurry layer, disposed on the surface of thesecond current collector;

asecond electrode tab;

wherein,

thesecond electrode plate comprising:

asecond electrode tab receiving groove, provided with the second current collector at the bottom and the second slurry layer on the periphery, the second electrode tabis received in thesecondelectrode tab receiving groove and the second electrode tab is electrically connected to the second current collector;

asecond electrode plate notch, located on the edge of the second electrode tab receiving groove and extending through the second electrode plate;

3. The secondary battery cell according to claim 2, wherein,the first electrode plate is anodeelectrode plate;

the first current collector is anode current collector;

the first slurry layer is anodeslurry layer;

the first electrode tabis anodeelectrode tab;

the first electrode tab receiving grooveis anode electrode tab receiving groove;

the first electrode plate notchis anodeelectrode plate notch;

thesecond electrode plate is cathodeelectrode plate;

thesecond current collector is cathode current collector;

thesecond slurry layer is cathodeslurry layer;

thesecond electrode tabis cathodeelectrode tab;

thesecond electrode tab receiving grooveis cathode electrode tab receiving groove;

thesecond electrode plate notchis cathodeelectrode plate notch.

4.The secondary battery cell according to claim 3, wherein the cathode electrode plate notch

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and anode electrode plate notch is formed by die-cut.

5. The secondary battery cell according to claim 4, wherein, the secondary battery cell is a wound-type cell.

6. The secondary battery cell according to claim 4, wherein,

thelength of the anode electrode plate notch in the length direction is 0.9-1.2 times of the length of the anode electrode tab receiving groove; and

thewidth of the anode electrode plate notch in the width direction is 0.2-0.8 times of the width of the anode electrode tab receiving groove.

7. The secondary battery cell according to claim 4, wherein,

thelength of the cathode electrode plate notch in the length directionis 0.9-1.2 times of the length of the cathode electrode tab receiving groove; and

thewidth of the cathode electrode plate notch in the width direction is 0.2-0.8 times of the width of the cathode electrode tab receiving groove.

8. The secondary battery cell according to claim 4, wherein, the secondary battery cell further comprises:

afirst insulating adhesive tape, stuck on the cathode electrode tab receiving groove having received the cathode electrode tab; and

asecond insulating adhesive tape, stuck on the cathode slurry layer at a position aligned with the anode electrode tab receiving groove after the secondary battery cell is wound and formed.

9. The secondary battery cell according to claim 8, wherein,

the anode electrode plate is further formed with: an anode paired recess, provided with the anode current collector at the bottom and the anode slurry layer on the periphery, and located exactly on the back side of the anode electrode tab receiving groove; and

thesecondary battery cell further comprises: a third insulating adhesive tape, stuck on the cathode slurry layer at a position aligned with the anode paired recess after the secondary battery cell is wound and formed.

10. The secondary battery cell according to claim 8, wherein,

the cathode electrode plate is further formed with: a cathode paired recess, provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove; and

thesecondary battery cell further comprises: a fourth insulating adhesive tape, stuck on the cathode paired recess.

11. The secondary battery cell according to claim 8, wherein,

the anode electrode plate is further formed with: an anode paired recess, provided with the anode current collector at the bottom and the anode slurry layeron the periphery, and located exactly on the back side of the anode electrode tab receiving groove; and

the cathode electrode plate is further formed with: a cathode paired recess, provided with the

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cathode current collectorat the bottom and the cathode slurry layer on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove; and

the secondary battery cell further comprises: a third insulating adhesive tape, stuck on the cathode slurry layer at a position aligned with the anode paired recess after the secondary battery cell is wound and formed; and

afourth insulating adhesive tape, stuck on the cathode paired recess.

12. The secondary battery cell according to claim 11, wherein, the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape and the fourth insulating adhesive tape are single-sided insulating adhesive tape or double-sided insulating adhesive tape.

13. A second battery cell winding formation system, wherein, comprising:

aworking platform, fixed immovably;

awinding mechanism, disposed on the working platform;

ananode electrode plate unwinding roller, disposed on the working platform, and wound with an anode electrode plate, wherein the anode electrode plate comprises: an anode current collector; and an anode slurry layer, disposed on the surface of the anode current collector;

an anode electrode plate cleaning mechanism, disposed on the working platform, located at the downstream of the anode electrode plate unwinding roller, and used for cleaning out, on the anode electrode plate, an anode electrode tab receiving grooveprovided with the anode current collector at the bottom and the anode slurry layer on the periphery;

an anode electrode plate die-cutting mechanism, disposed on the working platform, located at the downstream of the anode electrode plate cleaning mechanism, and used for, on the side edge of the anode electrode tab receiving groove, die-cutting the anode electrode plate to form an anode electrode plate die-cut notch extending through the anode electrode plate;

an anode electrode tab supply mechanism, disposed on the working platform, located at the downstream of the anode electrode plate die-cutting mechanism, wound with an anode electrode tab, and used for supplying the anode electrode tab to the anode electrode tab receiving groove of the anode electrode plate having die-cut out the anode electrode plate die-cut notch, such thatthe anode electrode tabis received in the anode electrode tab receiving groove;

an anode electrode tab connection mechanism, disposed on the working platform, located at the downstream of the anode electrode plate die-cutting mechanism, and used for electrically connecting and fixing the anode electrode tab received in the anode electrode tab receiving groove with the anode current collector at the anode electrode tab receiving groove;

an anode electrode plate convey mechanism, disposed on the working platform, and used for conveying the anode electrode plate unwound from the anode electrode plate unwinding roller to the winding mechanism sequentially via the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanism and the anode electrode tab connection mechanism;

acathode electrode plate unwinding roller , disposed on the working platform, and wound with a cathode electrode plate, wherein the cathode electrode platecomprises: a cathode current collector; and a cathode slurry layer, disposed on the surface of the cathode current collector;

acathode electrode plate cleaning mechanism, disposed on the working platform, located at the downstream of the cathode electrode plate unwinding roller, and used for cleaning out, on the

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cathode electrode plate, a cathode electrode tab receiving groove provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery;

acathode electrode plate die-cutting mechanism, disposed on the working platform, located at the downstream of the cathode electrode plate cleaning mechanism, and used for, on the side edge of the cathode electrode tab receiving groove, die-cutting the cathode electrode plate to form a cathode electrode plate notch extending through the cathode electrode plate;

acathode electrode tab supply mechanism, disposed on the working platform, located at the downstream of the cathode electrode plate die-cutting mechanism, wound with a cathode electrode tab, and used for supplying the cathode electrode tab to the cathode electrode tab receiving groove of the cathode electrode plate having die-cut the cathode electrode plate notch, such that the cathode electrode tabis received in the cathode electrode tab receiving groove;

acathode electrode tab connection mechanism, disposed on the working platform, located at the downstream of the cathode electrode plate die-cutting mechanism, and used for electrically connecting and fixing the cathode electrode tabreceived in the cathode electrode tab receiving groove with the cathode current collector at the cathode electrode tab receiving groove;

acathode electrode plate convey mechanism, disposed on the working platform, and used for conveying the cathode electrode plate unwound from the cathode electrode plate unwinding roller to the winding mechanism sequentially via the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism and the cathode electrode tab connection mechanism;

afirst separator unwinding roller, disposed on the working platform, and wound with a separator;

asecond separator unwinding roller, disposed on the working platform, and wound with another separator;

afirst separator convey mechanism, disposed on the working platform, and used for conveying the corresponding separatorunwound from the first separator unwinding roller to the winding mechanism, such that the corresponding separatoris configured between the anode electrode plate and the cathode electrode plate after the secondary battery cell is wound and formed; and

asecond separator convey mechanism, disposed on the working platform, and used for conveying the corresponding separator unwound from the second separator unwinding rollerto the winding mechanism, such that the corresponding separatoris configured between the anode electrode plate and the cathode electrode plate after the secondary battery cell is wound and formed.

14. The second battery cell winding formation system according to claim 13, wherein, the second battery cell winding formation system further comprises:

acentral control mechanism, in communication connection with and for controlling at least one selected from the anode electrode plate unwinding roller, the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanism, the anode electrode tab supply mechanism, the anode electrode tab connection mechanism, the cathode electrode plate unwinding roller, the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism, the cathode electrode tab supply mechanism, the cathode electrode tab connection mechanism and the winding mechanism.

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15. The second battery cell winding formation system according to claim 13, wherein, the second battery cell winding formation system further comprises:

afirst cathode electrode plate sticking mechanism, disposed on the working platform, located at the downstream of the cathode electrode tab connection mechanism, and used for sticking a first insulating adhesive tape on the cathode electrode tab receiving groove having received the cathode electrode tab; and

asecond cathode electrode plate sticking mechanism, disposed on the working platform, located between the first cathode electrode plate sticking mechanism and the winding mechanism, and used for sticking a second insulating adhesive tape on the cathode slurry layer at a position aligned with the anode electrode tab receiving groove after the secondary battery cell is wound and formed.

16. The second battery cell winding formation system according to claim 15, wherein,

the anode electrode plate cleaning mechanisms are two, wherein one anode electrode plate cleaning mechanism is used for cleaning out, on the anode electrode plate, an anode electrode tab receiving groove provided with the anode current collector at the bottom and the anode slurry layer on the periphery; and the other anode electrode plate cleaning mechanism is used for cleaning out, on the anode electrode plate, an anode paired recess provided with the anode current collector at the bottom and the anode slurry layer on the periphery and located exactly on the back side of the anode electrode tab receiving groove; and

thesecond cathode electrode plate sticking mechanism is further used for sticking a third insulating adhesive tape on the cathode slurry layer at a position aligned with the anode paired recess.

17. The second battery cell winding formation systemaccording to claim 15, wherein,

the cathode electrode plate cleaning mechanisms are two, wherein one cathode electrode plate cleaning mechanismis used for cleaning out, on the cathode electrode plate, a cathode electrode tab receiving groove provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery; and the other cathode electrode plate cleaning mechanism is used for cleaning out, on the cathode electrode plate, a cathode paired recess provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery and located exactly on the back side of the cathode electrode tab receiving groove; and

thefirst cathode electrode plate sticking mechanism is further used for sticking a fourth insulating adhesive tape on the cathode paired recess.

18. The second battery cell winding formation system according to claim 15, wherein,

the anode electrode plate cleaning mechanisms are two, wherein one anode electrode plate cleaning mechanism is used for cleaning out, on the anode electrode plate, an anode electrode tab receiving groove provided with the anode current collector at the bottom and the anode slurry layer on the periphery; and the other anode electrode plate cleaning mechanism is used for cleaning out, on the anode electrode plate, an anode paired recess provided with the anode current collector at the bottom and the anode slurry layer on the periphery and located exactly on the back side of the anode electrode tab receiving groove; and

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the cathode electrode plate cleaning mechanisms are two, wherein one cathode electrode plate cleaning mechanism is used for cleaning out, on the cathode electrode plate, a cathode electrode tab receiving groove provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery; and the other cathode electrode plate cleaning mechanism is used for cleaning out, on the cathode electrode plate, a cathode paired recess provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery and located exactly on the back side of the cathode electrode tab receiving groove; and

the first cathode electrode plate sticking mechanism is further used for sticking a fourth insulating adhesive tape on the cathode paired recess; and

thesecond cathode electrode plate sticking mechanism is further used for sticking a third insulating adhesive tape on the cathode slurry layer at a position aligned with the anode paired recess.

19. The second battery cell winding formation system according to claim 13, wherein, the second battery cell winding formation systemfurther comprises:

aplurality of anode electrode plate sensing mechanisms, disposed on the working platform, located on a convey path of the anode electrode plate starting from the anode electrode plate unwinding roller and passing through the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanism and the anode electrode tab connection mechanism until the winding mechanism, and used for sensing the position of the anode electrode plate on the convey path; and

aplurality of anode electrode plate corrective mechanisms, disposed on the working platform, located on a convey path of the anode electrode plate starting from the anode electrode plate unwinding roller and passing through the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanismand the anode electrode tab connection mechanism until the winding mechanism, and used for correcting the anode electrode plate.

20. The second battery cell winding formation system according to claim 13, wherein, the second battery cell winding formation system further comprises:

aplurality of cathode electrode plate sensing mechanisms, disposed on the working platform, located on a convey path of the cathode electrode plate starting from the cathode electrode plate unwinding roller and passing through the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism and the cathode electrode tab connection mechanismuntil the winding mechanism, and used for sensing the position of the cathode electrode plate on the convey path; and

aplurality of cathode electrode plate corrective mechanisms, disposed on the working platform, located on a convey path of the cathode electrode plate starting from the cathode electrode plate unwinding roller and passing through the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism and the cathode electrode tab connection mechanism until the winding mechanism, and used for correcting the cathode electrode plate.

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ABSTRACT OF THE DISCLOSURE

The present invention provides a secondary battery cell and winding formation system thereof. The secondary battery cell comprises an anode electrode plate, an anode electrode tab, a cathode electrode plate, a cathode electrode tab and a separator. The secondary battery cell winding formation system comprises a working platform, a winding mechanism, an anode electrode plate unwinding roller, an anode electrode plate cleaning mechanism, an anode electrode plate die-cutting mechanism, an anode electrode tab supply mechanism, an anode electrode tab connection mechanism, an anode electrode plate convey mechanism, a cathode electrode plate unwinding roller, a cathode electrode plate cleaning mechanism, a cathode electrode plate die-cutting mechanism, a cathode electrode tab supply mechanism, a cathode electrode tab connection mechanism, a cathode electrode plate convey mechanism, a first separator unwinding roller, a second separator unwinding roller, a first separator convey mechanism and a second separator convey mechanism. The secondary battery cell manufactured by the secondary battery cell winding formation system of the present invention can effectively prevent the secondary battery cell from generating internal short circuit, thus improving the safety performance of the secondary battery cell while ensuring a high energy density.

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PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
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Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Peipei		Guo	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Ningde, Fujian	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone		
Address 2			
City	Ningde, Fujian	State/Province	
Postal Code	352100	Country [i]	CN

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yi		Zhao	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Ningde, Fujian	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone		
Address 2			
City	Ningde, Fujian	State/Province	
Postal Code	352100	Country [i]	CN

Inventor 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ping		He	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Ningde, Fujian	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone		
Address 2			
City	Ningde, Fujian	State/Province	
Postal Code	352100	Country [i]	CN

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Hongxin		Fang	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Ningde, Fujian	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone		
Address 2			
City	Ningde, Fujian	State/Province	
Postal Code	352100	Country [i]	CN

Inventor 5 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Wenqiang		Cheng	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Ningde, Fujian	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone		
Address 2			
City	Ningde, Fujian	State/Province	
Postal Code	352100	Country [i]	CN

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	20995		
Email Address	efiling@knobbe.com	Add Email	Remove Email

Application Information:

Title of the Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF		
Attorney Docket Number	DHNG001.001C1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	6	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	20995		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	PCT/CN2015/088638	2015-08-31

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:	

If the Applicant is an Organization check here. ☒

Organization Name	Ningde Amperex Technology Limited

Mailing Address Information For Applicant:

Address 1	No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone		
Address 2			
City	Ningde, Fujian	**State/Province**	
Country	CN	Postal Code	352100
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature				Date (YYYY-MM-DD)	2018-02-28
First Name	David	Last Name	Dremann	Registration Number	71,708

Additional Signature may be generated within this form by selecting the Add button.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DHNG001.001C1
	Application Number	
Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

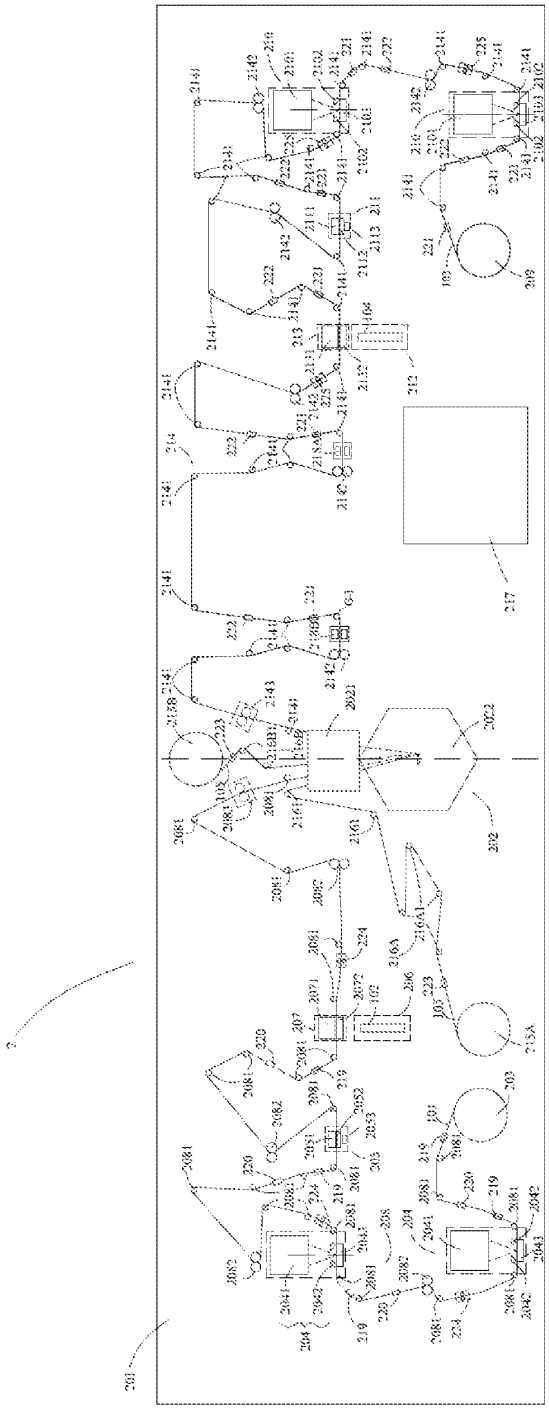


Fig.1

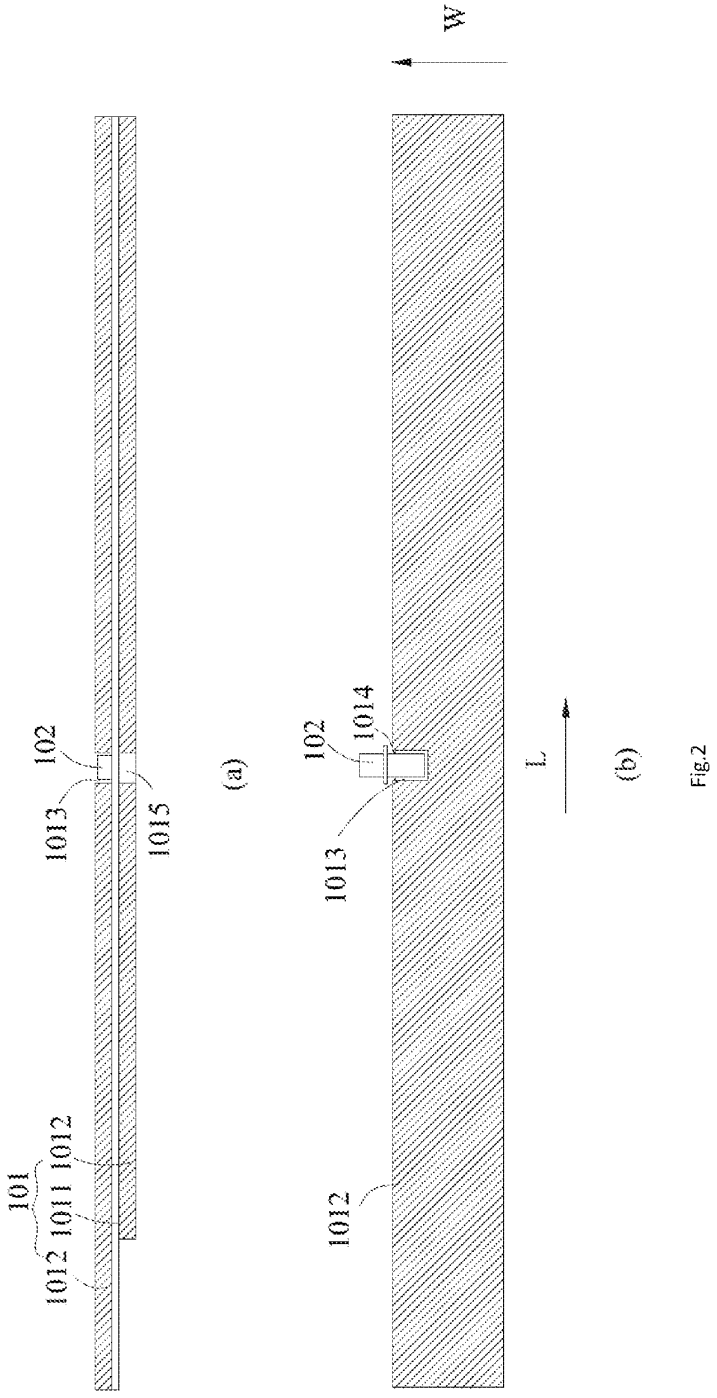


Fig.2

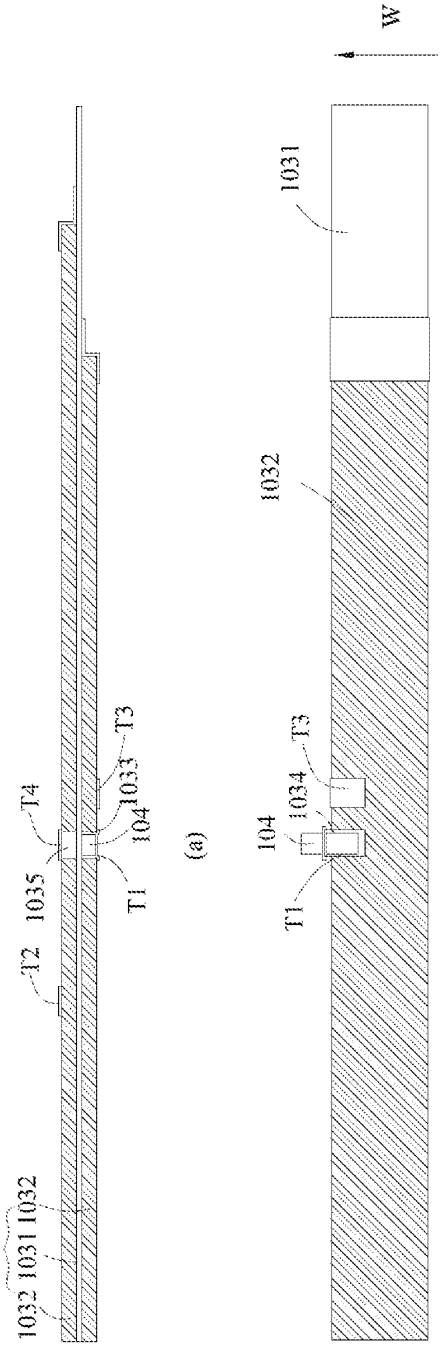

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(b)

Fig.3

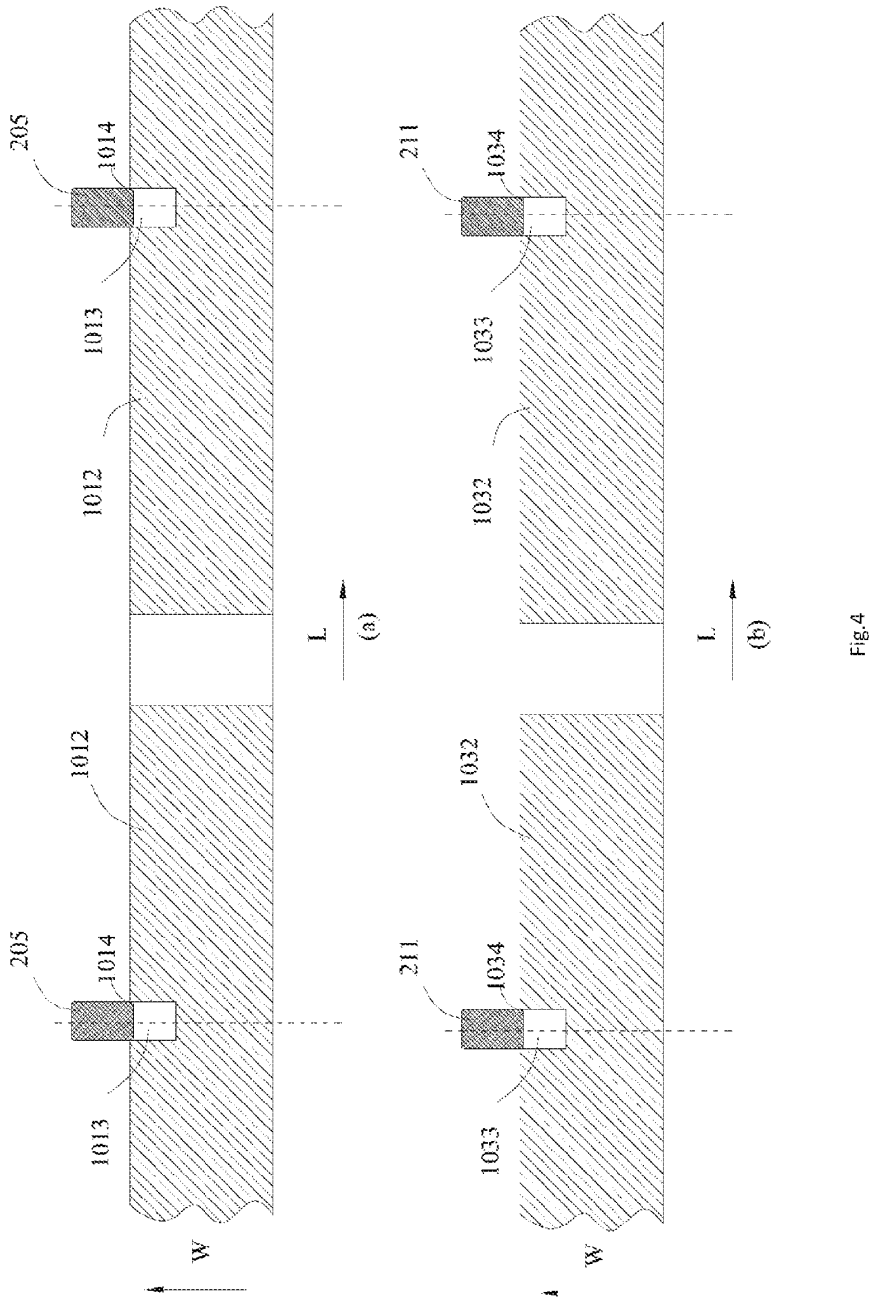

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(b)

Fig.4

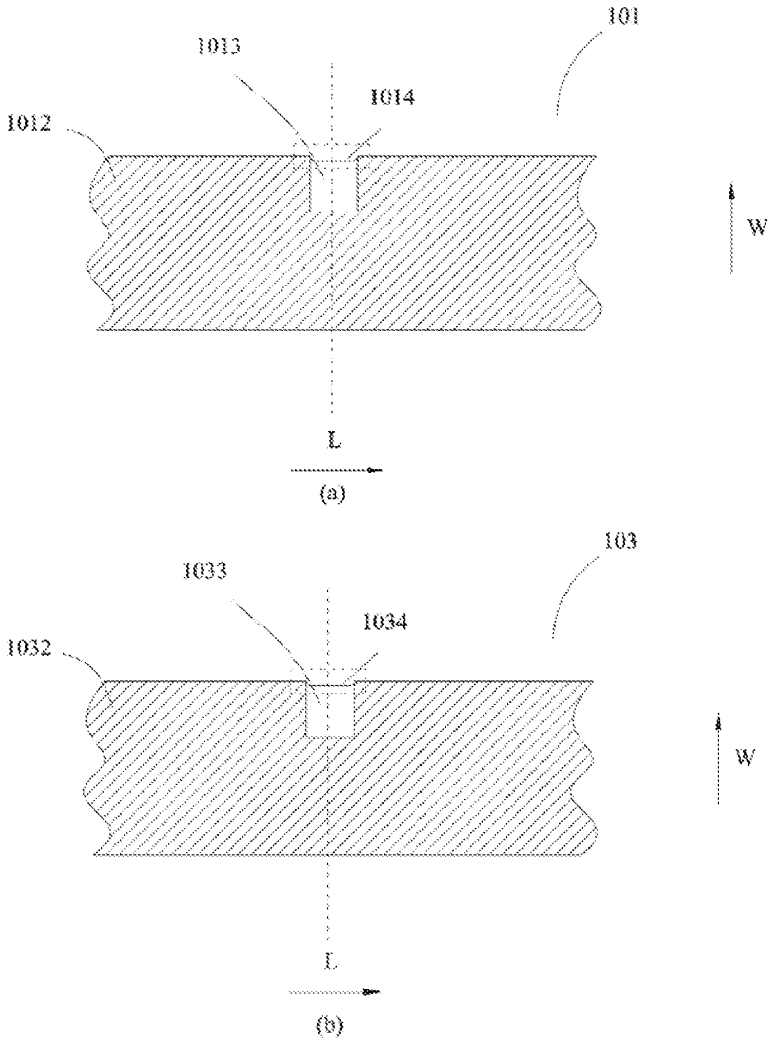
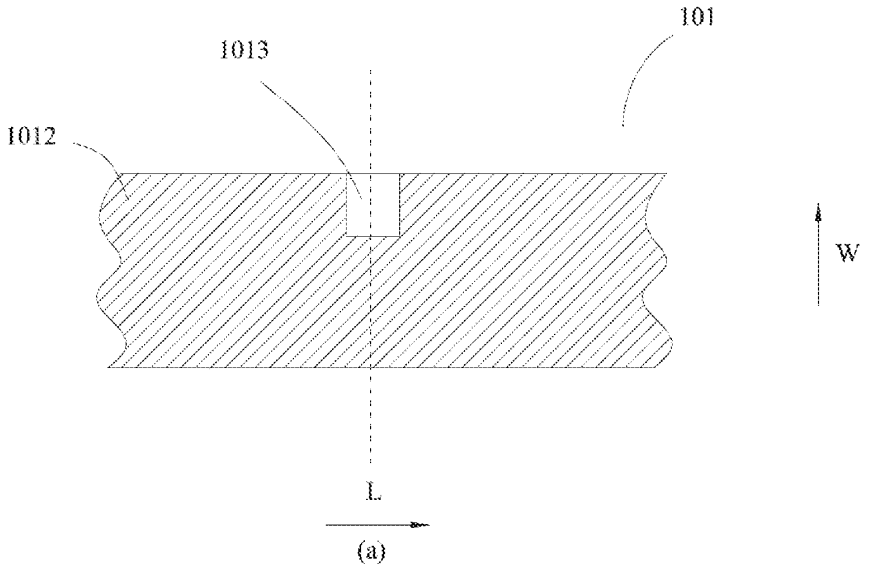


Fig.5



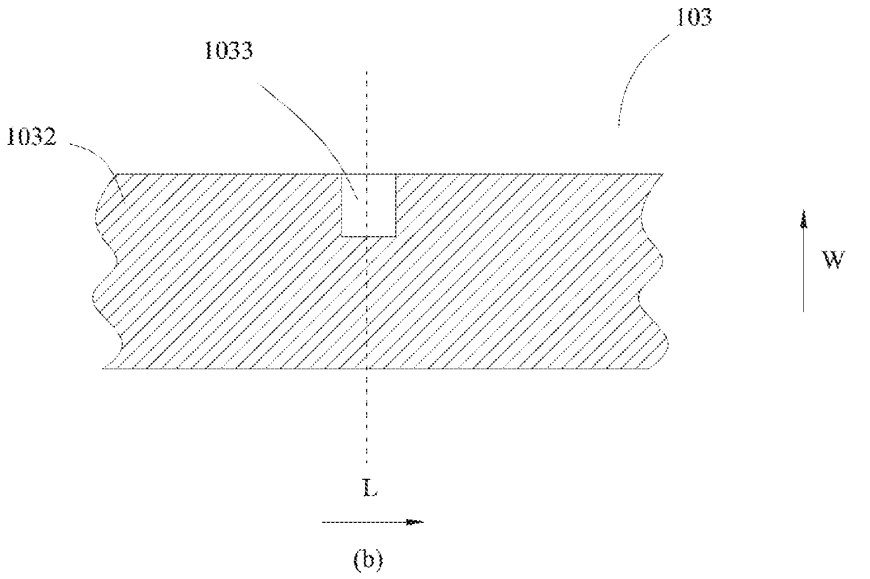


Fig.6

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Wenqiang Cheng Date (Optional): Feb. 28. 2018

Signature: Wenqiang Cheng

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: Peipei Guo Date (Optional): Feb. 28. 2018

Signature: Peipei Guo

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

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- [ ] United States application or PCT international application number _____ filed on _____.

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I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Ping He Date (Optional): Feb. 28. 2018

Signature: Ping He

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Yi Zhao Date (Optional): Feb. 28. 2018

Signature: Yi Zhao

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: Hongxin Fang Date (Optional): Feb 28, 2018

Signature: Hongxin Fang

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Filer:	David Michael Dremann/Blake Morgan
Attorney Docket Number:	DHNG001.001C1
Filed as Large Entity	
Filing Fees for Utility under 35 USC 111(a)	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1720**

Electronic Acknowledgement Receipt	
EFS ID:	31921746
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	20995
Filer:	David Michael Dremann/Zachary Galligan
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.001C1
Receipt Date:	28-FEB-2018
Filing Date:	
Time Stamp:	17:28:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	030118INTEFSW17291501
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		DHNG001001C1_Spec.pdf	351776 c69399c3013be91efacad93815c22e3dae3fae6d	yes	25

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	18
	Claims	19	24
	Abstract	25	25

Warnings:

Information:

2	Application Data Sheet	DHNG001001C1_ADS.pdf	169557 77d0fa84fead921fbe657b689f2dea449f35cfeb	no	8

Warnings:

Information:

This is not an USPTO supplied ADS fillable form

3	Drawings-other than black and white line drawings	DHNG001001C1_Drawings.pdf	531868 2c092496994ed6092d6ae651216f7ff4c7041d7c	no	6

Warnings:

Information:

4	Oath or Declaration filed	DHNG001001C1_Decs.pdf	1299510 3ec84248270b5cc4e4b9d432472eb1b954913164	no	5

Warnings:

Information:

5	Fee Worksheet (SB06)	fee-info.pdf	34958 69c9ece4ac50d74411a4a0ca6609b6938f824180	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2387669		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 15908327 Document Date: 02/28/2018

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

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- USPTO employees may access SCORE content via eDAN using the Supplemental Content tab, or via the SCORE web page.
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Form Revision Date: August 26, 2013

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/908,327	02/28/2018	1726	1720	DHNG001.001C1	20	2

CONFIRMATION NO. 2611

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

FILING RECEIPT



Date Mailed: 03/27/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Peipei Guo, Ningde, CHINA;
Yi Zhao, Ningde, CHINA;
Ping He, Ningde, CHINA;
Hongxin Fang, Ningde, CHINA;
Wenqiang Cheng, Ningde, CHINA;

Applicant(s)

Ningde Amperex Technology Limited, Ningde, CHINA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of PCT/CN2015/088638 08/31/2015

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 03/23/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/908,327**

Projected Publication Date: 07/05/2018

Non-Publication Request: No

Early Publication Request: No
Title

SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

Preliminary Class

429

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/908,327

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED		(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A		N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A		N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A		N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20	minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))								0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application No.	15/908327
	Filing Date	February 28, 2018
	First Named Inventor	Peipei Guo
	Art Unit	1723
(Multiple sheets used when necessary)	Examiner	Cano, Milton I.
SHEET 1 OF 1	Attorney Docket No.	DHNG001.001C1

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	1	CN 105406028 A	03-16-2016	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	2	CN 105990612 A	10-05-2016	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	3	CN 202495523 U	10-17-2012	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	4	CN 203733894 U	07-23-2014	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	5	CN 204905336 U	12-23-2015	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	6	CN 205355186 U	06-29-2016	NINGDE AMPEREX TECHNOLOGY LIMITED		X

28281419

Examiner Signature	Date Considered
***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

T[1] - Place a check mark in this area when an English language Translation is attached.

Espacenet

Bibliographic data: CN105406028 (A) — 2016-03-16

Polar piece coating removing method

Inventor(s): ZHANG FEN; ZHAO YI; HE PING; FANG HONGXIN; CHENG WENQIANG ± (ZHANG FEN, ; ZHAO YI, ; HE PING, ; FANG HONGXIN, ; CHENG WENQIANG)

Applicant(s): AMPEREX TECH LTD; NINGDE AMPEREX TECHNOLOGY LTD ± (AMPEREX TECHNOLOGY LTD, ; NINGDE AMPEREX TECHNOLOGY LTD)

Classification: - international:***H01M4/139***
- cooperative: **B23K26/0066**; **B23K26/352**; **H01M10/0525**; **H01M4/04**; **H01M4/0471**; B23K26/362; H01M2/26; H01M2220/20; H01M2220/30

Application number: CN20141464606 20140912 Global Dossier

Priority number (s): CN20141464606 20140912

Also published as: EP3193391 (A1) EP3193391 (A4) JP2017532721 (A) KR20170036007 (A) US2017170455 (A1) more

Abstract of CN105406028 (A)

The present invention provides a polar piece coating removing method, wherein the polar piece comprises a current collector and a coating coated on at least a surface of the current collector. The method comprises: (1) fixing the area to be removed on the polar piece from the surface opposite to the surface of the current collector at which the area to be removed is positioned by using a vacuum adsorption way; (2) carrying out laser beam irradiation on the coating of the area to be removed on the polar piece from one side of the surface of the current collector at which the area to be removed is positioned to defeat the coating of the area to be removed on the polar piece so as to expose the current collector at the area to be removed on the polar piece; and (3) removing the coating residue produced in the step (2). According to the present invention, the area to be removed on the polar piece is fixed by using the vacuum adsorption way, then the laser beam is used to remove the coating of the area to be removed, and the polar piece is fixed, such that the stress produced by the coating due to the heating caused by the laser effect during the laser removing process and the

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polar piece deformation caused by the residual stress released after the coating removing can be avoided.

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DESCRIPTION CN105406028

The invention provides a method for removing a pole piece coating. The pole piece includes a current collector and a coating layer coated on at least one surface of the collector. The method includes the following steps: (1) removing the area to be removed on the pole piece The opposite surface of the current collector surface where the area to be removed is located is fixed by vacuum adsorption; (2) the area to be removed from the surface of the current collector where the area to be removed is located by the laser beam illuminating the area to be removed The coating to break the coating of the region to be removed on the pole piece to expose the current collector at the region to be removed on the pole piece; and (c) to remove the coating residue generated in step (b) . First, the area to be removed on the pole piece is fixed by vacuum adsorption, and then the laser beam is used to remove the coating of the area to be removed. Since the pole piece is fixed, the coating can be prevented from being lasered during laser removal. The role of the heat generated by the stress and the residual stress released after removal of the coating caused by the pole piece deformation.

Pole coating removal method

Technical field

The invention relates to the field of energy storage devices, and in particular to a method for removing a pole piece coating.

Background technique

Lithium-ion batteries have received extensive attention because of their advantages such as high energy density

and environmental friendliness. They have been widely used in electronic devices such as mobile phones and notebook computers, and with the development of electric vehicle technology, lithium ion batteries are in the field of electric vehicles. The application is also getting more and more attention.

Despite the increasing market demand for lithium-ion batteries, the manufacturing speed of high-energy-density lithium-ion batteries is difficult to improve. This is because: In the process of manufacturing lithium-ion batteries, an important process that affects the manufacturing speed of lithium-ion batteries is to weld the tabs on the pole pieces of lithium-ion batteries, as shown in Figs. 1 and 2, because of the application The continuous coating 12 on the sheet 1 or the welding of the tabs needs to be welded in the middle portion of the tabs. In order to realize the welding of the tabs on the tab 1, first the poles to be welded on the tab 1 are to be removed (Or it is referred to as coating 12 on the area R) to be removed. Moreover, in some special battery production processes, it is also necessary to remove differently shaped coatings 12 at different positions of the pole pieces 1 of the battery. For example, as shown in FIGS. 3 and 4, it may sometimes also be necessary to remove the coating 12 on the region R to be removed at corresponding locations on both surfaces of the pole piece 1.

Currently used removal methods include mechanical scraping removal and chemical removal methods, but there are many problems with the two removal methods: Mechanical removal is difficult to guarantee the cleanliness of removal, especially in thin pole pieces. The pole pieces are scratched; chemical removal causes some damage to the environment, and there are disadvantages such as poor work environment and low production efficiency. In view of the deficiencies of the above two methods, U.S. Patent No. 8,309,880 B2, issued on November 13, 2012, discloses a method for removing a coating on a pole piece using a laser to solve the above two kinds of removal. There are problems with the method.

However, the method in this patent has the following deficiencies:

First, the principle of laser removal is that under the action of a laser, the coating absorbs certain energy, and the coating particles are vaporized, sublimated, and vibrated and thus removed. Since the energy distribution of the laser beam emitted by the laser is generally a Gaussian distribution, the distributed laser beam has a high middle energy and a low edge energy. The removal of the coating 12 on the pole piece 1 requires a certain range of energy, so in the laser beam with Gaussian distribution of this energy, the middle part with higher energy is likely to damage the foil (because the battery's pole piece 1 is set The fluid 11 is generally a copper foil and an aluminum foil and has a thickness of several micrometers to several dozen micrometers. This part of high energy easily penetrates the copper foil or the aluminum foil, affecting the removal quality and welding quality of the tabs, and the energy of the edges is low. The removal of the required energy causes the coating to remain, which also affects the quality of the removal. At the same time, these high-energy and low-energy energy utilization rates are low because they cannot be used effectively.

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Secondly, during the removal of the coating 12 of the pole piece 1 by the laser, under the action of the laser, the coating 12 is heated, and the stress is changed, thereby causing the pole piece 1 to be deformed, and the residual stress after the coating 12 is removed. The release sheet 1 will also have a slight deformation, which will affect the subsequent welding of the tabs.

Thirdly, in this patent, the inert gas is blown toward the removed region of the pole piece 1 by spraying an air flow so as to achieve the cleaning and cooling of the pole piece 1 . However, this method does not completely remove the particles on the removed area, which may cause the particles to remain around the removed area, affecting the performance of the battery.

Fourth, during the removal process, the laser needs to accelerate and decelerate at the corners, causing the quality of the laser head to move and the quality of the removal to be unstable and the size of the removal to be inaccurate. Therefore, this method is difficult to achieve mass production. .

Summary of the Invention

In view of the problems in the background art, the object of the present invention is to provide a method for removing a pole piece coating, which can prevent the pole piece from being deformed.

In order to achieve the above object, the present invention provides a method for removing a pole piece coating, the pole piece comprising a current collector and a coating layer coated on at least one surface of the current collector, comprising the steps of: (1) placing the pole piece thereon The area to be removed is fixed by vacuum suction from the opposite surface of the current collector surface where the area to be removed is located; (2) The laser beam irradiating the pole piece on the side of the surface of the current collector where the area to be removed is located. The coating of the area to be removed removes the coating on the region to be removed on the pole piece, thereby exposing the current collector at the region to be removed on the pole piece; and (c) removing the generated in step (b) Coating residue.

The beneficial effects of the present invention are as follows:

First, the area to be removed on the pole piece is fixed by vacuum adsorption, and then the laser beam is used to remove the coating of the area to be removed. Since the pole piece is fixed, the coating can be prevented from being lasered during laser removal. The role of the heat generated by the stress and the residual stress released

after removal of the coating caused by the pole piece deformation.

Description of the drawings

1 is a top view of an embodiment of a pole piece in a method for removing a pole piece coating according to the present invention;

Figure 2 is a front view of Figure 1;

FIG. 3 is a top view of an embodiment of a pole piece in a method for removing a pole piece coating according to the present invention; FIG.

Figure 4 is a front view of Figure 3;

5 is a top view of an embodiment of a pole piece in a method of removing a pole piece coating according to the present invention;

Figure 6 is a front view of Figure 5;

FIG. 7 is a top view of an embodiment of a pole piece in a method for removing a pole piece coating according to the present invention; FIG.

FIG. 8 is a front view of FIG. 7 .

Among them, the reference numerals are as follows:

1
Pole 12 coating

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11Current collector R to be removed

detailed description

The method of removing a pole piece coating according to the present invention will be described in detail below with reference to the accompanying drawings.

Referring to FIGS. 1 to 8, in a method for removing a coating for a pole piece according to the present invention, the pole piece 1 includes a current collector 11 and a coating 12 coated on at least one surface of the current collector 11, including steps: a) The region R to be removed on the pole piece 1 is fixed from the opposite surface of the surface of the current collector 11 where the region to be removed R is vacuum-sucked; (2) from the area R to be removed The surface 12 of the current collector 11 irradiates the coating layer 12 of the region to be removed R on the pole piece 1 with a laser beam to break the coating layer 12 of the region to be removed R on the pole piece 1, so that the pole piece 1 is The current collector 11 at the region R to be removed is exposed; and (c) the coating residue generated in step (b) is removed.

In the method for removing the pole piece coating according to the present invention, the region R to be removed on the pole piece 1 is first fixed by vacuum adsorption, and then the coating 12 of the region to be removed R is removed by using a laser beam. Since the pole piece 1 is fixed, the deformation of the pole piece 1 caused by the heat generated by the laser action of the coating layer 12 and the residual stress released after the coating layer 12 is removed during laser removal can be avoided.

In the method for removing a pole piece coating according to the present invention, vacuum degree of vacuum adsorption may be -20 KPa to -100 KPa.

In the method of removing the tab coating according to the present invention, referring to FIGS. 1 and 2, one surface of the current collector 11 may be coated with the coating 12.

In the example shown in FIGS. 1 and 2 , the coating 12 of the region to be removed R on the pole piece 1 is shown in one place, but in practice, the position of the coating 12 on the pole piece to be removed is in the position of the pole piece. The shape, shape, and number are not limited to this and can be changed as needed. At the same time, steps (a) to (c) may be performed step by step or simultaneously for the coating 12 of the region R to be removed in different positions, shapes, and numbers.

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In the method of removing a pole piece coating according to the present invention, referring to FIGS. 3 and 4, 5 and 6, 7 and 8, both surfaces of the current collector 11 may be coated with the coating 12.

In the examples shown in FIGS. 3 and 4, both surfaces of the current collector 11 are coated with the coating 12 in a mirror-image centered on the current collector 11. In the example shown in FIGS. 5 and 6, both surfaces of the current collector 11 coated with the coating 12 are not mirror-symmetrical with respect to the current collector 11. In the examples shown in FIGS. 7 and 8, both surfaces of the current collector 11 coated with the coating 12 are not mirror-symmetrical with respect to the current collector 11. In the examples shown in FIGS. 7 and 8, both surfaces of the current collector 11 coated with the coating 12 are mirror-symmetrical with respect to the current collector 11. In practice, the position, shape, and number of the coating layers 12 of the region R to be removed respectively on the two surfaces of the current collector 11 of the pole pieces are not limited thereto, and may be changed as needed. At the same time, steps (a) to (c) may be performed step by step or simultaneously for the coating 12 of the region R to be removed in different positions, shapes, and numbers.

In the method of removing a pole piece coating according to the present invention, the pole piece 1 is a positive pole piece or a negative pole piece.

In the method for removing a pole piece coating according to the present invention, in an embodiment, the pole piece 1 may be a pole piece of a lithium ion battery.

In the method for removing a coating for a pole piece according to the present invention, the thickness of the coating 12 applied on one surface of the collector 11 is 30 μm to 200 μm.

In the method of removing a pole piece coating according to the present invention, in an embodiment, the laser beam may be a flat-topped beam.

The energy distribution of the laser light beam of the flat-top light source is flat and evenly distributed, which can prevent the removal of the area R to be removed on the pole piece 1 caused by the uneven energy of the laser beam, and avoid the occurrence of the laser beam. The energy distribution is not uniform, resulting in deformation of the pole piece 1 due to uneven heating. All the energy of the flat-topped beam is fully utilized in an optimal manner. The closer the Flatness is to 1, the better.

In the method for removing a coating for a pole piece according to the present invention, in one embodiment,

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the power of the laser may be 20W-500W. If the power of the laser is too low, the coating 12 in the region R to be removed on the pole piece 1 cannot be effectively removed, and if the power is too low, multiple removals are required to remove the coating 12 and increase the pole piece 1 Thermal denaturation, if the power of the laser is too high, excessive heat generation may cause the pole piece 1 to generate an excessive heat-affected zone, and may also damage the collector 11 .

In the method for removing a coating for a pole piece according to the present invention, in one embodiment, the laser beam can break the coating 12 of the region R to be removed on the pole piece 1 by galvanoscanning. Galvo scanning ensures that the laser head does not move, thus improving the quality of laser beam removal, removing the stability, removing the precise dimensions, and easily achieving mass production.

In the method for removing a coating for a pole piece according to the present invention, in an embodiment, the step (c) may take at least one of a suction suction and an airflow purging. As a result, the particles on the coating removal area can be completely removed. In one embodiment, the negative pressure suction suction may be -5Kpa to -50KPa.

In the method for removing a coating for a pole piece according to the present invention, after step (c), the method further includes the step of removing the coating residue by sticky dust to assist the auxiliary cleaning.

In the method of removing a pole piece coating according to the present invention, the current collector 11 exposed in the removal area of the coating layer 12 can be used for welding lugs.

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CLAIMS CN105406028

1.

A method for removing a pole piece coating, the pole piece (1) comprises a current collector (11) and a coating (12) coated on at least one surface of the current collector (11), characterized by comprising:

(1) fixing the region to be removed (R) on the pole piece (1) from the opposite surface of the surface of the collector (11) on which the region (R) to be removed (R) is located by vacuum adsorption;

(2) The laser beam is applied to the coating (12) of the region to be removed (R) on the pole piece (1) from the surface side of the current collector (11) where the region (R) to be removed (R) is located to rout a coating (12) of the region to be removed (R) on the pole piece (1) to expose the current collector (11) at the region to be removed (R) on the pole piece (1); and

(c) The removal of coating residues produced in step (b).

2.

The method for removing a coating for a pole piece according to claim 1, wherein the vacuum degree of vacuum adsorption is -20 kPa to -100 kPa.

3.

The method for removing a coating for a pole piece according to claim 1, characterized in that the thickness of

the coating (12) coated on one surface of the current collector (11) is 30 μm to 200 μm.

4.
The method of removing a pole piece coating according to claim 1, wherein the laser beam is a flat-topped beam.

5.
The method for removing a pole piece coating according to claim 1, wherein the power of the laser is 20W-500W.

6.
The method for removing a coating of a pole piece according to claim 1, characterized in that the laser beam strikes the coating (12) of the region (R) to be removed on the pole piece (1) by galvanometric scanning.

7.
The method for removing a coating for a pole piece according to claim 1, characterized in that the step (c) takes at least one of suction suction and airflow purging.

8.
The method for removing a coating for a pole piece according to claim 7, characterized in that the negative pressure for suction suction is -5 Kpa to -50 KPa.

9.
The method for removing a pole piece coating according to claim 1, characterized in that after step (iii), the method further comprises the following steps:

Remove coating residues by sticky dust.

10.
The method of removing a pole piece coating according to claim 1, characterized in that the exposed current collector (11) in the removal area of the coating (12) is used for welding the tabs.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 105406028 A
(43)申请公布日 2016.03.16

(21)申请号 201410464606.0

(22)申请日 2014.09.12

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(51)Int.Cl.
H01M 4/139(2010.01)

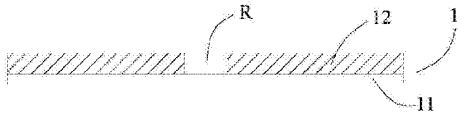
权利要求书1页 说明书4页 附图3页

(54)发明名称

极片涂层的移除方法

(57)摘要

本发明提供了一种极片涂层的移除方法，极片包括集流体和涂覆在集流体的至少一个表面上的涂层，包括步骤：(一)将极片上的待移除区域从该待移除区域所处的集流体表面的相反的表面采用真空吸附方式固定；(二)从该待移除区域所处的集流体表面一侧激光束照射极片上的该待移除区域的涂层，以击溃极片上的该待移除区域的涂层，从而使极片上该待移除区域处的集流体露出；以及(三)清除在步骤(二)中产生的涂层残留物。首先将极片上的待移除区域采用真空吸附方式固定，然后采用激光束移除该待移除区域的涂层，由于极片被固定，所以可避免在激光移除的过程中涂层由于激光作用受热产生的应力以及涂层被移除后释放的残余应力导致的极片的变形。



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1. 一种极片涂层的移除方法，极片 (1) 包括集流体 (11) 和涂覆在集流体 (11) 的至少一个表面上的涂层 (12)，其特征在于，包括步骤：

（一）将极片 (1) 上的待移除区域 (R) 从该待移除区域 (R) 所处的集流体 (11) 表面的相反的表面采用真空吸附方式固定；

（二）从该待移除区域 (R) 所处的集流体 (11) 表面一侧激光束照射极片 (1) 上的该待移除区域 (R) 的涂层 (12)，以击溃极片 (1) 上的该待移除区域 (R) 的涂层 (12)，从而使极片 (1) 上该待移除区域 (R) 处的集流体 (11) 露出；以及

（三）清除在步骤（二）中产生的涂层残留物。

2. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，真空吸附的真空度为 -20KPa ～ -100KPa。

3. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，涂覆在集流体 (11) 的一个表面上的涂层 (12) 的厚度为 30μm ～ 200μm。

4. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，激光束为平顶光束。

5. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，激光的功率为 20W-500W。

6. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，激光束通过振镜扫描的方式击溃极片 (1) 上待移除区域 (R) 的涂层 (12)。

7. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，步骤（三）采取的方式是负压吸除、气流吹扫中的至少一种。

8. 根据权利要求 7 所述的极片涂层的移除方法，其特征在于，负压吸除的负压为 -5Kpa ～ -50KPa。

9. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，步骤（三）之后还包括步骤：

通过粘尘方式清除涂层残留物。

10. 根据权利要求 1 所述的极片涂层的移除方法，其特征在于，涂层 (12) 移除区域露出的集流体 (11) 用于焊接极耳。

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极片涂层的移除方法

技术领域

[0001] 本发明涉及储能器件领域，尤其涉及一种极片涂层的移除方法。

背景技术

[0002] 锂离子电池因其具有能量密度高、环境友好等优点而受到广泛的关注，在手机、笔记本电脑等电子设备中得到了广泛应用，并且随着电动汽车技术的发展，锂离子电池在电动汽车领域的应用也越来越受到关注。

[0003] 尽管市场对锂离子电池的需求越来越大，高能量密度的锂离子电池的制造速度却很难得到提高。这是因为：在制造锂离子电池的工序中，影响锂离子电池制造速度的一个重要工序就是在锂离子电池的极片上焊接极耳，如图 1 和图 2 所示，由于涂布时，极片 1 上是连续的涂层 12，或者极耳的焊接需要在极片的中间部位焊接，为了实现极耳在极片 1 上的焊接，首先要移除极片 1 上待焊接极耳区域（或者称之为待移除区域 R）上的涂层 12。而且，在一些特殊的电池生产工艺中，还需要在电池的极片 1 的不同位置移除不同形状的涂层 12。例如，如图 3 和 4 所示，有时还需要在极片 1 的两个表面上的对应位置移除待移除区域 R 上的涂层 12。

[0004] 目前常用的移除方法包括机械刮除移除法和化学移除法，但两种移除方法存在着很多问题：机械移除难以保证移除的洁净度，特别是在薄极片中还容易刮伤极片；化学移除则对环境造成了一定的伤害，存在着工作环境差和生产效率低等缺点。针对以上两种方法存在的不足，于 2012 年 11 月 13 日授权公告的美国专利号为 US8309880B2 的专利文献公开了一种采用激光移除极片上的涂层的方法，解决了上述两种移除方法存在的问题。

[0005] 但是，该专利中的方法存在以下不足：

[0006] 第一，激光移除的原理是：在激光的作用下，涂层吸收一定的能量，涂层颗粒发生气化、升华和振动等，从而被移除。由于激光器发出的激光束的能量分布一般都是高斯分布，这种分布的激光束中间能量高、边缘能量较低。而移除极片 1 上的涂层 12 需要一定范围内的能量，所以这种能量呈高斯分布的激光束中，能量较高的中间部分容易伤害到箔材（因为电池的极片 1 的集流体 11 一般为铜箔和铝箔，厚度为几微米到十几微米，这部分高能量很容易将铜箔或铝箔穿透），影响移除质量和极耳的焊接质量；而边缘的能量又低于移除需要的能量，这样就造成涂层的残留，也同样影响了移除的质量。同时这些高能量和低能量由于不能被有效的利用而使得能量的利用率很低。

[0007] 第二，采用激光移除极片 1 的涂层 12 的过程中，在激光的作用下涂层 12 因受热，应力会发生变化，进而导致极片 1 变形，涂层 12 被去除后由于残余应力的释放极片 1 也会产生微量变形，进而影响后续极耳的焊接。

[0008] 第三，该专利中通过喷出气流的方式将惰性气体吹向极片 1 的移除后的区域，以实现对极片 1 的清洁和冷却。但是，这种方法不能完全的清除移除后的区域上的颗粒，从而会使颗粒残留在移除后的区域的周围，影响电池的性能。

[0009] 第四，在移除过程中激光在拐角处要不停的加速、减速，从而导致激光头移动进行

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移除的品质不稳定、移除的尺寸不精准，所以这种方法很难实现量产化。

发明内容

[0010] 鉴于背景技术中存在的问题，本发明的目的在于提供一种极片涂层的移除方法，其能避免极片变形。

[0011] 为了实现上述目的，本发明提供了一种极片涂层的移除方法，极片包括集流体和涂覆在集流体的至少一个表面上的涂层，包括步骤：（一）将极片上的待移除区域从该待移除区域所处的集流体表面的相反的表面采用真空吸附方式固定；（二）从该待移除区域所处的集流体表面一侧激光束照射极片上的该待移除区域的涂层，以击溃极片上的该待移除区域的涂层，从而使极片上该待移除区域处的集流体露出；以及（三）清除在步骤（二）中产生的涂层残留物。

[0012] 本发明的有益效果如下：

[0013] 首先将极片上的待移除区域采用真空吸附方式固定，然后采用激光束移除该待移除区域的涂层，由于极片被固定，所以可避免在激光移除的过程中涂层由于激光作用受热产生的应力以及涂层被移除后释放的残余应力导致的极片的变形。

附图说明

[0014] 图 1 为根据本发明的极片涂层的移除方法中的极片的一实施例的俯视图；

[0015] 图 2 为图 1 的正视图；

[0016] 图 3 为根据本发明的极片涂层的移除方法中的极片的一实施例的俯视图；

[0017] 图 4 为图 3 的正视图；

[0018] 图 5 为根据本发明的极片涂层的移除方法中的极片的一实施例的俯视图；

[0019] 图 6 为图 5 的正视图；

[0020] 图 7 为根据本发明的极片涂层的移除方法中的极片的一实施例的俯视图；

[0021] 图 8 为图 7 的正视图。

[0022] 其中，附图标记说明如下：

[0023] 1 极片 12 涂层

[0024] 11 集流体 R 待移除区域

具体实施方式

[0025] 下面参照附图来详细说明根据本发明的极片涂层的移除方法。

[0026] 参照图 1 至图 8，在根据本发明的极片涂层的移除方法中，极片 1 包括集流体 11 和涂覆在集流体 11 的至少一个表面上的涂层 12，包括步骤：（一）将极片 1 上的待移除区域 R 从该待移除区域 R 所处的集流体 11 表面的相反的表面采用真空吸附方式固定；（二）从该待移除区域 R 所处的集流体 11 表面一侧激光束照射极片 1 上的该待移除区域 R 的涂层 12，以击溃极片 1 上的该待移除区域 R 的涂层 12，从而使极片 1 上该待移除区域 R 处的集流体 11 露出；以及（三）清除在步骤（二）中产生的涂层残留物。

[0027] 在根据本发明的极片涂层的移除方法中，首先将极片 1 上的待移除区域 R 采用真空吸附方式固定，然后采用激光束移除该待移除区域 R 的涂层 12，由于极片 1 被固定，所以

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可避免在激光移除的过程中涂层12由于激光作用受热产生的应力以及涂层12被移除后释放的残余应力导致的极片1的变形。

[0028] 在根据本发明的极片涂层的移除方法中，真空吸附的真空度可为-20KPa～-100KPa。

[0029] 在根据本发明的极片涂层的移除方法中，参照图1和图2，集流体11的一个表面可涂覆有涂层12。在图1和图2示出的例子中，极片1上的待移除区域R的涂层12示出为一处，但实际中，待移除区域R的涂层12在极片上的位置、形状、及数量不限于此，均可以根据需要改变。同时，对于不同位置、形状及数量的待移除区域R的涂层12，可以分步或同时进行步骤（一）～（三）。

[0030] 在根据本发明的极片涂层的移除方法中，参照图3和图4、图5和图6、图7和图8，集流体11的两个表面可涂覆有涂层12。

[0031] 在图3和图4示出的例子中，集流体11的两个表面涂覆有涂层12以集流体11为中心呈镜像对称。在图5和图6示出的例子中，集流体11的两个表面涂覆有涂层12不以集流体11为中心呈镜像对称。在图7和图8示出的例子中，集流体11的两个表面涂覆有涂层12不以集流体11为中心呈镜像对称。在图7和图8示出的例子中，集流体11的两个表面涂覆有涂层12部分以集流体11为中心呈镜像对称。在实际中，待移除区域R的涂层12分别在极片的集流体11的两个表面上的位置、形状、及数量均不限于此，均可以根据需要改变。同时，对于不同位置、形状及数量的待移除区域R的涂层12，可以分步或同时进行步骤（一）～（三）。

[0032] 在根据本发明的极片涂层的移除方法中，极片1为正极极片或负极极片。

[0033] 在根据本发明的极片涂层的移除方法中，在一实施例中，极片1可为锂离子电池的极片。

[0034] 在根据本发明的极片涂层的移除方法中，涂覆在集流体11的一个表面上的涂层12的厚度为30μm～200μm。

[0035] 在根据本发明的极片涂层的移除方法中，在一实施例中，激光束可为平顶光束。

[0036] 平顶光源激光束的能量分布呈平坦曲线状、分布均匀，可避免激光束能量不均匀导致的极片1上的待移除区域R移除不干净的情况的发生，同时可避免因激光束能量分布不均匀，导致的极片1因受热不均匀产生的变形。所述平顶光束的所有能量都以最佳方式被充分利用。平顶率(Flatness)越接近1越好。

[0037] 在根据本发明的极片涂层的移除方法中，在一实施例中，激光的功率可为20W-500W。如果激光的功率过低，不能有效地将极片1上的待移除区域R的涂层12移除干净，而且功率过低的话需要多次移除才能去除涂层12，增加极片1的热变性，如果激光的功率过高，产生的热量过多会使极片1产生过大的热影响区域，同时也可能会伤害到集流体11。

[0038] 在根据本发明的极片涂层的移除方法中，在一实施例中，激光束可通过振镜扫描的方式击溃极片1上待移除区域R的涂层12。振镜扫描可保证激光头不动，从而提高激光束进行移除的品质，移除稳定、移除尺寸精准，易实现量产化。

[0039] 在根据本发明的极片涂层的移除方法中，在一实施例中，步骤（三）可采取的方式是负压吸除、气流吹扫中的至少一种。由此，能够完全地清除涂层移除区域上的颗粒。在一

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实施例中，负压吸除的负压可为 -5Kpa ～ -50KPa。

[0040] 在根据本发明的极片涂层的移除方法中，步骤（三）之后还包括步骤：通过粘尘方式清除涂层残留物，以起到辅助的进一步的清洁作用。

[0041] 在根据本发明的极片涂层的移除方法中，涂层 12 移除区域露出的集流体 11 可用于焊接极耳。

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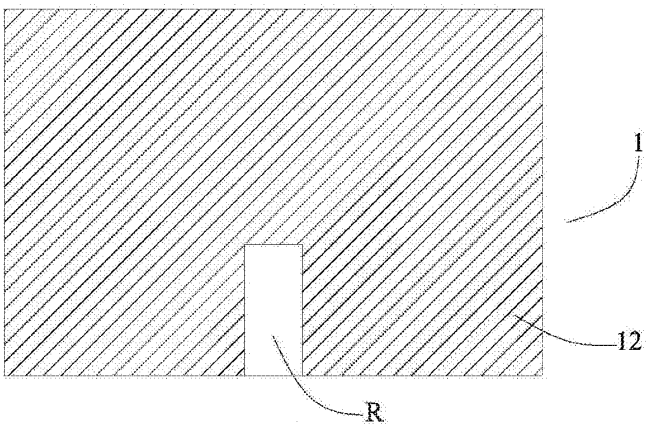


图 1

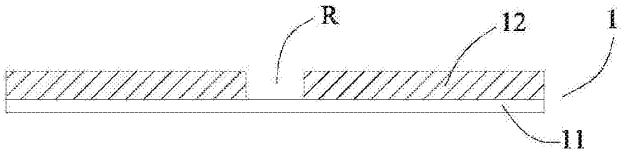


图 2

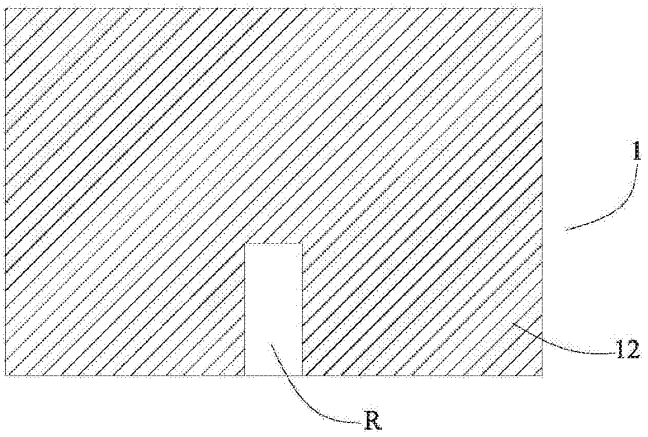


图 3

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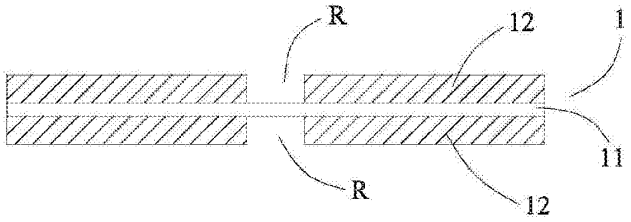


图 4

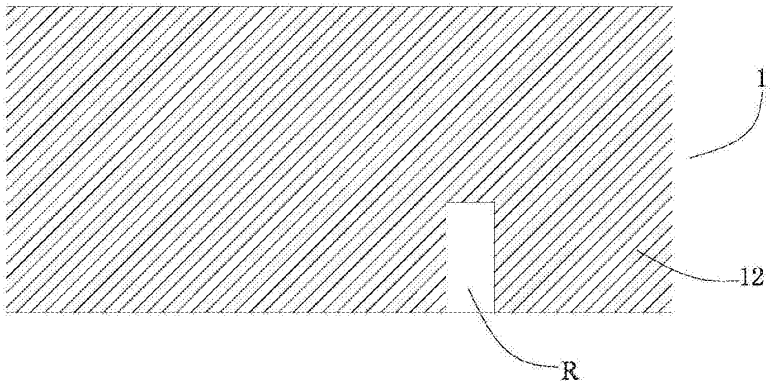


图 5

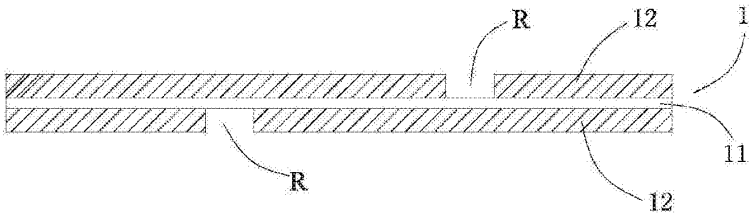


图 6

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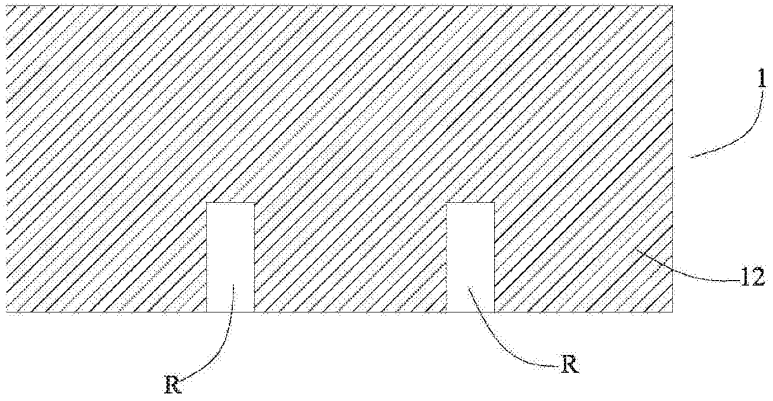


图 7

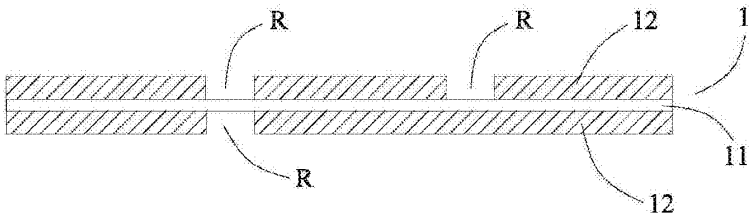


图 8

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Espacenet

Bibliographic data: CN105990612 (A) — 2016-10-05

Electrical core

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Classification: **- international:** ***H01L21/8234; H01M10/0587; H01M2/26***
- cooperative:

Application number: CN2015160477 20150205 Global Dossier

Priority number (s): CN2015160477 20150205

Abstract of CN105990612 (A)

The invention provides an electrical core. The electrical core comprises a first pole piece containing a first current collector and a first diaphragm; a first tab; a second pole piece containing a second current collector and a second diaphragm; a second tab; and an isolated film. According to the invention, at least one surface of the first current collector has a part which is unequipped with the first diaphragm, wherein the part is defined as a first surface blank area, the first surface blank area is formed by removing the first diaphragm arranged on a corresponding part on the surface of the first current collector; at least one surface of the second current collector has the part which is unequipped with the second diaphragm, wherein the part is defined as a second surface blank area, the second surface blank area is formed by removing the second diaphragm arranged on the corresponding part on the surface of the second current collector; and the first tab and the second tab are respectively arranged in the first surface blank area and the second surface blank area. The first pole piece is the anode pole piece or the cathode pole piece, the second pole piece is the cathode pole piece or the anode pole piece; and the anode pole piece is inserted into an end part of the electrical core during a reeling process.

Espacenet

Description: CN105990612 (A) — 2016-10-05

Electrical core

Description of CN105990612 (A)

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Abstract
本发明提供了一种电芯，其包括：第一极片，包括第一集流体及第一膜片；第一极耳；第二极片，包括第二集流体及第二膜片；第二极耳；隔离膜。第一集流体的至少一个表面存在未设置有第一膜片的部分且该部分定义为第一表面空白区，第一表面空白区经由移除设置在第一集流体的表面上对应部分的第一膜片而形成；第二集流体的至少一个表面存在未设置有第二膜片的部分且该部分定义为第二表面空白区，第二表面空白区经由移除设置在第二集流体的表面上对应部分的第二膜片而形成；第一极耳和第二极耳分别设置于第一表面空白区内和第二表面空白区内。第一极片为阳极极片或阴极极片，第二极片为阴极极片或阳极极片；阳极极片在卷绕过程中头部插至电芯的端部。

电芯

技术领域

本发明涉及储能器件领域，尤其涉及一种电芯。

背景技术

锂离子电池已被广泛应用于各类电子产品，随着电子产品趋向小型化、智能化发展，对锂离子电池的能量密度及厚度提出了更高的要求，这就需要在更小的体积中贡献出更可能多的能量。但传统的锂离子电池由于极耳厚度以及贴覆于极耳上绝缘绿胶厚度的叠加，使得极耳区成为电池的最大厚度区，导致极耳区以外的电芯尺寸空间浪费，并且极耳在极片上也占用了较大的区域，使得可涂覆活性物质的面积减少。此外，目前卷绕过程中阳极极片头部均不能插入至电芯端部，造成电芯内部的有效尺寸空间得不到有效的利用。

于2012年10月17日授权公告的中国专利授权公告号为202495523 U的专利文献公开了一种锂离子电池及其极片，其采用在阴/阳极极片一端部上开设凹槽，使极耳嵌入阴/阳极极片凹槽共同形成的凹槽空腔中，减少了极耳对电芯厚度的累加。但其极耳在极片上还是占用较大面积，降低了开槽效率并导致极片上可涂覆活性物质的面积减少；而且在卷绕时阳极极片头部距离电芯端部3.5～4.5mm，电芯内部有效尺寸空间尚未得到有效利用。此外，该专利所述结构中阳极极片凹槽和阴极极片凹槽对应的阴极极片区未粘贴绝缘绿

胶，电芯存在内短路以及析锂风险。

于2014年7月23日授权公告的中国专利授权公告号为CN 203733894 U的专利文献公开了一种锂离子电池，其采用在阴/阳极极片中部开设凹槽，使极耳分别嵌入阴阳极极片的凹槽中，实现减少极耳对电芯的厚度累加，此外还采用在阴极极耳上下两面以及阳极极耳对应的阴极极片区贴覆绝缘绿胶来减小内短路的发生。虽然该专利解决了内短路及析锂风险的问题，但该专利中所贴覆的绝缘绿胶粘覆住了极耳附近区域的活性物质层，从而减小了活性物质层的有效面积，并且该专利中凹槽的面积仍较大。此外该专利所属的电芯在卷绕时阳极极片头部距离电芯端部3.5～4.5mm，电芯内部有效尺寸空间也同样未得到有效利用。

发明内容

鉴于背景技术中存在的问题，本发明的目的在于提供一种电芯，其能提高电芯的容量和体积能量密度

为了实现上述目的，本发明提供了一种电芯，其包括：第一极片，包括第一集流体以及设置在第一集流体的表面上的含有第一活性材料的第一膜片；第一极耳，电连接于第一极片的第一集流体；第二极片，与第一极片极性相反，包括第二集流体以及设置在第二集流体的表面上的含有第二活性材料的第二膜片；第二极耳，电连接于第二极片的第二集流体；以及隔离膜，设置于第一极片和第二极片之间；其中，第一极片、隔离膜和第二极片依序卷绕形成电芯。第一集流体的至少一个表面存在未设置有第一膜片的部分且该部分定义为第一表面空白区，第一表面空白区经由移除设置在第一集流体的表面上对应部分的第一膜片而形成；第二集流体的至少一个表面存在未设置有第二膜片的部分且该部分定义为第二表面空白区，第二表面空白区经由移除设置在第二集流体的表面上对应部分的第二膜片而形成；第一极耳设置于第一表面空白区内且电连接于第一表面空白区，第一极耳的厚度小于等于第一膜片的厚度；第二极耳设置于第二表面空白区内且电连接于第一表面空白区，第二极耳的厚度小于等于第二膜片的厚度。第一极片为阳极极片或阴极极片，相应地第二极片为阴极极片或阳极极片；第一极耳为阳极极耳或阴极极耳，相应地第二极耳为阴极极耳或阳极极耳；第一活性材料为阳极活性材料或阴极活性材料，相应地第二活性材料为阴极活性材料或阳极活性材料；第一膜片为阳极膜片或阴极膜片，相应地第二膜片为阴极膜片或阳极膜片；第一集流体为阳极集流体或阴极集流体，相应地第二集流体为阴极集流体或阳极集流体；第一表面空白区为阳极空白区或阴极空白区，相应地第二表面空白区为阴极空白区或阳极空白区；阳极极片在卷绕过程中阳极极片的头部插至电芯的端部。

本发明的有益效果如下：

在根据本发明的电芯中，阳极极片在卷绕过程中阳极极片的头部插至电芯的端部，从而更充分地利用电芯内部的有效尺寸空间，使电芯的容量和体积能量密度得以进一步提升。

附图说明

图1为根据本发明的电芯的一实施例的侧视图；

图2为根据本发明的电芯的一实施例的第一极耳焊接的结构示意图；

图3为图2的变化实施例的电芯的第一极耳焊接的结构示意图；

图4为图2的另一变化实施例的电芯的第一极耳焊接的结构示意图；

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图5为根据本发明的电芯的另一实施例的第一极耳区域的部分放大图；

图6为根据本发明的电芯的另一实施例的第一极耳粘结的结构示意图；

图7为本发明的一对比例的电芯的第一极耳焊接的结构示意图；

图8为本发明的一对比例的电芯的侧视图。

其中，附图标记说明如下：

1第一极片 S焊点

11第一集流体 4第二极耳

111第一表面空白区 5隔离膜

12第一膜片 6第一绝缘胶

2第一极耳 7第二绝缘胶

3第二极片 L长度方向

31第二集流体 W宽度方向

311第二表面空白区 T厚度方向

32第二膜片

具体实施方式

下面参照附图来详细说明根据本发明的电芯。

参照图1至图7，根据本发明的电芯包括：第一极片1，包括第一集流体11以及设置在第一集流体11的表面上的含有第一活性材料的第一膜片12；第一极耳2，电连接于第一极片1的第一集流体11；第二极片3，与第一极片1极性相反，包括第二集流体31以及设置在第二集流体31的表面上的含有第二活性材料的第二膜片32；第二极耳4，电连接于第二极片3的第二集流体31；以及隔离膜5，设置于第一极片1和第二极片3之间；其中，第一极片1、隔离膜5和第二极片3依序卷绕形成电芯。第一集流体11的至少一个表面存在未设置有第一膜片12的部分且该部分定义为第一表面空白区111，第一表面空白区111经由移除设置在第一集流体11的表面上对应部分的第一膜片12而形成；第二集流体31的至少一个表面存在未设置有第二膜片32的部分且该部分定义为第二表面空白区311，第二表面空白区311经由移除设置在第二集流体31的表面上对应部分的第二膜片32而形成；第一极耳2设置于第一表面空白区111内且电连接于第一表面空白区111，第一极耳2的厚度小于等于第一膜片12的厚度；第二极耳4设置于第二表面空白区311内且电连接于第一表面空白区111，第二极耳4的厚度小于等于第二膜片32的厚度。第一极片1为阳极极片或阴极极片，相应地第二极片3为阴极极片或阳极极片；第一极耳2为阳极极耳或阴极极耳，相应地第二极耳4为阴极极耳或阳极极耳；第一活性材料为阳极活性材料或阴极活性材料，相应地第二活性材料为阴极活性材料或阳极活性材料；第一膜片12为阳极膜片或阴极膜片，相应地第二膜片32为阴极膜片或阳极膜片；第一集流体11为阳极集流体或阴极集流体，相应地第二集流体31为阴极集流体或阳极集流体；第一表面空白区111为阳极空白区或阴极空白区，相应地第二表面空白区311为阴极空白区或阳极空白区；阳极极片在卷绕过程中阳极极片的头部插至电芯的端部。

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在根据本发明的电芯中，阳极极片在卷绕过程中阳极极片的头部插至电芯的端部，(参照图1，相比于图8对比例示出的电芯，阳极极片在卷绕过程中阳极极片的头部不能插至电芯的端部，只能插至电芯的中部)从而更充分地利用电芯内部的有效尺寸空间，使电芯的容量和体积能量密度得以进一步提升。而且，本发明的电芯的内阻(DCR)显著降低。

首先，需要说明的是，本发明的各部件的长度指的是各部件的长度方向L上的距离，各部件的宽度指的是各部件的长度方向W上的距离，各部件的厚度指的是各部件的厚度方向T上的距离。

在根据本发明的电芯的一实施例中，第一极耳2与第一表面空白区111电连接在一起的第一面积可为1～30mm 2 ，第一表面空白区111的面积可为第一面积的1～15倍；第二极耳4与第二表面空白区311电连接在一起的第二面积可为1～30mm 2 ，第二表面空白区311的面积可为第二面积的1～15倍。

在根据本发明的电芯的一实施例中，第一表面空白区111的长度和第二表面空白区311的长度可分别为电芯的宽度的0.5%～40%。

在根据本发明的电芯的一实施例中，第一表面空白区111的宽度为第一极片1的宽度的1/4～3/4；第二表面空白区311的宽度为第二极片3的宽度的1/4～3/4。

在根据本发明的电芯的一实施例中，第一表面空白区111可经由激光移除或机械移除设置在第一集流体11的表面上对应部分的第一膜片12而形成；第二表面空白区311可经由激光移除或机械移除设置在第二集流体31的表面上对应部分的第二膜片32而形成。本发明能够使第一表面空白区111和第二表面空白区311的面积大大减小，因此就增大了第一膜片12和第二膜片32的面积，从而提高了电芯的容量和体积能量密度，同时提高了第一表面空白区111和第二表面空白区311的移除效率，从而提高电芯的生产效率。

在根据本发明的电芯的一实施例中，参照图1，第一极耳2与第一表面空白区111可通过焊接而电连接在一起；第二极耳4与第二表面空白区311可通过焊接而电连接在一起。在一实施例中，焊接可为超声焊接。

在根据本发明的电芯的一实施例中，参照图1，第一集流体11的两个表面在相对的位置存在未设置有第一膜片12的部分，从而形成两个第一表面空白区111，第一极耳2设置于其中的一个；第二集流体31的两个表面在相对的位置存在未设置有第二膜片32的部分，从而形成两个第二表面空白区311，第二极耳4设置于其中的一个。具体地，以两个第一表面空白区111为例，超声焊接第一极耳2时，在一个第一表面空白区111上焊接第一极耳2，在另一个第一表面空白区111上支撑焊座，换句话说，两个第一表面空白区111是受限制于目前的超声焊接工艺，本发明并不限制于必须形成两个第一表面空白区111。类似地，第二表面空白区311也如此，不再描述。

在根据本发明的电芯的一实施例中，焊点S的点数可为1～6个(在图1、图2、图3示出的例子中，焊点S的点数分别为1个、2个、3个)。当焊点S的点数大于1个时，参照图3和图4，超声焊接的焊点S沿宽度方向W可平行设置。在一实施例中，各焊点S在宽度方向W上之间的间距可为0.05mm～4mm。

在根据本发明的电芯的一实施例中，各焊点S的长度分别比第一极耳2和第二极耳4的长度小0.05mm～10mm，各焊点S的宽度为1mm～8mm。

相对于现有技术，本发明减少了超声焊接的焊点S的点数并缩短了焊点S之间的间距。

在根据本发明的电芯的一实施例中，参照图5和图6，第一极耳2与第一表面空白区111可

通过粘结而电连接在一起；第二极耳4与第二表面空白区311可通过粘结而电连接在一起。与前文的通过焊接而电连接在一起时不同，通过粘结而电连接在一起时，第一表面空白区111和第二表面空白区311均为一个，因此，进一步增大了第一膜片12和第二膜片32的面积，从而提高了电芯的容量和体积能量密度，同时提高了第一表面空白区111和第二表面空白区311的移除效率，从而提高电芯的生产效率。

在一实施例中，粘结可采用导电胶。在一实施例中，导电胶的长度分别比第一极耳2和第二极耳4的长度小2mm～10mm，导电胶的宽度比分别比第一极耳2和第二极耳4的宽度小1mm～5mm。

在根据本发明的电芯的一实施例中，导电胶可主要由有机硅树脂基体、硅酮类基体、环氧树脂基体、或聚合物类基体与金属纤维或金属颗粒组成。在一实施例中，金属颗粒可为Ag、Cu、Au、Ni中的至少一种。

在根据本发明的电芯的一实施例中，粘接可采用低熔点金属或低熔点合金。在一实施例中，低熔点金属可为锡、铅、锌、锑、铋中的至少一种；低熔点合金可为锡、铅、锌、锑、铋中的至少两种形成的合金。优选地，低熔点合金可为锡铋合金。

在根据本发明的电芯的一实施例中，低熔点金属或低熔点合金的长度可分别比第一极耳2和第二极耳4的长度小1mm～5mm；低熔点金属或低熔点合金的宽度可分别比第一极耳2和第二极耳4的宽度小1mm～5mm。

在根据本发明的电芯的一实施例中，参照图1和图5，电芯还可包括：第一绝缘胶6，贴覆在第一极耳2的面对第二极片3的表面；第二绝缘胶7，贴覆在第二极耳4的面对第一极片1的表面。在此需要说明的是，当第一极耳2与第一表面空白区111可通过焊接而电连接在一起、第二极耳4与第二表面空白区311可通过焊接而电连接在一起，并存在两个第一表面空白区111和两个第二表面空白区311时，以两个第一表面空白区111为例，第一绝缘胶6不仅贴覆在第一极耳2的面对第二极片3的表面(即第一绝缘胶6覆盖在设置有第一极耳2的一个第一表面空白区111)，同时，另一个第一表面空白区111上也贴覆有第一绝缘胶6，由此保证第一极片1和第二极片3之间绝缘，避免电芯存在内短路以及析锂风险。类似地，第二表面空白区311也如此，这里不再描述。当在一实施例中，第一绝缘胶6和第二绝缘胶7可为绝缘绿胶。

在根据本发明的电芯的一实施例中，参照图1和图5，第一绝缘胶6的长度和宽度与第一绝缘胶6的长度和宽度相同，并完全覆盖第一表面空白区111；第二绝缘胶7的长度和宽度与第二绝缘胶7的长度和宽度相同，并完全覆盖第二表面空白区311。第一绝缘胶6和第二绝缘胶7仅完全覆盖第一表面空白区111和第二表面空白区311，不粘遮第一表面空白区111和第二表面空白区311两侧的第一膜片12和第二膜片32，从而使电芯的厚度得以降低。

下面说明根据本发明的电芯的实施例、对比例、测试过程以及测试结果。

实施例1

以423482型号软包装锂离子电池(成品电芯厚度为4.2mm、宽度为34mm、长度为82mm)为例，电池的阳极极耳与阴极极耳尺寸一致，即两个极耳长度为30mm、宽度为4mm、厚度为0.06mm，且长度方向有13mm焊接在极片上。

经冷压工序后的极片(阳极极片上单层阳极膜片的厚度为67μm、阴极极片上单层阴极膜片的厚度为53μm)，采用激光方式在各极片的宽度的1/2处对膜片清洗并清洗出总面积为224mm 2 的双面表面空白区，其中单面表面空白区的宽度为8mm、长度为14mm，将极耳焊接于一个面上的表面空白区，极耳总焊点面积为24mm 2 ，焊接点为2个、单焊点长

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度为4mm、单焊点宽度为3mm、焊点在宽度方向上的间距为1.5mm。绝缘绿胶粘贴阴极极耳及另一面的表面空白区、阳极极耳及另一面的表面空白区。阴极极片、阳极极片和隔离膜卷绕且阳极极片头部为电芯一侧的端部。

实施例2

同实施例1，除以下与实施例1的不同之处：

阳极极耳与阴极极耳长度方向有7mm焊接于极片上。采用机械清洗方式在极片的宽度的1/2处对膜片清洗并清洗出总面积为128mm 2 的双面表面空白区，其中单面表面空白区的宽度为8mm、长度为8mm，将极耳焊接于表面空白区中，极耳总焊点面积为12mm 2 ，焊接点为1个、单焊点长度为4mm、单焊点宽度为3mm。

实施例3

同实施例1，除以下与实施例1的不同之处：

阳极极耳与阴极极耳长度方向有7mm通过聚合物基体和银纤维组成的导电胶粘结于极片上。采用激光清洗方式在极片的宽度的1/2对膜片清洗并清洗出总面积为64mm 2 的单面表面空白区，其中单面表面空白区的宽度为8mm、长度为8mm，将极耳通过导电胶粘结于表面空白区，极耳粘结面积为28mm 2 ，导电胶长度为7mm，导电胶的宽度为4mm。

实施例4

同实施例1，除以下与实施例1的不同之处：

阳极极耳与阴极极耳长度方向有7mm通过低熔点合金-锡铋合金粘结于极片上。采用激光清洗方式在极片的宽度的1/2对膜片清洗并清洗出总面积为64mm 2 的单面表面空白区，其中单面表面空白区的宽度为8mm、长度为8mm，将极耳通过低熔点合金-锡铋合金粘结于表面空白区，极耳粘结面积为28mm 2 ，锡铋合金的长度为7mm，锡铋合金的宽度为4mm。

对比例

以423482型号软包装锂离子电池(成品电芯厚度为4.2mm、宽度为34mm、长度为82mm)为例，电池阳极极耳与阴极极耳尺寸一致，即极耳长度为45mm、宽度为4mm、厚度为0.06mm，且长度方向有25mm焊接在极片上。

极片(阳极极片上单层阳极膜片的厚度为64μm、阴极极片上单层阴极膜片的厚度为51μm)经冷压工序后无需清洗极片上的膜片而形成表面空白区，而是直接将极耳焊接在极片的集流体留出的不设置膜片的部分的表面上，焊接点为3个、单焊点长度为4mm、单焊点宽度为3mm、焊点间距为4mm。阴极极片、阳极极片和隔离膜卷绕而成的电芯结构为传统的电芯结构，参照图7和图8。

对实施例1-4和对比例所得的电池进行容量和体积能量密度测试、厚度以及直流电阻(DCR)测量。

容量测试：采用标称电流将电芯充电到标称上限电压，然后再以标称电流放电到截至电压所释放出来的电量。

体积能量密度测试：(容量*标称电压)/体积。

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厚度测试：用PPG测厚仪测量。

直流电阻DCR测量：先采用0.1C放电10s，再采用1C放电1s，由这两段的电压差/电流差计算而得。

其中，各实施例、对比例各采用500个电池进行测试，所得的测试结果示于表1。

表1实施例1-4和对比例的电池的测试结果

[image]

由表1可以看出，实施例1-4的平均容量和平均体积能量密度比对比例均有较大提升；DCR也相对较小。

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CLAIMS CN105990612

1.

A cell includes: a first pole piece (1) including a first current collector (11) and a first diaphragm (12) containing a first active material disposed on a surface of the first current collector (11) The first tab (2) is electrically connected to the first current collector (11) of the first pole piece (1); the second pole piece (3) is opposite in polarity to the first pole piece (1), including A second collector (31) and a second diaphragm (32) containing a second active material disposed on the surface of the second current collector (31); a second tab (4) electrically connected to the second pole piece (a second collector (3) of 3); and a separator (5) disposed between the first pole piece (1) and the second pole piece (3); wherein, the first pole piece (1) and the separator (5) and a second pole piece (3) are sequentially wound to form a battery core; at least one surface of the first current collector (11) has a portion where the first diaphragm (12) is not provided and the portion is defined as first The surface blank area (111), the first surface blank area (111) is formed by removing the first diaphragm (12) provided on the corresponding portion of the surface of the first current collector (11); the second current collector (31) At least one of the surfaces is a portion not provided with a second diaphragm (32) and the portion is defined as The surface blank area (311), the second surface blank area (311) is formed by removing the second diaphragm (32) provided on the corresponding portion of the surface of the second current collector (31); the first tab (2) Disposed in the first surface free area (111) and electrically connected to the first surface free area (111), the thickness of the first tab (2) is less than or equal to the thickness of the first diaphragm (12); the second tab (4) disposed in the second surface blank area (311) and electrically connected to the first surface blank area (111), and the thickness of the second tab (4) is less than or equal to the thickness of the second diaphragm (32); The sheet (1) is an anode or cathode plate, correspondingly the second plate (3) is a cathode plate or an anode plate; the first tab (2) is an anode tab or a cathode tab, accordingly The second tab (4) is a cathode tab or an anode tab; the first active material is an anode active material or cathode active material, and the second active material is a cathode active material or an anode active material; the first diaphragm (12) For the anode or cathode membrane, the second membrane (32) is the cathode membrane or the anode membrane; the first current collector (11) is the anode or cathode current collector, and the corresponding second episode The body (31) is

a cathode collector or an anode collector; the first surface blank area (111) is an anode blank area or a cathode blank area, and the corresponding second surface blank area (311) is a cathode blank area or an anode blank area; It is characterized in that the anode pole piece inserts the head of the anode pole piece to the end of the battery core during winding.

2.

The cell according to claim 1, wherein the first area (1) of the first tab (2) and the first surface blank area (111) are electrically connected together with a first area of 1 3030 mm 2 , and the first surface is a blank area (The area of 111) is 1 to 15 times of the first area; the second area of the second tab (4) and the second surface blank area (311) is electrically connected together is 1 to 30 mm 2 , and the second surface is blank area (The area of 311) is 1-15 times of the second area.

3.

The battery cell according to claim 1, characterized in that the length of the first surface blank area (111) and the length of the second surface blank area (311) are respectively 0.5% to 40% of the width of the cell; The width of the surface blank area (111) is 1/4 to 3/4 of the width of the first pole piece (1); the width of the second surface blank area (311) is 1/1 of the width of the second pole piece (3). 4 to 3/4.

4.

The cell according to claim 1, characterized in that the first tab (2) and the first surface blank area (111) are electrically connected together by ultrasonic welding; the second tab (4) and the second surface The blank areas (311) are electrically connected together by ultrasonic welding; both surfaces of the first current collector (11) exist at opposite positions in which the first diaphragm (12) is not provided, thereby forming two first surfaces. In the blank area (111), the first tab (2) is provided to one of them; both surfaces of the second current collector (31) exist at opposite positions to the part where the second diaphragm (32) is not provided, thereby forming Two second surface blank areas (311) are provided on which one of the second tabs (4) is disposed.

5.

The cell according to claim 4, characterized in that the number of soldered dots (S) is 1 to 6; the length of each soldering point (S) is greater than that of the first tab (2) and the second tab (The length of 4) is small from 0.05 mm to 10 mm, the width of each solder point (S) is from 1 mm to 8 mm, and the pitch between each solder point (S) in the width direction (W) is from 0.05 mm to 4 mm.

6.

The cell according to claim 1, characterized in that the first tab (2) and the first surface blank area (111) are electrically connected together by bonding; the second tab (4) and the second surface The blank areas (311) are

electrically connected together by bonding.

7.

The battery cell according to claim 6, wherein: a conductive adhesive is used for the bonding; the length of the conductive adhesive is less than the length of the first tab (2) and the second tab (4) by 0.2 mm to 10 mm, respectively. The width of the glue is respectively smaller by 0.1 mm to 5 mm than the width of the first tab (2) and the second tab (4).

8.

The cell according to claim 6, wherein the bonding uses a low-melting point metal or a low-melting point alloy; the low-melting point metal or the low-melting point alloy has a length longer than that of the first tab (2) and the second tab (4) respectively. The length of the small size is 0.1 mm to 5 mm; the width of the low melting point metal or the low melting point alloy is smaller than the width of the first tab (2) and the second tab (4) by 0.1 mm to 5 mm, respectively.

9.

The battery cell according to claim 1, characterized in that the battery core further comprises: a first insulating adhesive (6) attached to a surface of the first tab (2) facing the second pole piece (3); The second insulating glue (7) is attached to the surface of the second tab (4) facing the first pole piece (1).

10.

The cell according to claim 9, characterized in that the length and the width of the first insulating adhesive (6) are the same as the length and the width of the first insulating adhesive (6) and completely cover the first surface blank area (111). The length and width of the second insulating paste (7) are the same as the length and width of the second insulating paste (7), and completely cover the second surface blank area (311).

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(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 105990612 A
(43)申请公布日 2016.10.05

(21)申请号 201510060477.3

(22)申请日 2015.02.05

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(51)Int.Cl.
H01M 10/0587(2010.01)
H01M 2/26(2006.01)
H01L 21/8234(2006.01)

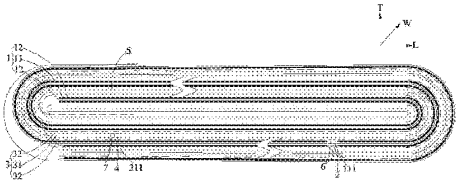
权利要求书2页 说明书6页 附图5页

(54)发明名称

电芯

(57)摘要

本发明提供了一种电芯，其包括：第一极片，包括第一集流体及第一膜片；第一极耳；第二极片，包括第二集流体及第二膜片；第二极耳；隔离膜。第一集流体的至少一个表面存在未设置有第一膜片的部分且该部分定义为第一表面空白区，第一表面空白区经由移除设置在第一集流体的表面上对应部分的第一膜片而形成；第二集流体的至少一个表面存在未设置有第二膜片的部分且该部分定义为第二表面空白区，第二表面空白区经由移除设置在第二集流体的表面上对应部分的第二膜片而形成；第一极耳和第二极耳分别设置于第一表面空白区内和第二表面空白区内。第一极片为阳极极片或阴极极片，第二极片为阴极极片或阳极极片；阳极极片在卷绕过程中头部插至电芯的端部。



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1. 一种电芯，包括：

第一极片（1），包括第一集流体（11）以及设置在第一集流体（11）的表面上的含有第一活性材料的第一膜片（12）；

第一极耳（2），电连接于第一极片（1）的第一集流体（11）；

第二极片（3），与第一极片（1）极性相反，包括第二集流体（31）以及设置在第二集流体（31）的表面上的含有第二活性材料的第二膜片（32）；

第二极耳（4），电连接于第二极片（3）的第二集流体（31）；以及

隔离膜（5），设置于第一极片（1）和第二极片（3）之间；

其中，第一极片（1）、隔离膜（5）和第二极片（3）依序卷绕形成电芯；

第一集流体（11）的至少一个表面存在未设置有第一膜片（12）的部分且该部分定义为第一表面空白区（111），第一表面空白区（111）经由移除设置在第一集流体（11）的表面上对应部分的第一膜片（12）而形成；

第二集流体（31）的至少一个表面存在未设置有第二膜片（32）的部分且该部分定义为第二表面空白区（311），第二表面空白区（311）经由移除设置在第二集流体（31）的表面上对应部分的第二膜片（32）而形成；

第一极耳（2）设置于第一表面空白区（111）内且电连接于第一表面空白区（111），第一极耳（2）的厚度小于等于第一膜片（12）的厚度；

第二极耳（4）设置于第二表面空白区（311）内且电连接于第一表面空白区（111），第二极耳（4）的厚度小于等于第二膜片（32）的厚度；

第一极片（1）为阳极极片或阴极极片，相应地第二极片（3）为阴极极片或阳极极片；第一极耳（2）为阳极极耳或阴极极耳，相应地第二极耳（4）为阴极极耳或阳极极耳；第一活性材料为阳极活性材料或阴极活性材料，相应地第二活性材料为阴极活性材料或阳极活性材料；第一膜片（12）为阳极膜片或阴极膜片，相应地第二膜片（32）为阴极膜片或阳极膜片；第一集流体（11）为阳极集流体或阴极集流体，相应地第二集流体（31）为阴极集流体或阳极集流体；第一表面空白区（111）为阳极空白区或阴极空白区，相应地第二表面空白区（311）为阴极空白区或阳极空白区；

其特征在于，

阳极极片在卷绕过程中阳极极片的头部插至电芯的端部。

2. 根据权利要求 1 所述的电芯，其特征在于，

第一极耳（2）与第一表面空白区（111）电连接在一起的第一面积为 1 ～ 30mm^2，第一表面空白区（111）的面积为第一面积的 1 ～ 15 倍；

第二极耳（4）与第二表面空白区（311）电连接在一起的第二面积为 1 ～ 30mm^2，第二表面空白区（311）的面积为第二面积的 1 ～ 15 倍。

3. 根据权利要求 1 所述的电芯，其特征在于，

第一表面空白区（111）的长度和第二表面空白区（311）的长度分别为电芯的宽度的 0.5%～ 40%；

第一表面空白区（111）的宽度为第一极片（1）的宽度的 1/4 ～ 3/4；

第二表面空白区（311）的宽度为第二极片（3）的宽度的 1/4 ～ 3/4。

4. 根据权利要求 1 所述的电芯，其特征在于，

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第一极耳 (2) 与第一表面空白区 (111) 通过超声焊接而电连接在一起；

第二极耳 (4) 与第二表面空白区 (311) 通过超声焊接而电连接在一起；

第一集流体 (11) 的两个表面在相对的位置存在未设置有第一膜片 (12) 的部分，从而形成两个第一表面空白区 (111)，第一极耳 (2) 设置于其中的一个；

第二集流体 (31) 的两个表面在相对的位置存在未设置有第二膜片 (32) 的部分，从而形成两个第二表面空白区 (311)，第二极耳 (4) 设置于其中的一个。

5. 根据权利要求 4 所述的电芯，其特征在于，

焊点 (S) 的点数为 1 ～ 6 个；

各焊点 (S) 的长度分别比第一极耳 (2) 和第二极耳 (4) 的长度小 0.05mm ～ 10mm，各焊点 (S) 的宽度为 1mm ～ 8mm；

各焊点 (S) 在宽度方向 (W) 上之间的间距为 0.05mm ～ 4mm。

6. 根据权利要求 1 所述的电芯，其特征在于，

第一极耳 (2) 与第一表面空白区 (111) 通过粘结而电连接在一起；

第二极耳 (4) 与第二表面空白区 (311) 通过粘结而电连接在一起。

7. 根据权利要求 6 所述的电芯，其特征在于，

粘结采用导电胶；

导电胶的长度分别比第一极耳 (2) 和第二极耳 (4) 的长度小 0.2mm ～ 10mm，

导电胶的宽度分别比第一极耳 (2) 和第二极耳 (4) 的宽度小 0.1mm ～ 5mm。

8. 根据权利要求 6 所述的电芯，其特征在于，

粘接采用低熔点金属或低熔点合金；

低熔点金属或低熔点合金的长度分别比第一极耳 (2) 和第二极耳 (4) 的长度小 0.1mm ～ 5mm；

低熔点金属或低熔点合金的宽度分别比第一极耳 (2) 和第二极耳 (4) 的宽度小 0.1mm ～ 5mm。

9. 根据权利要求 1 所述的电芯，其特征在于，电芯还包括：

第一绝缘胶 (6)，贴覆在第一极耳 (2) 的面对第二极片 (3) 的表面；

第二绝缘胶 (7)，贴覆在第二极耳 (4) 的面对第一极片 (1) 的表面。

10. 根据权利要求 9 所述的电芯，其特征在于，

第一绝缘胶 (6) 的长度和宽度与第一绝缘胶 (6) 的长度和宽度相同，并完全覆盖第一表面空白区 (111)；

第二绝缘胶 (7) 的长度和宽度与第二绝缘胶 (7) 的长度和宽度相同，并完全覆盖第二表面空白区 (311)。

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电芯

技术领域

[0001] 本发明涉及储能器件领域，尤其涉及一种电芯。

背景技术

[0002] 锂离子电池已被广泛应用于各类电子产品，随着电子产品趋向小型化、智能化发展，对锂离子电池的能量密度及厚度提出了更高的要求，这就需要在更小的体积中贡献出更可能多的能量。但传统的锂离子电池由于极耳厚度以及贴覆于极耳上绝缘绿胶厚度的叠加，使得极耳区成为电池的最大厚度区，导致极耳区以外的电芯尺寸空间浪费，并且极耳在极片上也占用了较大的区域，使得可涂覆活性物质的面积减少。此外，目前卷绕过程中阳极极片头部均不能插入至电芯端部，造成电芯内部的有效尺寸空间得不到有效的利用。

[0003] 于2012年10月17日授权公告的中国专利授权公告号为202495523 U的专利文献公开了一种锂离子电池及其极片，其采用在阴/阳极极片一端部上开设凹槽，使极耳嵌入阴/阳极极片凹槽共同形成的凹槽空腔中，减少了极耳对电芯厚度的累加。但其极耳在极片上还是占用较大面积，降低了开槽效率并导致极片上可涂覆活性物质的面积减少；而且在卷绕时阳极极片头部距离电芯端部3.5～4.5mm，电芯内部有效尺寸空间尚未得到有效利用。此外，该专利所述结构中阳极极片凹槽和阴极极片凹槽对应的阴极极片区未粘贴绝缘绿胶，电芯存在内短路以及析锂风险。

[0004] 于2014年7月23日授权公告的中国专利授权公告号为CN 203733894 U的专利文献公开了一种锂离子电池，其采用在阴/阳极极片中部开设凹槽，使极耳分别嵌入阴阳极极片的凹槽中，实现减少极耳对电芯的厚度累加，此外还采用在阴极极耳上下两面以及阳极极耳对应的阴极极片区贴覆绝缘绿胶来减小内短路的发生。虽然该专利解决了内短路及析锂风险的问题，但该专利中所贴覆的绝缘绿胶粘覆住了极耳附近区域的活性物质层，从而减小了活性物质层的有效面积，并且该专利中凹槽的面积仍较大。此外该专利所属的电芯在卷绕时阳极极片头部距离电芯端部3.5～4.5mm，电芯内部有效尺寸空间也同样未得到有效利用。

发明内容

[0005] 鉴于背景技术中存在的问题，本发明的目的在于提供一种电芯，其能提高电芯的容量和体积能量密度

[0006] 为了实现上述目的，本发明提供了一种电芯，其包括：第一极片，包括第一集流体以及设置在第一集流体的表面上的含有第一活性材料的第一膜片；第一极耳，电连接于第一极片的第一集流体；第二极片，与第一极片极性相反，包括第二集流体以及设置在第二集流体的表面上的含有第二活性材料的第二膜片；第二极耳，电连接于第二极片的第二集流体；以及隔离膜，设置于第一极片和第二极片之间；其中，第一极片、隔离膜和第二极片依序卷绕形成电芯。第一集流体的至少一个表面存在未设置有第一膜片的部分且该部分定义为第一表面空白区，第一表面空白区经由移除设置在第一集流体的表面上对应部分的第

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一膜片而形成；第二集流体的至少一个表面存在未设置有第二膜片的部分且该部分定义为第二表面空白区，第二表面空白区经由移除设置在第二集流体的表面上对应部分的第二膜片而形成；第一极耳设置于第一表面空白区内且电连接于第一表面空白区，第一极耳的厚度小于等于第一膜片的厚度；第二极耳设置于第二表面空白区内且电连接于第一表面空白区，第二极耳的厚度小于等于第二膜片的厚度。第一极片为阳极极片或阴极极片，相应地第二极片为阴极极片或阳极极片；第一极耳为阳极极耳或阴极极耳，相应地第二极耳为阴极极耳或阳极极耳；第一活性材料为阳极活性材料或阴极活性材料，相应地第二活性材料为阴极活性材料或阳极活性材料；第一膜片为阳极膜片或阴极膜片，相应地第二膜片为阴极膜片或阳极膜片；第一集流体为阳极集流体或阴极集流体，相应地第二集流体为阴极集流体或阳极集流体；第一表面空白区为阳极空白区或阴极空白区，相应地第二表面空白区为阴极空白区或阳极空白区；阳极极片在卷绕过程中阳极极片的头部插至电芯的端部。

[0007] 本发明的有益效果如下：

[0008] 在根据本发明的电芯中，阳极极片在卷绕过程中阳极极片的头部插至电芯的端部，从而更充分地利用电芯内部的有效尺寸空间，使电芯的容量和体积能量密度得以进一步提升。

附图说明

[0009] 图1为根据本发明的电芯的一实施例的侧视图；

[0010] 图2为根据本发明的电芯的一实施例的第一极耳焊接的结构示意图；

[0011] 图3为图2的变化实施例的电芯的第一极耳焊接的结构示意图；

[0012] 图4为图2的另一变化实施例的电芯的第一极耳焊接的结构示意图；

[0013] 图5为根据本发明的电芯的另一实施例的第一极耳区域的部分放大图；

[0014] 图6为根据本发明的电芯的另一实施例的第一极耳粘结的结构示意图；

[0015] 图7为本发明的一对比例的电芯的第一极耳焊接的结构示意图；

[0016] 图8为本发明的一对比例的电芯的侧视图。

[0017] 其中，附图标记说明如下：

[0018] 1 第一极片　　S 焊点

[0019] 11 第一集流体　　4 第二极耳

[0020] 111 第一表面空白区　　5 隔离膜

[0021] 12 第一膜片　　6 第一绝缘胶

[0022] 2 第一极耳　　7 第二绝缘胶

[0023] 3 第二极片　　L 长度方向

[0024] 31 第二集流体　　W 宽度方向

[0025] 311 第二表面空白区　　T 厚度方向

[0026] 32 第二膜片

具体实施方式

[0027] 下面参照附图来详细说明根据本发明的电芯。

[0028] 参照图1至图7，根据本发明的电芯包括：第一极片1，包括第一集流体11以及设

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置在第一集流体 11 的表面上的含有第一活性材料的第一膜片 12；第一极耳 2，电连接于第一极片 1 的第一集流体 11；第二极片 3，与第一极片 1 极性相反，包括第二集流体 31 以及设置在第二集流体 31 的表面上的含有第二活性材料的第二膜片 32；第二极耳 4，电连接于第二极片 3 的第二集流体 31；以及隔离膜 5，设置于第一极片 1 和第二极片 3 之间；其中，第一极片 1、隔离膜 5 和第二极片 3 依序卷绕形成电芯。第一集流体 11 的至少一个表面存在未设置有第一膜片 12 的部分且该部分定义为第一表面空白区 111，第一表面空白区 111 经由移除设置在第一集流体 11 的表面上对应部分的第一膜片 12 而形成；第二集流体 31 的至少一个表面存在未设置有第二膜片 32 的部分且该部分定义为第二表面空白区 311，第二表面空白区 311 经由移除设置在第二集流体 31 的表面上对应部分的第二膜片 32 而形成；第一极耳 2 设置于第一表面空白区 111 内且电连接于第一表面空白区 111，第一极耳 2 的厚度小于等于第一膜片 12 的厚度；第二极耳 4 设置于第二表面空白区 311 内且电连接于第一表面空白区 111，第二极耳 4 的厚度小于等于第二膜片 32 的厚度。第一极片 1 为阳极极片或阴极极片，相应地第二极片 3 为阴极极片或阳极极片；第一极耳 2 为阳极极耳或阴极极耳，相应地第二极耳 4 为阴极极耳或阳极极耳；第一活性材料为阳极活性材料或阴极活性材料，相应地第二活性材料为阴极活性材料或阳极活性材料；第一膜片 12 为阳极膜片或阴极膜片，相应地第二膜片 32 为阴极膜片或阳极膜片；第一集流体 11 为阳极集流体或阴极集流体，相应地第二集流体 31 为阴极集流体或阳极集流体；第一表面空白区 111 为阳极空白区或阴极空白区，相应地第二表面空白区 311 为阴极空白区或阳极空白区；阳极极片在卷绕过程中阳极极片的头部插至电芯的端部。

[0029] 在根据本发明的电芯中，阳极极片在卷绕过程中阳极极片的头部插至电芯的端部，（参照图 1，相比于图 8 对比例示出的电芯，阳极极片在卷绕过程中阳极极片的头部不能插至电芯的端部，只能插至电芯的中部）从而更充分地利用电芯内部的有效尺寸空间，使电芯的容量和体积能量密度得以进一步提升。而且，本发明的电芯的内阻（DCR）显著降低。

[0030] 首先，需要说明的是，本发明的各部件的长度指的是各部件的长度方向 L 上的距离，各部件的宽度指的是各部件的长度方向 W 上的距离，各部件的厚度指的是各部件的厚度方向 T 上的距离。

[0031] 在根据本发明的电芯的一实施例中，第一极耳 2 与第一表面空白区 111 电连接在一起的第一面积可为 1 ～ 30mm^2，第一表面空白区 111 的面积可为第一面积的 1 ～ 15 倍；第二极耳 4 与第二表面空白区 311 电连接在一起的第二面积可为 1 ～ 30mm^2，第二表面空白区 311 的面积可为第二面积的 1 ～ 15 倍。

[0032] 在根据本发明的电芯的一实施例中，第一表面空白区 111 的长度和第二表面空白区 311 的长度可分别为电芯的宽度的 0.5%～ 40%。

[0033] 在根据本发明的电芯的一实施例中，第一表面空白区 111 的宽度为第一极片 1 的宽度的 1/4 ～ 3/4；第二表面空白区 311 的宽度为第二极片 3 的宽度的 1/4 ～ 3/4。

[0034] 在根据本发明的电芯的一实施例中，第一表面空白区 111 可经由激光移除或机械移除设置在第一集流体 11 的表面上对应部分的第一膜片 12 而形成；第二表面空白区 311 可经由激光移除或机械移除设置在第二集流体 31 的表面上对应部分的第二膜片 32 而形成。本发明能够使第一表面空白区 111 和第二表面空白区 311 的面积大大减小，因此就增大了第一膜片 12 和第二膜片 32 的面积，从而提高了电芯的容量和体积能量密度，同时提高

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了第一表面空白区 111 和第二表面空白区 311 的移除效率，从而提高电芯的生产效率。

[0035] 在根据本发明的电芯的一实施例中，参照图 1，第一极耳 2 与第一表面空白区 111 可通过焊接而电连接在一起；第二极耳 4 与第二表面空白区 311 可通过焊接而电连接在一起。在一实施例中，焊接可为超声焊接。

[0036] 在根据本发明的电芯的一实施例中，参照图 1，第一集流体 11 的两个表面在相对的位置存在未设置有第一膜片 12 的部分，从而形成两个第一表面空白区 111，第一极耳 2 设置于其中的一个；第二集流体 31 的两个表面在相对的位置存在未设置有第二膜片 32 的部分，从而形成两个第二表面空白区 311，第二极耳 4 设置于其中的一个。具体地，以两个第一表面空白区 111 为例，超声焊接第一极耳 2 时，在一个第一表面空白区 111 上焊接第一极耳 2，在另一个第一表面空白区 111 上支撑焊座，换句话说，两个第一表面空白区 111 是受限制于目前的超声焊接工艺，本发明并不限制于必须形成两个第一表面空白区 111。类似地，第二表面空白区 311 也如此，不再描述。

[0037] 在根据本发明的电芯的一实施例中，焊点 S 的点数可为 1 ～ 6 个（在图 1、图 2、图 3 示出的例子中，焊点 S 的点数分别为 1 个、2 个、3 个）。当焊点 S 的点数大于 1 个时，参照图 3 和图 4，超声焊接的焊点 S 沿宽度方向 W 可平行设置。在一实施例中，各焊点 S 在宽度方向 W 上之间的间距可为 0.05mm ～ 4mm。

[0038] 在根据本发明的电芯的一实施例中，各焊点 S 的长度分别比第一极耳 2 和第二极耳 4 的长度小 0.05mm ～ 10mm，各焊点 S 的宽度为 1mm ～ 8mm。

[0039] 相对于现有技术，本发明减少了超声焊接的焊点 S 的点数并缩短了焊点 S 之间的间距。

[0040] 在根据本发明的电芯的一实施例中，参照图 5 和图 6，第一极耳 2 与第一表面空白区 111 可通过粘结而电连接在一起；第二极耳 4 与第二表面空白区 311 可通过粘结而电连接在一起。与前文的通过焊接而电连接在一起时不同，通过粘结而电连接在一起时，第一表面空白区 111 和第二表面空白区 311 均为一个，因此，进一步增大了第一膜片 12 和第二膜片 32 的面积，从而提高了电芯的容量和体积能量密度，同时提高了第一表面空白区 111 和第二表面空白区 311 的移除效率，从而提高电芯的生产效率。

[0041] 在一实施例中，粘结可采用导电胶。在一实施例中，导电胶的长度分别比第一极耳 2 和第二极耳 4 的长度小 2mm ～ 10mm，导电胶的宽度比分别比第一极耳 2 和第二极耳 4 的宽度小 1mm ～ 5mm。

[0042] 在根据本发明的电芯的一实施例中，导电胶可主要由有机硅树脂基体、硅酮类基体、环氧树脂基体、或聚合物类基体与金属纤维或金属颗粒组成。在一实施例中，金属颗粒可为 Ag、Cu、Au、Ni 中的至少一种。

[0043] 在根据本发明的电芯的一实施例中，粘接可采用低熔点金属或低熔点合金。在一实施例中，低熔点金属可为锡、铅、锌、锑、铋中的至少一种；低熔点合金可为锡、铅、锌、锑、铋中的至少两种形成的合金。优选地，低熔点合金可为锡铋合金。

[0044] 在根据本发明的电芯的一实施例中，低熔点金属或低熔点合金的长度可分别比第一极耳 2 和第二极耳 4 的长度小 1mm ～ 5mm；低熔点金属或低熔点合金的宽度可分别比第一极耳 2 和第二极耳 4 的宽度小 1mm ～ 5mm。

[0045] 在根据本发明的电芯的一实施例中，参照图 1 和图 5，电芯还可包括：第一绝缘胶

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6，贴覆在第一极耳2的面对第二极片3的表面；第二绝缘胶7，贴覆在第二极耳4的面对第一极片1的表面。在此需要说明的是，当第一极耳2与第一表面空白区111可通过焊接而电连接在一起、第二极耳4与第二表面空白区311可通过焊接而电连接在一起，并存在两个第一表面空白区111和两个第二表面空白区311时，以两个第一表面空白区111为例，第一绝缘胶6不仅贴覆在第一极耳2的面对第二极片3的表面（即第一绝缘胶6覆盖在设置有第一极耳2的一个第一表面空白区111），同时，另一个第一表面空白区111上也贴覆有第一绝缘胶6，由此保证第一极片1和第二极片3之间绝缘，避免电芯存在内短路以及析锂风险。类似地，第二表面空白区311也如此，这里不再描述。当在一实施例中，第一绝缘胶6和第二绝缘胶7可为绝缘绿胶。

[0046] 在根据本发明的电芯的一实施例中，参照图1和图5，第一绝缘胶6的长度和宽度与第一绝缘胶6的长度和宽度相同，并完全覆盖第一表面空白区111；第二绝缘胶7的长度和宽度与第二绝缘胶7的长度和宽度相同，并完全覆盖第二表面空白区311。第一绝缘胶6和第二绝缘胶7仅完全覆盖第一表面空白区111和第二表面空白区311，不粘遮第一表面空白区111和第二表面空白区311两侧的第一膜片12和第二膜片32，从而使电芯的厚度得以降低。

[0047] 下面说明根据本发明的电芯的实施例、对比例、测试过程以及测试结果。

[0048] 实施例1

[0049] 以423482型号软包装锂离子电池（成品电芯厚度为4.2mm、宽度为34mm、长度为82mm）为例，电池的阳极极耳与阴极极耳尺寸一致，即两个极耳长度为30mm、宽度为4mm、厚度为0.06mm，且长度方向有13mm焊接在极片上。

[0050] 经冷压工序后的极片（阳极极片上单层阳极膜片的厚度为67μm、阴极极片上单层阴极膜片的厚度为53μm），采用激光方式在各极片的宽度的1/2处对膜片清洗并清洗出总面积为224mm^{2}的双面表面空白区，其中单面表面空白区的宽度为8mm、长度为14mm，将极耳焊接于一个面上的表面空白区，极耳总焊点面积为24mm^2，焊接点为2个、单焊点长度为4mm、单焊点宽度为3mm、焊点在宽度方向上的间距为1.5mm。绝缘绿胶粘贴阴极极耳及另一面的表面空白区、阳极极耳及另一面的表面空白区。阴极极片、阳极极片和隔离膜卷绕且阳极极片头部为电芯一侧的端部。

[0051] 实施例2

[0052] 同实施例1，除以下与实施例1的不同之处：

[0053] 阳极极耳与阴极极耳长度方向有7mm焊接于极片上。采用机械清洗方式在极片的宽度的1/2处对膜片清洗并清洗出总面积为128mm^{2}的双面表面空白区，其中单面表面空白区的宽度为8mm、长度为8mm，将极耳焊接于表面空白区中，极耳总焊点面积为12mm^2，焊接点为1个、单焊点长度为4mm、单焊点宽度为3mm。

[0054] 实施例3

[0055] 同实施例1，除以下与实施例1的不同之处：

[0056] 阳极极耳与阴极极耳长度方向有7mm通过聚合物基体和银纤维组成的导电胶粘结于极片上。采用激光清洗方式在极片的宽度的1/2对膜片清洗并清洗出总面积为64mm^{2}的单面表面空白区，其中单面表面空白区的宽度为8mm、长度为8mm，将极耳通过导电胶粘结于表面空白区，极耳粘结面积为28mm^2，导电胶长度为7mm，导电胶的宽度为4mm。

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[0057] 实施例 4

[0058] 同实施例 1，除以下与实施例 1 的不同之处：

[0059] 阳极极耳与阴极极耳长度方向有 7mm 通过低熔点合金－锡铋合金粘结于极片上。采用激光清洗方式在极片的宽度的 1/2 对膜片清洗并清洗出总面积为 64mm^{2}的单面表面空白区，其中单面表面空白区的宽度为 8mm、长度为 8mm，将极耳通过低熔点合金－锡铋合金粘结于表面空白区，极耳粘结面积为 28mm^2，锡铋合金的长度为 7mm，锡铋合金的宽度为 4mm。

[0060] 对比例

[0061] 以 423482 型号软包装锂离子电池（成品电芯厚度为 4.2mm、宽度为 34mm、长度为 82mm）为例，电池阳极极耳与阴极极耳尺寸一致，即极耳长度为 45mm、宽度为 4mm、厚度为 0.06mm，几长度方向有 25mm 焊接在极片上。

[0062] 极片（阳极极片上单层阳极膜片的厚度为 64μm、阴极极片上单层阴极膜片的厚度为 51μm）经冷压工序后无需清洗极片上的膜片而形成表面空白区，而是直接将极耳焊接在极片的集流体留出的不设置膜片的部分的表面上，焊接点为 3 个、单焊点长度为 4mm、单焊点宽度为 3mm、焊点间距为 4mm。阴极极片、阳极极片和隔离膜卷绕而成的电芯结构为传统的电芯结构，参照图 7 和图 8。

[0063] 对实施例 1-4 和对比例所得的电池进行容量和体积能量密度测试、厚度以及直流电阻（DCR）测量。

[0064] 容量测试：采用标称电流将电芯充电到标称上限电压，然后再以标称电流放电到截至电压所释放出来的电量。

[0065] 体积能量密度测试：（容量＊标称电压）/ 体积。

[0066] 厚度测试：用 PPG 测厚仪测量。

[0067] 直流电阻 DCR 测量：先采用 0.1C 放电 10s，再采用 1C 放电 1s，由这两段的电压差 / 电流差计算而得。

[0068] 其中，各实施例、对比例各采用 500 个电池进行测试，所得的测试结果示于表 1。

[0069] 表 1 实施例 1-4 和对比例的电池的测试结果

[0070]

	平均容量 /mAh	平均体积能量密度 /Wh/L	平均厚度 /mm	DCR/mΩ
实施例 1	1940	652	4.067	52
实施例 2	1950	655	4.067	51
实施例 3	1957	658	4.066	51
实施例 4	1957	658	4.066	50
对比例	1830	615	4.067	74

[0071] 由表 1 可以看出，实施例 1-4 的平均容量和平均体积能量密度比对比例均有较大提升；DCR 也相对较小。

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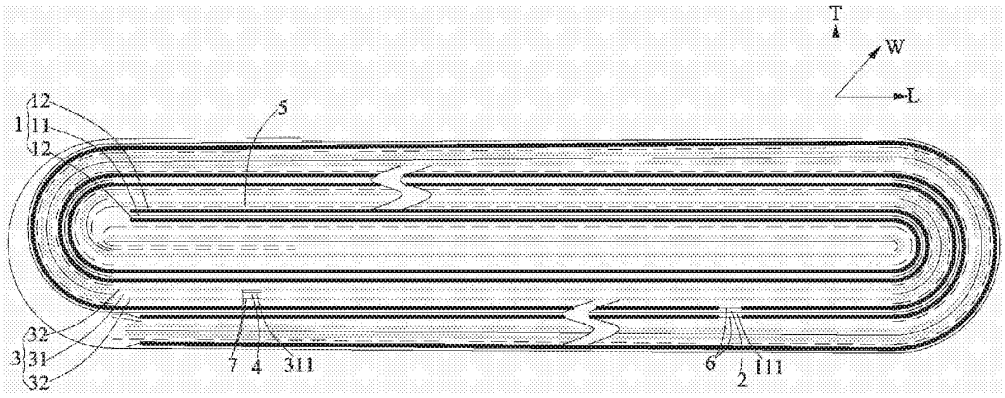


图 1

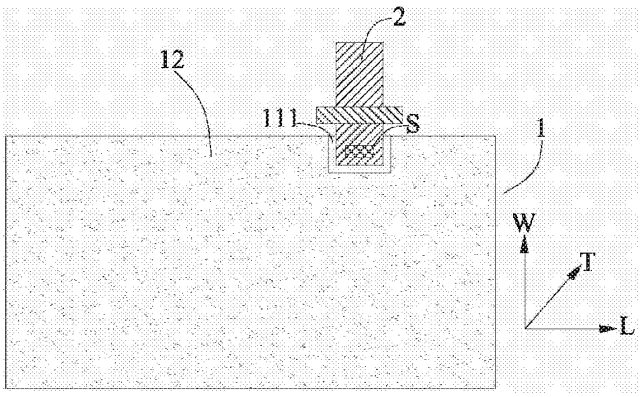


图 2

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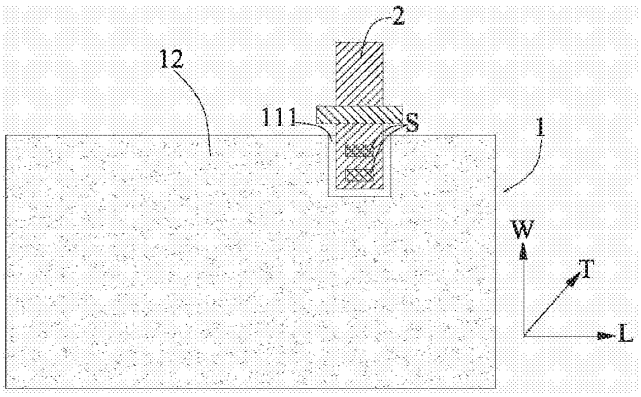


图 3

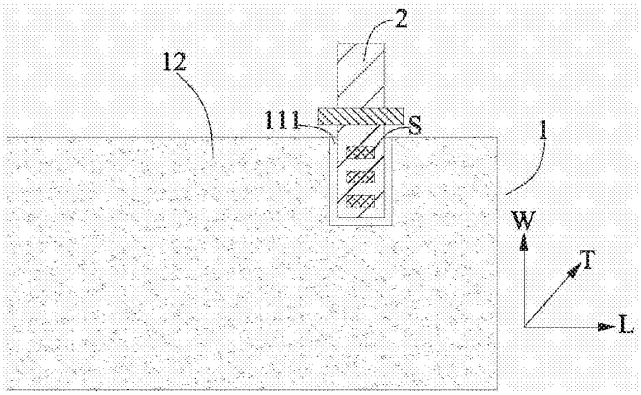


图 4

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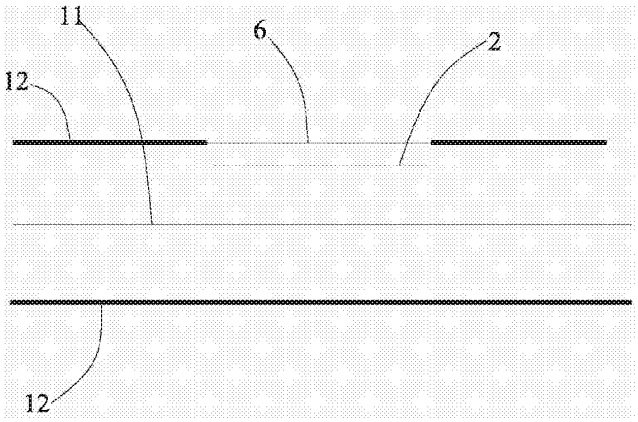


图 5

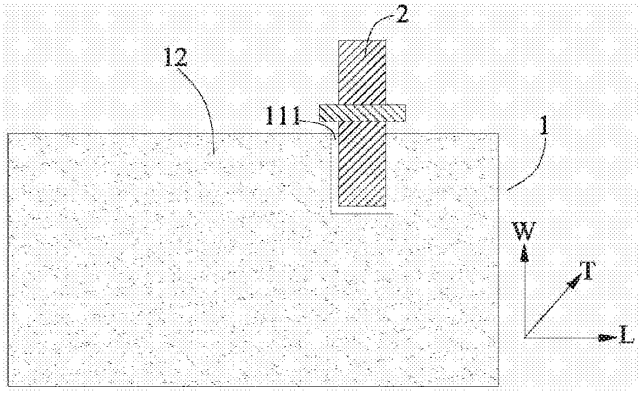


图 6

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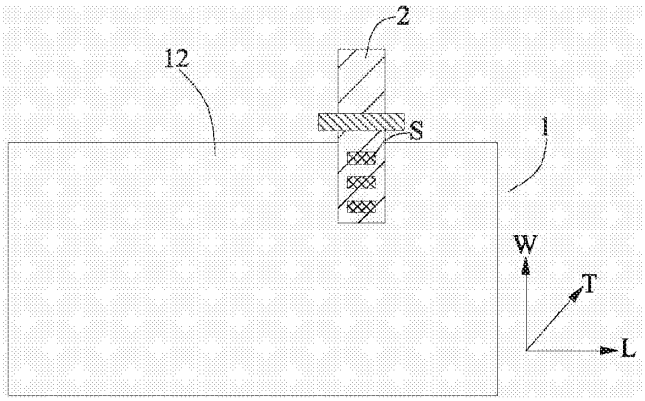


图 7

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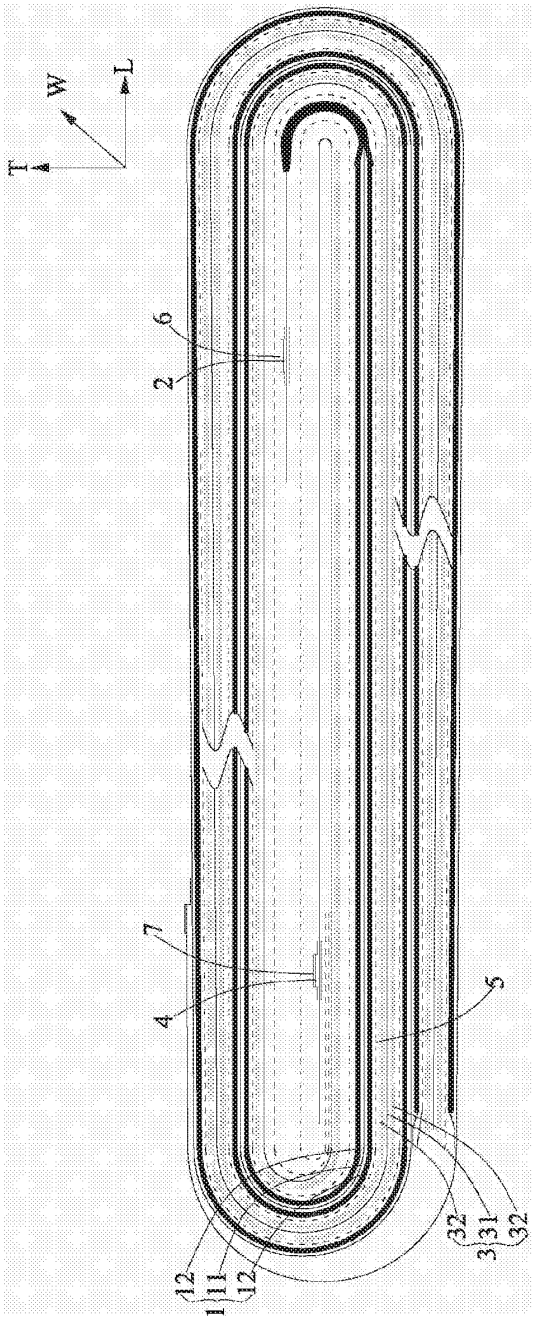


图 8

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Espacenet

Bibliographic data: CN202495523 (U) — 2012-10-17

Lithium ion battery and electrode plate thereof

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Classification: **- international:** ***H01M10/058; H01M2/26; H01M4/13***
- cooperative:

Application number: CN2012266049U 20120227

Priority number (s): CN2012266049U 20120227

Abstract of CN202495523 (U)

The utility model belongs to the technical field of lithium ion battery, in particular to a lithium ion battery electrode plate which comprises a current collector, an active material layer which is attached to a surface of the current collector, and electrode lugs welded on the current collector. The active material layer is provided with at least two grooves which are preset for the embedding of the electrode lugs, and the length of each groove is smaller than the width of the electrode plate. Compared with the prior art, the lithium ion battery and the electrode plate thereof enable the electrode lugs to be embedded into the grooves along a thickness direction by the arrangement of the grooves on the active material layer of the positive plate and the negative plate, so that the thickness of the electrodes is not added to the overall thickness of an electricity core, and more space is provided for active materials inside the electricity core. On the premise that the size of the electricity core is not changed, the capacity and the energy density of the lithium ion battery are greatly improved. Since the grooves on the electrode plate are basically corresponding to the electrode lugs, nonuniform stress on the electrode plate corresponding to the grooves can be avoided, and the performance of a battery can be ensured. Meanwhile, the utility model further discloses the lithium ion battery provided with the electrode plate.

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DESCRIPTION CN202495523

The utility model belongs to the technical field of lithium ion batteries, in particular to a lithium ion battery pole piece, which comprises a current collector, an active material layer adhered on the surface of the current collector, and a tab welded on the collector, on the active material layer. There are at least two grooves reserved for the embedded tabs, the length of the grooves being less than the width of the pole pieces. Compared with the prior art, the present invention provides a recess in the active material layer of the positive and negative pole pieces so that the tab can be embedded in the recess in the thickness direction, so that the thickness of the tab is not accumulated in the recess. The overall thickness of the battery core provides more space for the active material in the battery core. Without changing the size of the battery core, the capacity and energy density of the battery are significantly improved, and the groove on the pole piece basically corresponds to The lug can avoid the uneven force of the pole piece corresponding to the groove, thereby ensuring the battery performance. In addition, the utility model also discloses a lithium ion battery containing the pole piece.

Lithium ion battery and its pole piece

Technical field

The utility model belongs to the technical field of lithium ion batteries, in particular to a lithium ion battery pole piece capable of fully utilizing the battery's size space, improving battery capacity and energy density, and a lithium ion battery comprising the pole piece.

Background technique

Lithium-ion batteries have been widely used in mobile and portable appliances due to their high energy density, high average open circuit voltage, and long cycle life. Flexible packaging lithium-ion batteries are widely used in consumer electronics because of their advantages such as flexible design and good safety performance.

The pole piece of a commercial lithium-ion battery contains a current collector, tabs and an active material layer, wherein the active material layer is a continuous and uniform coating. The positive and negative pole pieces together with the diaphragm constitute a battery core. The thickness of the battery core consists of the thickness of the positive and negative pole pieces, the thickness of the diaphragm, and the thickness of the tabs. At different parts of the cell, the thickness is not the same, with the thickness at the solder lug being the largest. Commercial lithium-ion batteries generally define the thickness of the battery in terms of the maximum thickness of the battery.

With the development of miniaturization and multi-functionalization of electronic products, their energy density requirements for lithium-ion batteries are also increasing, which requires the batteries to contribute more capacity in the same space. The thickness of the traditional lithium ion battery due to the accumulation of the thickness of the tab, the thickness of the welding lug region is the maximum thickness of the battery, while the thickness of the unsoldered tab is relatively small, this part of the space can not be fully utilized, resulting in Within a certain model size, it is difficult to further increase the battery capacity. The accumulation of the tab thickness to the battery thickness has become one of the bottlenecks that have constrained the further increase in the energy density of conventional lithium-ion batteries.

The utility model patent No. CN201087907Y proposes to provide a groove on the electrode pole piece so that the battery lug can be embedded in the groove, which can relieve the accumulation of the thickness of the lug and the thickness of the battery to some extent. However, the length of the groove provided on the pole piece in this patent is the same as the width of the pole piece, considering that the welding part of the tab in a commercial battery is usually 10-30 mm, and when the pole piece of the battery is wider, the pole piece has The large-area blank recess area cannot correspond to the tabs, not only the unevenness of the corresponding pole pieces of the recessed area, resulting in deterioration of the interface contact, affecting the performance of the battery, but also wasting the space within the battery and failing to make the battery energy. The density is optimal.

In view of this, it is indeed necessary to improve the pole pieces of lithium-ion batteries so as to more fully utilize the effective size space of the batteries and increase battery capacity and energy density.

Utility model content

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One of the objectives of the present invention is to provide a lithium ion battery pole that can fully utilize the size space of the battery and improve the battery capacity and energy density in response to the deficiencies of the prior art.

In order to achieve the above objectives, the present invention adopts the following technical solutions:

A lithium ion battery pole piece includes a current collector, an active material layer adhered on the surface of the current collector, and a tab welded on the current collector. At least two of the active material layers are provided with embedded lugs. In the groove, the length of the groove is smaller than the width of the pole piece, so that the groove area basically corresponds to the lug, avoiding the interface contact deterioration problem caused by uneven force of the corresponding pole piece of the concave area, thereby ensuring the battery Performance, but also saves the space within the battery, so that the battery energy density is optimal.

As an improvement of the lithium ion battery pole piece of the present invention, the width of the groove is larger than the width of the tab welding area.

As an improvement of the lithium ion battery pole piece of the present invention, the length of the groove is greater than the length of the tab welding area. So that the tab can be embedded in the groove.

As an improvement of the lithium ion battery pole piece of the present invention, the depth of the groove is less than or equal to the thickness of the single-sided active material layer.

As an improvement of the pole piece of the lithium ion battery of the present invention, the opening direction of the groove is the same as the protruding direction of the tab.

As an improvement of the lithium ion battery pole piece of the present invention, the pole piece comprises a positive pole piece and a negative pole piece, a positive pole tab is welded on the positive pole piece, and a negative pole tab is welded on the negative pole piece.

As an improvement of the lithium ion battery pole piece of the present invention, the positive pole piece and the negative pole piece are provided with two grooves, and when winding or laminating, the position of the groove on the positive pole piece is the same as described above. The positions of the recesses on the negative pole piece correspond to one another and together form a cavity.

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As an improvement of the lithium ion battery pole piece of the present invention, the positive pole tabs and the negative pole tabs are embedded in the cavity.

Compared with the prior art, the present invention provides a recess in the active material layer of the positive and negative electrode tabs so that the tab can be embedded in the recess in the thickness direction, so that the thickness of the tab is not accumulated in the recess. The overall thickness of the battery core provides more space for the active material in the battery core. Without changing the size of the battery core, the capacity and energy density of the battery are significantly improved, and the groove on the pole piece basically corresponds to The lug, so as to avoid uneven force of the pole piece corresponding to the groove, thereby ensuring battery performance.

Another object of the present invention is to provide a lithium ion battery comprising a positive pole piece, a negative pole piece, a separator interposed between the positive pole piece and the negative pole piece, and an electrolyte. The positive pole piece is welded on There is a positive electrode tab, and a negative electrode tab is welded on the negative electrode tab. The positive electrode tab is the lithium ion battery electrode described in the above paragraph, and the negative electrode tab is the lithium ion battery electrode sheet described in the above paragraph. The positive and negative tabs are embedded in the grooves when wound or laminated.

Compared with the prior art, the lithium ion battery of the present invention has a groove on the pole piece that can be embedded in the tab, so that the position where the thickness of the battery is the largest is no longer the tab position, which solves the problem of the uneven thickness of the entire core. , thereby more fully utilize the effective size space of the battery and improve the battery capacity and energy density.

Description of the drawings

FIG. 1 is a structure diagram of a negative pole piece of a lithium ion battery according to the present invention;

FIG. 2 is a structure diagram of a positive pole piece of a lithium ion battery according to the present invention;

FIG. 3 is a schematic view of a winding structure of a lithium ion battery according to the present invention.

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detailed description

Hereinafter, a pole piece of a lithium ion battery and a lithium ion battery including the pole piece provided by the present invention will be further described in detail in conjunction with the accompanying drawings and specific implementation manners of the specification:

As shown in FIG. 1 , the negative pole piece of the lithium ion battery of the present invention includes: a negative electrode tab 1, a negative electrode current collector 3, and a negative electrode active material layer 5 attached to the negative electrode current collector 3, wherein the negative electrode active material layer 5 On the negative slot 7 is provided. The negative electrode tab 1 is welded to the blank negative electrode current collector 3 that is not coated with the active material, and the negative electrode active material layer 5 is applied to both surfaces of the negative electrode current collector 3 . Wherein, the width of the negative electrode groove 7 is larger than the width of the welding region of the negative electrode tab 1, the length of the negative electrode groove 7 is greater than the length of the welding region of the negative electrode tab 1, and the depth of the negative electrode groove 7 is less than or equal to one-sided. Thickness of the negative electrode active material layer 5 . The opening direction of the negative electrode groove 7 is the same as the protruding direction of the negative electrode tab 1 .

As shown in FIG. 2, the positive pole piece of a lithium ion battery of the present invention includes a positive pole tab 2, a positive electrode collector 4 and a positive electrode active material layer 6 coated on the positive electrode collector 4, wherein the positive electrode active material layer. A positive groove 8 is provided on 6 . The positive electrode active material layer 6 is coated on both sides of the positive electrode collector 4, and the positive electrode tab 2 is welded to the blank positive electrode collector 4 not coated with the active material. The width of the positive groove 8 is larger than the width of the welding region of the positive tab 2, the length of the positive groove 8 is greater than the length of the welding region of the positive tab 2, and the depth of the positive groove 8 is less than or equal to one side. The thickness of the positive electrode active material layer 6 . The opening direction of the positive electrode recess 8 is the same as the protruding direction of the positive electrode tab 2 .

As shown in FIG. 3, the positive and negative pole pieces and the separator 9 of the present invention are wound to form a battery core, wherein the negative electrode tab 1 is inserted into the negative electrode recess 7 and the positive electrode active material layer 6 on the negative electrode active material layer 5. In the space formed by the positive electrode recess 8, the positive electrode tab 2 is inserted into the space formed by the negative electrode recess 7 on the negative electrode active material layer 5 and the positive electrode recess 8 on the positive electrode active material layer 6. In the thickness direction, the negative electrode recess 7 and the positive electrode recess 8 on the negative electrode active material layer 5 and the positive electrode active material layer 6 form a cavity, so that the boss formed by the negative electrode tab 1 and the positive electrode

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tab 2 can be embedded therein. The thickness of the entire battery is compensated by the thickness of the negative electrode tab 1 and the positive electrode tab 2 , so that the thickness of the active material layer can be increased in portions other than the tab welding region, and can be increased without changing the battery size. The purpose of battery capacity.

detailed description

Take the square lithium ion battery model 616790 (a finished battery with a thickness of 6.1 mm, a width of 67 mm, and a length of 90 mm) as an example. The positive electrode tab 2 and the negative electrode tab 1 of the battery have the same size, and have a thickness of 0.1 mm, a width of 6 mm, and a length of 40 mm, and 30 mm in the longitudinal direction is the length welded to the pole piece.

According to the pole piece provided by the present invention, the single-layer thickness of the positive active material layer 6 on the positive pole piece is 58 μ m thick, and the single-layer thickness of the negative active material layer 5 on the negative pole piece is 70 μ m thick. The structure of the core formed by winding the positive and negative pole pieces and the separator is a core structure provided by the present invention. The thickness of the main body of the battery made using this cell was uniform and the thickness of the main body of the cell was 6.1 mm. Contrast implementation

Take the square lithium ion battery model 616790 (a finished battery with a thickness of 6.1 mm, a width of 67 mm, and a length of 90 mm) as an example. The positive and negative electrode tabs of the battery have the same dimensions, a thickness of 0.1 mm, a width of 6 mm, and a length of 40 mm, wherein 30 mm in the longitudinal direction is the length welded to the pole piece.

A conventional pole piece structure is used, in which the length and width of the positive and negative pole pieces are exactly the same as those in the embodiment. The only difference is that the thickness of the active material layer is different, and the thickness of the single layer of the positive active material layer on the positive pole piece is 56 μ m thick. The thickness of the monolayer of the negative electrode active material layer on the negative electrode tab was 67 μ m thick. The cell structure formed by winding the positive and negative electrode pieces and the separator is a conventional cell structure. The thickness of the welding lug region of the battery fabricated using this cell was the largest, the thickness at the welding tab of the cell was 6.1 mm, and the thickness of the main body portion of the battery at the unsoldered tab was 6.0 mm.

It can be seen from the above that the use of the pole piece of the present invention can solve the problem of the uneven thickness of the whole cell, thereby more fully utilizing the effective size space of the battery.

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The battery obtained in the specific embodiment and the comparative embodiment was subjected to a capacity test and a volumetric energy density test. The results obtained are shown in Table 1.

Table 1: Capacity and volumetric energy density of Examples and Comparative batteries.

[image]

From Table 1, it can be seen that the use of the pole piece provided by the present invention can significantly increase the capacity and volume energy density of the battery at the same size.

Based on the above disclosure and teachings, those skilled in the art to which the present invention pertains can also make changes and modifications to the above embodiments. Therefore, the present invention is not limited to the specific embodiments disclosed and described above, and some modifications and alterations of the present invention should fall within the protection scope of the claims of the present invention. In addition, although some specific terms are used in this specification, these terms are only for convenience of description and do not constitute any limitation on the present invention.

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CLAIMS CN202495523

1.
A lithium ion battery pole piece includes a current collector, an active material layer attached on the surface of the current collector, and a tab welded on the current collector, wherein at least two of the active material layers are embedded Ears reserved grooves, the length of the groove is less than the width of the pole piece.

2.
The lithium ion battery pole piece according to claim 1, wherein the width of the groove is greater than the width of the tab welding region.

3.
The lithium ion battery pole piece according to claim 1, wherein the length of the groove is greater than the length of the tab welding region.

4.
The lithium ion battery pole piece according to claim 1, wherein the groove has a depth less than or equal to the thickness of the single-sided active material layer.

5.
The lithium ion battery pole piece according to claim 1, characterized in that the opening direction of the groove is the same as the protruding direction of the tab.

6.

The lithium ion battery pole piece according to claim 1, wherein the pole piece comprises a positive pole piece and a negative pole piece, a positive pole tab is welded on the positive pole piece, and a negative pole is welded on the negative pole piece. ear.

7.

The lithium ion battery pole piece according to claim 6, characterized in that: the positive pole piece and the negative pole piece are provided with two grooves, and when winding or laminating, the position of the groove on the positive pole piece is Corresponding to the positions of the grooves on the negative pole piece, a cavity is formed together.

8.

The lithium ion battery pole piece of claim 7, wherein the positive pole tab and the negative pole tab are embedded in the cavity.

9.

A lithium ion battery includes a positive pole piece, a negative pole piece, a separator spaced between the positive pole piece and the negative pole piece, and an electrolyte. The positive pole piece is welded with a positive pole tab, and the negative pole pole A negative electrode tab is welded on the sheet, characterized in that the positive electrode sheet is a lithium ion battery pole piece according to any one of claims 1 to 8, and the negative electrode pole piece is any one of the claims 1 to 8. Lithium-ion battery pole pieces, the positive pole tabs and the negative pole tabs are embedded in the grooves when being wound or laminated.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 202495523 U
(45)授权公告日 2012.10.17

(21)申请号 201220066049.3

(22)申请日 2012.02.27

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(51)Int.Cl.
H01M 4/13(2010.01)
H01M 2/26(2006.01)
H01M 10/058(2010.01)

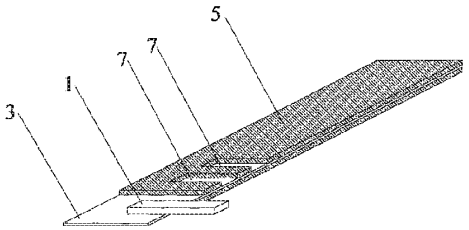
权利要求书 1 页 说明书 4 页 附图 2 页

(54)实用新型名称

锂离子电池及其极片

(57)摘要

本实用新型属于锂离子电池技术领域，尤其涉及一种锂离子电池极片，包括集流体、附着在集流体表面的活性物质层，以及焊接在集流体上的极耳，所述活性物质层上设有至少两个为嵌入极耳预留的凹槽，所述凹槽的长度小于极片的宽度。相对于现有技术，本实用新型通过在正负极极片的活性物质层上设置凹槽，使得在厚度方向上，极耳可以嵌入该凹槽内，这样就使得极耳的厚度不累加在电芯的整体厚度上，为电芯内活性物质提供了更多的空间，在不改变电芯尺寸的前提下，显著提升了电池的容量和能量密度，而且由于极片上的凹槽基本对应于极耳，可以避免凹槽对应的极片受力不均的情况，从而保证电池性能。此外，本实用新型还公开了一种包含该极片的锂离子电池。



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1. 一种锂离子电池极片，包括集流体、附着在集流体表面的活性物质层，以及焊接在集流体上的极耳，其特征在于：所述活性物质层上设有至少两个为嵌入极耳预留的凹槽，所述凹槽的长度小于极片的宽度。

2. 根据权利要求 1 所述的锂离子电池极片，其特征在于：所述凹槽的宽度大于极耳焊接区域的宽度。

3. 根据权利要求 1 所述的锂离子电池极片，其特征在于：所述凹槽的长度大于极耳焊接区域的长度。

4. 根据权利要求 1 所述的锂离子电池极片，其特征在于：所述凹槽的深度小于等于单面活性物质层的厚度。

5. 根据权利要求 1 所述的锂离子电池极片，其特征在于：所述凹槽的开口方向与极耳的伸出方向相同。

6. 根据权利要求 1 所述的锂离子电池极片，其特征在于：所述极片包括正极极片和负极极片，所述正极极片上焊接有正极极耳，所述负极极片上焊接有负极极耳。

7. 根据权利要求 6 所述的锂离子电池极片，其特征在于：所述正极极片和负极极片上均设有两个凹槽，卷绕或叠片时，所述正极极片上的凹槽位置与所述负极极片上的凹槽位置一一对应，共同形成空腔。

8. 根据权利要求 7 所述的锂离子电池极片，其特征在于：所述正极极耳和负极极耳嵌入所述空腔内。

9. 一种锂离子电池，包括正极极片、负极极片、间隔于所述正极极片和负极极片之间的隔膜，以及电解液，所述正极极片上焊接有正极极耳，所述负极极片上焊接有负极极耳，其特征在于：所述正极极片为权利要求 1 至 8 任一项所述的锂离子电池极片，所述负极极片为权利要求 1 至 8 任一项所述的锂离子电池极片，所述正极极耳和负极极耳在卷绕或者叠片时嵌入凹槽内。

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锂离子电池及其极片

技术领域

[0001] 本实用新型属于锂离子电池技术领域，尤其涉及一种能够充分利用电池的尺寸空间、提升电池容量和能量密度的锂离子电池极片，以及包含该极片的锂离子电池。

背景技术

[0002] 锂离子电池因能量密度高、平均开路电压高和循环寿命长等优点已广泛应用于移动、便携式电器中。软包装锂离了电池因其尺寸可灵活设计、安全性能好等优势而广泛应用在消费电子产品领域。

[0003] 商品化的锂离子电池的极片包含集流体、极耳和活性物质层，其中活性物质层为连续均匀的涂层。正负极极片与隔膜一起组成电芯，电芯的厚度由正负极极片的厚度、隔膜的厚度、极耳的厚度共同累加组成。在电芯的不同部位，厚度并不相同，其中在焊接极耳处的厚度最大。商品化的锂离了电池一般均以电池的最大厚度定义该型号电池的厚度。

[0004] 随着电子产品向小型化、多功能化发展，其对锂离子电池的能量密度要求也越来越高，这就要求电池在同样的空间内要贡献出更多的容量。而传统的锂离子电池的厚度由于极耳厚度的累加，使得焊接极耳区域的厚度为电池的最大厚度，而未焊接极耳的区域厚度则相对较小，这部分空间不能被充分利用，导致在一定型号尺寸内，电池的容量难以进一步提高。极耳的厚度对电池厚度的累加已经成为制约传统锂离了电池能量密度进一步提升的瓶颈之一。

[0005] 专利号为 CN201087907Y 的实用新型专利提出在电极极片上设置凹槽，使电池极耳嵌入凹槽，可以在一定程度上缓解极耳厚度对电池厚度的累加。但是该专利中在极片上设置的凹槽长度与极片的宽度相同，考虑到在商业化电池中极耳的焊接部分通常为 10 ～ 30 毫米，当电池的极片较宽时，极片上有大面积的空白凹槽区域不能对应极耳，不仅会使该凹陷区域对应的极片受力不均，造成界面接触变差，影响电池性能，而且浪费了电池内的空间，不能使电池的能量密度达到最优。

[0006] 有鉴于此，确有必要改进锂离子电池的极片，从而更加充分的利用电池的有效尺寸空间，提升电池容量和能量密度。

实用新型内容

[0007] 本实用新型的目的之一在于：针对现有技术的不足，而提供一种能够充分利用电池的尺寸空间、提升电池容量和能量密度的锂离子电池极片。

[0008] 为了达到上述目的，本实用新型采用如下技术方案：

[0009] 一种锂离子电池极片，包括集流体、附着在集流体表面的活性物质层，以及焊接在集流体上的极耳，所述活性物质层上设有至少两个为嵌入极耳预留的凹槽，所述凹槽的长度小于极片的宽度，从而使凹槽区域基本上对应极耳，避免该凹陷区域对应的极片受力不均而造成的界面接触变差问题，从而保证电池性能，而且节省了电池内的空间，使电池的能量密度达到最优。

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[0010] 作为本实用新型锂离子电池极片的一种改进，所述凹槽的宽度大于极耳焊接区域的宽度。

[0011] 作为本实用新型锂离子电池极片的一种改进，所述凹槽的长度大于极耳焊接区域的长度。以使极耳能够嵌入凹槽内。

[0012] 作为本实用新型锂离子电池极片的一种改进，所述凹槽的深度小于等于单面活性物质层的厚度。

[0013] 作为本实用新型锂离子电池极片的一种改进，所述凹槽的开口方向与极耳的伸出方向相同。

[0014] 作为本实用新型锂离子电池极片的一种改进，所述极片包括正极极片和负极极片，所述正极极片上焊接有正极极耳，所述负极极片上焊接有负极极耳。

[0015] 作为本实用新型锂离子电池极片的一种改进，所述正极极片和负极极片上均设有两个凹槽，卷绕或叠片时，所述正极极片上的凹槽位置与所述负极极片上的凹槽位置一一对应，共同形成空腔。

[0016] 作为本实用新型锂离子电池极片的一种改进，所述正极极耳和负极极耳嵌入所述空腔内。

[0017] 相对于现有技术，本实用新型通过在正负极极片的活性物质层上设置凹槽，使得在厚度方向上，极耳可以嵌入该凹槽内，这样就使得极耳的厚度不累加在电芯的整体厚度上，为电芯内活性物质提供了更多的空间，在不改变电芯尺寸的前提下，显著提升了电池的容量和能量密度，而且由于极片上的凹槽基本对应于极耳，从而可以避免该凹槽对应的极片受力不均的情况，从而保证电池性能。

[0018] 本实用新型的另一个目的在于提供一种锂离子电池，包括正极极片、负极极片、间隔于所述正极极片和负极极片之间的隔膜，以及电解液，所述正极极片上焊接有正极极耳，所述负极极片上焊接有负极极耳，所述正极极片为上述段落所述的锂离子电池极片，所述负极极片为上述段落所述的锂离子电池极片，所述正极极耳和负极极耳在卷绕或者叠片时嵌入凹槽内。

[0019] 相对于现有技术，本实用新型锂离子电池由于其极片上留有可以嵌入极耳的凹槽，使得电池的厚度最大的位置不再是极耳位置，解决了电芯整体厚度不均匀的问题，从而更加充分的利用电池的有效尺寸空间，提升了电池的容量和能量密度。

附图说明

[0020] 图 1 为本实用新型锂离子电池负极极片结构图；

[0021] 图 2 为本实用新型锂离子电池正极极片结构图；

[0022] 图 3 为本实用新型锂离子电池卷绕结构示意图。

具体实施方式

[0023] 下面结合说明书附图和具体实施方式对本实用新型提供的一种锂离子电池的极片及包含该极片的锂离子电池做进一步的详细描述：

[0024] 如图 1 所示，本实用新型的锂离子电池负极极片包括：负极极耳 1、负极集流体 3 和附着在所述负极集流体 3 上的负极活性物质层 5，其中负极活性物质层 5 上设有负极凹槽

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7。负极极耳 1 焊接在未涂覆活性物质的空白负极集流体 3 上，负极活性物质层 5 涂覆于负极集流体 3 的两面。其中，所述负极凹槽 7 的宽度大于负极极耳 1 焊接区域的宽度；所述负极凹槽 7 的长度大于负极极耳 1 焊接区域的长度；所述负极凹槽 7 的深度小于等于单面负极活性物质层 5 的厚度。所述负极凹槽 7 的开口方向与负极极耳 1 的伸出方向相同。

[0025] 如图 2 所示，本实用新型的锂离子电池正极极片包括：正极极耳 2、正极集流体 4 和涂覆在所述正极集流体 4 上的正极活性物质层 6，其中正极活性物质层 6 上设有正极凹槽 8。正极活性物质层 6 涂覆于正极集流体 4 的两面，正极极耳 2 焊接在未涂覆活性物质的空白正极集流体 4 上。其中，所述正极凹槽 8 的宽度大于正极极耳 2 焊接区域的宽度；所述正极凹槽 8 的长度大于正极极耳 2 焊接区域的长度；所述正极凹槽 8 的深度小于等于单面正极活性物质层 6 的厚度。所述正极凹槽 8 的开口方向与正极极耳 2 的伸出方向相同。

[0026] 如图 3 所示，采用本实用新型的正负极极片与隔膜 9 经卷绕成为电芯，其中，负极极耳 1 嵌入负极活性物质层 5 上的负极凹槽 7 与正极活性物质层 6 上的正极凹槽 8 组成的空间内，正极极耳 2 嵌入负极活性物质层 5 上的负极凹槽 7 与正极活性物质层 6 上的正极凹槽 8 组成的空间内。在厚度方向上，负极活性物质层 5 和正极活性物质层 6 上的负极凹槽 7 和正极凹槽 8 形成空腔，使负极极耳 1 和正极极耳 2 形成的凸台可以嵌入其中，这样就抵消了负极极耳 1 和正极极耳 2 的厚度对整个电池厚度的累加，使得在极耳焊接区域以外的部分上可以增加活性物质层的厚度，在不改变电池尺寸的前提下，达到提高电池容量的目的。

具体实施方式

[0027] 以 616790 型号（成品电池的厚度为 6.1 毫米，宽度为 67 毫米，长度为 90 毫米）的方形锂离子电池为例。电池的正极极耳 2 和负极极耳 1 的尺寸相同，其厚度为 0.1 毫米，宽度为 6 毫米，长度为 40 毫米，其中长度方向上有 30 毫米为焊接在极片上的长度。

[0028] 采用本实用新型提供的极片，其中正极极片上的正极活性物质层 6 的单层厚度为 58 微米厚，负极极片上的负极活性物质层 5 的单层厚度为 70 微米厚。正负极极片与隔膜卷绕形成的电芯结构为本实用新型提供的电芯结构。使用该电芯制作的电池的主体部分厚度均匀相等，电池主体各处厚度均为 6.1 毫米。对比实施方式

[0029] 以 616790 型号（成品电池的厚度为 6.1 毫米，宽度为 67 毫米，长度为 90 毫米）的方形锂离子电池为例。电池的正负极极耳的尺寸相同，其厚度为 0.1 毫米，宽度为 6 毫米，长度为 40 毫米，其中长度方向上有 30 毫米为焊接在极片上的长度。

[0030] 采用传统的极片结构，其中正负极极片的长度、宽度与实施例完全相同，区别仅是活性物质层的厚度不同，正极极片上的正极活性物质层的单层厚度为 56 微米厚，负极极片上的负极活性物质层的单层厚度为 67 微米厚。正负极极片与隔膜卷绕形成的电芯结构为传统的电芯结构。使用该电芯制作的电池的焊接极耳区域的厚度最大，电池焊接极耳处的厚度为 6.1 毫米，未焊接极耳处的电池主体部分的厚度为 6.0 毫米。

[0031] 由此可知，采用本实用新型的极片可以解决了电芯整体厚度不均匀的问题，从而更加充分的利用电池的有效尺寸空间。

[0032] 对具体实施方式和对比实施方式所得电池进行容量测试和体积能量密度测试，所得结果示于表 1。

[0033] 表 1：实施例与对比例电池的容量和体积能量密度。

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[0034]

	容量	体积能量密度
具体实施方式	4250mAh	430Wh/L
对比实施方式	4150mAh	420Wh/L

[0035] 由表 1 可以看到，采用本实用新型提供的极片可以显著提高电池在相同尺寸下的容量和体积能量密度。

[0036] 根据上述说明书的揭示和教导，本实用新型所属领域的技术人员还可以对上述实施方式进行变更和修改。因此，本实用新型并不局限于上面揭示和描述的具体实施方式，对本实用新型的一些修改和变更也应当落入本实用新型的权利要求的保护范围内。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本实用新型构成任何限制。

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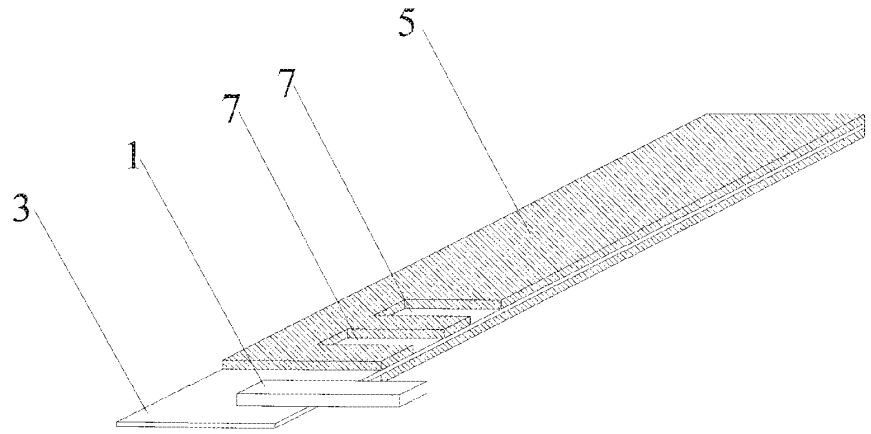


图 1

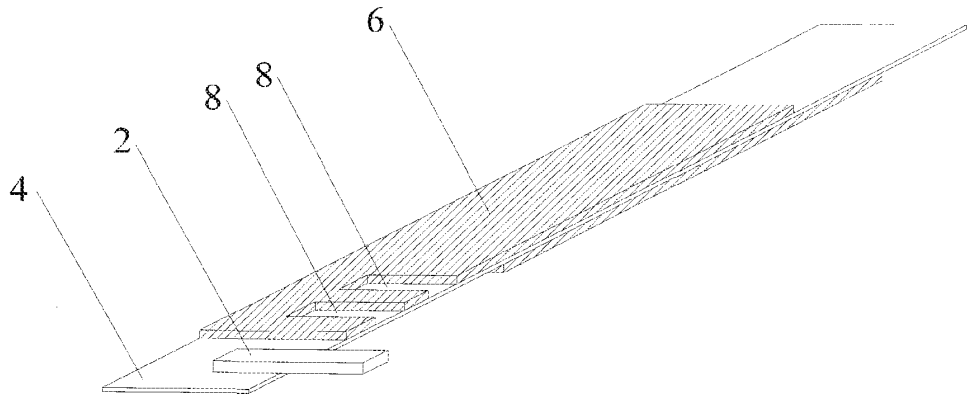


图 2

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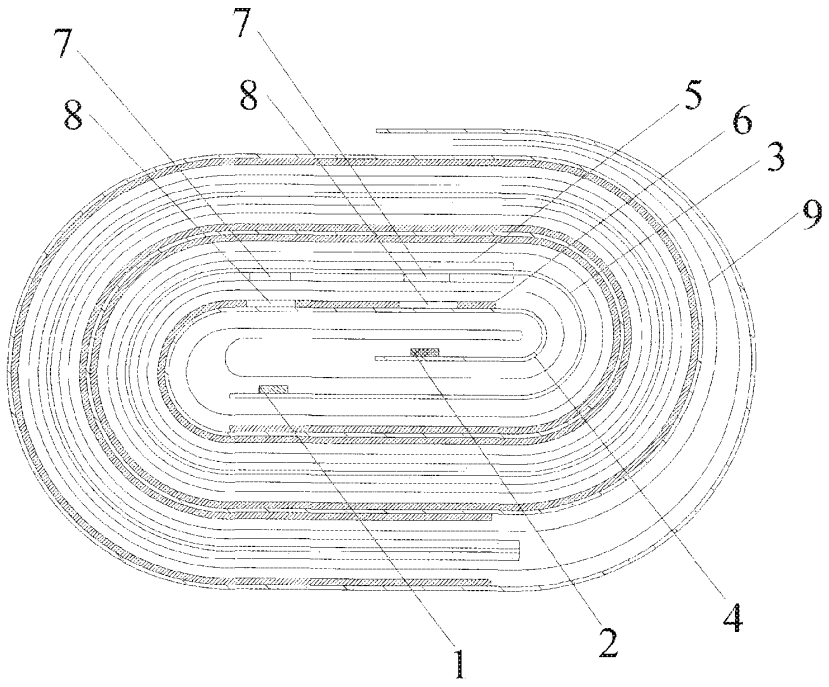


图 3

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Espacenet

Bibliographic data: CN203733894 (U) — 2014-07-23

Lithium ion battery

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Classification:	**- international:*H01M10/0525; H01M2/34*** **- cooperative: H01M10/0525; H01M10/058; H01M2/263; H01M2/30; H01M4/13; H01M4/139**
Application number:	CN2014230319U 20140117
Priority number (s):	CN2014230319U 20140117
Also published as:	US2015207111 (A1)

Abstract of CN203733894 (U)



The utility model belongs to the technical field of lithium ion batteries, and particularly relates to a lithium ion battery.
The lithium ion battery comprises a positive plate, a negative plate, a diaphragm arranged between the positive plate and the negative plate, as well as an electrolyte, wherein a positive pole film piece is provided with a first groove; a negative pole film piece is provided with a second groove, a positive pole tab is welded in the first groove, and a negative pole tab is welded in the second groove; each of upper and lower surfaces of the positive pole tab is covered with a first insulating glue layer, and a second insulating glue layer is attached to the surface, corresponding to the second groove, of the positive pole film piece. Compared with prior art, the lithium ion battery provided by the utility model has the advantages that the upper and lower surfaces of the positive pole tab are covered with the first insulating glue layers, the second insulating glue layer is attached to the surface, corresponding to the second groove, of the positive pole film piece, inner short circuit and lithium resolving dangers of a battery are greatly reduced, the safety property of the battery on the premise of high energy density is guaranteed, and the lithium ion battery can be popularized and used on the market.

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DESCRIPTION CN203733894

The utility model belongs to the technical field of lithium ion batteries, in particular to a lithium ion battery comprising a positive electrode sheet, a negative electrode sheet, a separator disposed between the positive electrode sheet and the negative electrode sheet, and an electrolyte. The positive electrode diaphragm is provided with a first recess The groove and the negative electrode diaphragm are provided with a second groove, the positive electrode tab is welded in the first groove, and the negative electrode tab is welded in the second groove. The upper and lower surfaces of the positive electrode tab are covered with a first insulating adhesive. Layer, a second insulating adhesive layer is attached to the surface of the positive film corresponding to the second recess. Compared with the prior art, the present invention can cover the first insulating adhesive layer on the upper and lower surfaces of the positive electrode tab and the second insulating adhesive layer on the surface of the positive electrode film corresponding to the second recess. To reduce the risk of internal short-circuit and lithium evolution of the battery, and then to improve the safety performance of the battery under the premise of ensuring a high energy density, so that the market can be promoted and applied.

Lithium Ion Battery

Technical field

The utility model belongs to the technical field of lithium ion batteries, in particular to a lithium ion battery.

Background technique

Lithium-ion batteries at this stage are moving in the direction of thinner thickness and higher energy density,

which requires the battery to provide as much energy as possible in a thinner volume. In traditional lithium-ion battery designs, the tabs are components that are welded to the current collector and used to conduct the current. Whether the battery is Jelly-rolled or laminated, the entire battery is due to the presence of the tabs. The increase of the thickness means that the thickness of the tab welding region of the battery is the maximum thickness of the battery, and the thickness of the portion usually occupies 1 to 5% of the entire thickness of the battery after the winding. Therefore, the thickness of the tabs and the accumulation of the battery thickness have become one of the bottlenecks that restrict the further increase of the energy density of the conventional lithium ion battery.

In response to the above problems, the Chinese utility model patents disclosed with publication number CN202495523U and publication number CN201087907Y all propose to provide a groove on the electrode pole piece so that the battery tab is embedded in the groove, which can reduce the thickness of the tab to the thickness of the battery to some extent. Accumulated, but when a groove is provided at one end of the pole piece in the length direction, the variation of the film thickness around the groove is much larger than the thickness of the film far from the end of the groove, especially due to the arrangement of the groove There are many water chestnuts in this place, making the membrane at the water chestnut easily fall off, especially when the active material for the negative electrode is made of easily swellable material such as silicon. This is especially the case. Moreover, this structure also makes the overall internal resistance of the battery larger, and can not fully utilize the capacity of the lithium ion battery. In addition, since the insulating layer is not attached to the positive electrode region corresponding to the positive groove region or the negative electrode recess, the internal short-circuit and the risk of lithium evolution occur, and it is difficult to promote the application in the market.

Utility model content

The purpose of the utility model is to provide a lithium ion battery with high energy density and good safety aiming at the deficiency of the prior art.

In order to achieve the above objectives, the present invention adopts the following technical solutions: a lithium ion battery including a positive electrode sheet, a negative electrode sheet, a separator disposed between the positive electrode sheet and the negative electrode sheet, and an electrolyte, and the positive electrode sheet includes a positive electrode A current collector, a positive electrode tab and a positive electrode tab attached to a surface of the positive electrode current collector, the negative electrode sheet comprising a negative electrode current collector, a negative electrode tab and a negative electrode tab attached to a surface of the negative electrode current collector, and the positive electrode tab A first groove is disposed on the sheet, a second groove is disposed on the negative electrode film, the positive electrode tab is welded in the first groove, and the negative electrode tab is welded to the second groove. The upper and lower surfaces of the positive electrode tab are covered with a first insulating adhesive layer, and the surface of the positive electrode film corresponding to the second recess is affixed with a second insulating adhesive layer on the lower surface of the positive electrode tab.

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The first insulating adhesive layer completely covers the blank positive current collector at the first recess.

Wherein, the positive tab can be completely incorporated into the first recess, and the negative tab can be fully incorporated into the second recess. In the present invention, the first groove and the second groove are respectively disposed on the positive electrode sheet and the negative electrode sheet, and the positive electrode tab and the negative electrode tab are respectively incorporated in the first recess and the second recess, so that the thickness direction The thickness of the positive (negative) pole tab is less than the thickness of the positive (negative) pole piece, so that the thickness of the tab is not accumulated over the entire thickness of the cell, providing more space for the active material within the cell, and thus Increased battery energy density.

The first groove and the second groove can be manufactured by mechanical solvent cleaning or laser cleaning.

As an improvement of the lithium ion battery of the present invention, the width of the second insulating adhesive layer is greater than the width of the second groove, and the length of the second insulating adhesive layer is greater than the length of the second groove.

As an improvement of the lithium ion battery of the present invention, the first insulating adhesive layer and the second insulating adhesive layer are all configured as a green adhesive layer, a black adhesive layer, a yellow adhesive layer or a white adhesive layer.

As an improvement of the lithium ion battery of the present invention, the distance from the center of the first groove to the end of the positive electrode film (the end perpendicular to the longitudinal direction of the positive electrode current collector) is the distance of the positive electrode film. In a length of 1/4 to 3/4, the distance from the center of the second groove to one end of the negative electrode film (an end perpendicular to the length direction of the negative electrode current collector) is the length of the negative electrode sheet. 1/4~3/4.

That is, the first groove and the second groove are respectively disposed in the middle portions of the positive electrode sheet and the negative electrode sheet, so that the area around the groove caused when the groove is disposed at the end of the electrode sheet is overcome when the electrode sheet expands. The defects such as the inconsistency of the thickness, the change in the thickness, and the detachment of the diaphragm easily reduce the internal resistance of the full battery, and significantly increase the battery capacity and energy density without changing the size of the battery core.

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As an improvement of the lithium ion battery of the present invention, the distance from the center of the first groove to one end of the positive electrode film is 1/2 of the length of the positive electrode film, and the second groove is The distance from the center to one end of the negative electrode sheet is 1/2 of the length of the negative electrode sheet.

As an improvement of the lithium ion battery of the present invention, the length of the first groove is smaller than the length of the positive electrode tab by 1 to 100 mm, and the width of the first groove is larger than the width of the positive electrode tab 1 to 10 mm; the length of the second groove is 1 to 100 mm smaller than the length of the negative electrode tab, and the width of the second groove is 1 to 10 mm larger than the width of the negative electrode tab.

As an improvement of the lithium ion battery of the present invention, the length of the first groove is smaller than the width of the positive electrode film by 1 to 100 mm, and the length of the second groove is smaller than the width of the negative electrode film. 1~100mm.

As an improvement of the lithium ion battery of the present invention, the depth of the first groove is less than or equal to the thickness of the positive electrode film, and the depth of the second groove is less than or equal to the thickness of the negative electrode film.

As an improvement of the lithium ion battery of the present invention, the depth of the first groove is greater than the thickness of the positive electrode tab by 0.005-0.1 mm, and the depth of the second groove is greater than the thickness of the negative electrode tab Large 0.005~0.1mm.

Compared with the prior art, the present invention can cover the first insulating adhesive layer on the upper and lower surfaces of the positive electrode tab and the second insulating adhesive layer on the surface of the positive electrode film corresponding to the second recess. To reduce the risk of internal short-circuit and lithium evolution of the battery, and then to improve the safety performance of the battery under the premise of ensuring a high energy density, so that the market can be promoted and applied.

Description of the drawings

FIG. 1 is a front view of a positive electrode sheet in Example 1 of the present invention.

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Fig. 2 is a front view of a negative electrode sheet in Example 1 of the present invention.

FIG. 3 is a top view of the positive electrode sheet in Example 1 of the present invention.

4 is a top view of a negative electrode sheet in Example 1 of the present invention.

Fig. 5 is a sectional view of a first embodiment of the present invention.

detailed description

The present invention and its beneficial effects will be further described in detail with reference to the examples and the accompanying drawings, but the specific embodiments of the present invention are not limited thereto.

Example 1

As shown in FIG. 1 to FIG. 5, a lithium ion battery provided by this embodiment includes a positive electrode sheet 1, a negative electrode sheet 2, a separator 3 disposed between the positive electrode sheet 1 and the negative electrode sheet 2, and an electrolyte. 1 includes a positive electrode collector 11, a positive electrode sheet 12 and a positive electrode tab 13 attached to the surface of the positive electrode collector 11, and a negative electrode sheet 2 including a negative electrode collector 21, a negative electrode sheet 22 attached to the surface of the negative electrode collector 21, and a negative electrode tab. 23, a first groove 14 is disposed on the positive electrode diaphragm 12, a second groove 24 is disposed on the negative electrode film 22. The positive electrode lug 13 is welded in the first groove 14, and the negative electrode tab 23 is welded to the second recess. In the groove 24, the upper and lower surfaces of the positive electrode tab 13 are covered with a first insulating adhesive layer 15, and the surface of the positive electrode film 12 corresponding to the second groove 24 is affixed with a second insulating adhesive layer 16.

The width of the second insulating adhesive layer 16 is greater than the width of the second groove 24. The length of the second insulating adhesive layer 16 is greater than the length of the second groove 24.

The first insulating adhesive layer 15 and the second insulating adhesive layer 16 are each provided as a green adhesive layer.

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The distance from the center of the first groove 14 to one end of the positive electrode diaphragm 12 (one end perpendicular to the longitudinal direction of the positive electrode current collector 11 and the positive electrode current collector 11 whose blank is not left) is the length of the positive electrode film 12 . 1/2, the distance from the center of the second groove 24 to the one end of the negative electrode diaphragm 22 (an end perpendicular to the lengthwise direction of the negative electrode collector 21, and the negative electrode current collector 21 whose blank is not left) is negative The length of the diaphragm 22 is 1/2.

The length of the first groove 14 is 25 mm smaller than the length of the positive electrode tab 13, the width of the first groove 14 is 4 mm greater than the width of the positive electrode tab 13, and the length of the second groove 24 is 25 mm smaller than the length of the negative electrode tab 23. The width of the second groove 24 is greater than the width of the negative electrode tab 23 by 4 mm.

The length of the first groove 14 is 55 mm smaller than the width of the positive electrode sheet 12, and the length of the second groove 24 is 57 mm smaller than the width of the negative electrode sheet 22.

The depth of the first groove 14 is smaller than the thickness of the positive electrode film 12, and the depth of the second groove 24 is smaller than the thickness of the negative electrode film 22.

The depth of the first groove 14 is greater than the thickness of the positive electrode tab 13 by 0.02 mm, and the depth of the second groove 24 is greater than the thickness of the negative electrode tab 23 by 0.02 mm.

Taking a square lithium ion battery of type 303482 (a finished battery having a thickness of 3.0 mm, a width of 34 mm and a length of 82 mm) as an example, the steps for preparing the lithium ion battery of this embodiment are as follows:

Preparation of positive electrode sheet: Using NMP as a solvent, 95wt% of positive electrode active material lithium cobaltate, 2wt% of binder PVDF, and 3wt% of conductive agent graphite were added to NMP in proportion, and the viscosity range was 3000-6000pa. s cathode slurry. The positive electrode slurry was coated on a 12 μ m aluminum foil, dried, and cold pressed to obtain a positive electrode sheet 1 having a tap density of 4.1 g/cm<3>, a length of 277 mm, a width of 75 mm, and a thickness of 0.114 mm. The positive film 12 of the positive electrode sheet 1 at the middle position (1/2 of the length of the positive electrode sheet 1) is removed by laser cleaning to form the first groove 14. The specification of the positive electrode tab 13 is 0.08 mm in thickness, 6 mm in width, and 45 mm in length. The size of the first groove 14 to be removed is: 0.10 mm in

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thickness, 10 mm in width, and 20 mm in length. Then, the positive electrode tab 13 is laser welded to the first groove 14, and the length of the positive electrode tab 13 protruding from the positive electrode sheet 1 is 15 mm. The upper and lower surfaces of the positive tab 13 are covered with green glue, and green glue is applied on the positive film 12 corresponding to the second groove 24 at the time of winding, and the green glue on the lower surface of the positive electrode lug 13 completely covers the first The blank positive current collector 11 at the groove 14 .

Preparation of negative electrode sheet: Using deionized water as a solvent, 95 wt % of negative electrode active material graphite, 2 wt % of binder SBR, 2 wt % of conductive agent graphite, and 1 wt % of thickener CMC were added to deionized water, followed by stirring. The negative electrode paste has a viscosity in the range of 1000-3000 pa.s. The negative electrode slurry was coated on a 6 μ m copper foil, dried, and cold pressed to obtain a negative electrode sheet having a compacted density of 1.6 g/cm<3>, a length of 285 mm, a width of 77 mm, and a thickness of 0.135 mm. The active material in the middle position of the negative electrode sheet 2 (half of the entire length of the negative electrode sheet 2) is removed by mechanical cleaning to form the second groove 24. The negative electrode tab 23 has a thickness of 0.08 mm, a width of 6 mm, and a length of 45 mm. The size of the second recess 24 formed by the removal is 0.10 mm in thickness, 10 mm in width, and 20 mm in length. The negative electrode tab 23 is laser welded to the second groove 24, and the length of the negative electrode tab 23 protruding from the negative electrode sheet 2 is 15 mm.

Preparation of Electrolyte: Ethyl Carbonate (EMC), Diethyl Carbonate (DEC), Ethylene Carbonate (EC), Propylene Carbonate (PC) were mixed uniformly at a ratio of 1:1:0.5:0.5, and lithium hexafluorophosphate was added (LiPF 6) was used as a solute, and the concentration of lithium hexafluorophosphate (LiPF 6) was 1 M to prepare an electrolyte base solution. Then, lithium difluorooxalatoborate in a weight ratio of 0.5% and adiponitrile in a weight ratio of 1% were added to the electrolytic solution and sufficiently dissolved to obtain an electrolytic solution for a lithium ion battery.

Preparation of batteries: The prepared positive electrode sheet 1 and negative electrode sheet 2 and the separator 3 (a polyethylene film having a thickness of 0.013 mm) were wound in accordance with a conventional winding process to form a bare cell, and the main body of the bare cell was fabricated. The thickness is even and equal, the average thickness of the battery body is 2.78 mm, the bare cell is dried, injected into the electrolyte, packaged, and finally made into a battery.

Example 2

The difference from Example 1 is:

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The distance from the center of the first groove 14 to one end of the positive electrode diaphragm 12 (one end perpendicular to the longitudinal direction of the positive electrode current collector 11 and the positive electrode current collector 11 whose blank is not left) is the length of the positive electrode film 12 . 1/4, the distance from the center of the second groove 24 to the one end of the negative electrode diaphragm 22 (an end perpendicular to the longitudinal direction of the negative electrode collector 21 and the negative electrode current collector 21 whose blank is not left) is the negative electrode The length of the diaphragm 22 is 1/4.

The length of the first groove 14 is 75 mm smaller than the length of the positive electrode tab 13, the width of the first groove 14 is 2 mm larger than the width of the positive electrode tab 13, and the length of the second groove 24 is 75 mm smaller than the length of the negative electrode tab 23. The width of the second groove 24 is greater than the width of the negative electrode tab 23 by 2 mm.

The length of the first groove 14 is 30 mm smaller than the width of the positive electrode sheet 12, and the length of the second groove 24 is 33 mm smaller than the width of the negative electrode sheet 22.

The depth of the first groove 14 is greater by 0.08 mm than the thickness of the positive electrode tab 13, and the depth of the second groove 24 is greater by 0.08 mm than the thickness of the negative electrode tab 23.

The negative electrode active material is silicon.

The first insulating adhesive layer 15 and the second insulating adhesive layer 16 are each provided as a vinyl layer.

The rest is the same as Embodiment 1, and will not be repeated here.

Example 3

The difference from Example 1 is:

The distance from the center of the first groove 14 to one end of the positive electrode diaphragm 12 (one end perpendicular to the longitudinal direction of the positive electrode current collector 11 and the positive

electrode current collector 11 whose blank is not left) is the length of the positive electrode film 12 . 3/4, the distance from the center of the second groove 24 to the one end of the negative electrode diaphragm 22 (an end perpendicular to the longitudinal direction of the negative electrode collector 21 and the negative electrode current collector 21 whose blank is not left) is the negative electrode The length of the diaphragm 22 is 3/4.

The length of the first groove 14 is 50 mm smaller than the length of the positive electrode tab 13, the width of the first groove 14 is 8 mm larger than the width of the positive electrode tab 13, and the length of the second groove 24 is 50 mm shorter than the length of the negative electrode tab 23. The width of the second groove 24 is greater than the width of the negative electrode tab 23 by 8 mm.

The length of the first groove 14 is 70 mm smaller than the width of the positive electrode sheet 12, and the length of the second groove 24 is 73 mm smaller than the width of the negative electrode sheet 22.

The depth of the first groove 14 is greater than the thickness of the positive electrode tab 13 by 0.05 mm, and the depth of the second groove 24 is greater than the thickness of the negative electrode tab 23 by 0.05 mm.

The negative electrode active material is silicon.

Each of the first insulating adhesive layer 15 and the second insulating adhesive layer 16 is a white adhesive layer.

The rest is the same as Embodiment 1, and will not be repeated here.

Example 4

The difference from Example 2 is:

The distance from the center of the first groove 14 to one end of the positive electrode diaphragm 12 (one end perpendicular to the longitudinal direction of the positive electrode current collector 11 and the positive electrode current collector 11 whose blank is not left) is the length of the positive electrode film 12 . 1/6, the distance from the center of the second groove 24 to the one end of the negative electrode diaphragm 22 (an end perpendicular to the longitudinal direction of the negative electrode current collector 21, and the negative electrode current collector 21 whose blank is not left) is negative The length of the diaphragm 22 is 1/6. The first

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insulating adhesive layer 15 and the second insulating adhesive layer 16 are each provided as a yellow adhesive layer.

The rest is the same as Embodiment 2, and will not be repeated here.

Example 5

The difference from Example 3 is:

The distance from the center of the first groove 14 to one end of the positive electrode diaphragm 12 (one end perpendicular to the longitudinal direction of the positive electrode current collector 11 and the positive electrode current collector 11 whose blank is not left) is the length of the positive electrode film 12 . 4/5, the distance from the center of the second groove 24 to the one end of the negative electrode film 22 (an end perpendicular to the lengthwise direction of the negative electrode collector 21 and the negative electrode current collector 21 whose blank is not left) is the negative electrode The length of the diaphragm 22 is 4/5.

The rest is the same as Embodiment 3 and will not be described here.

Comparative Example 1

Different from Embodiment 1, the first insulating adhesive layer 15 is not covered on the upper and lower surfaces of the positive electrode tab 13, and the second insulating adhesive layer 16 is not provided on the surface of the positive electrode film 12 corresponding to the second groove 24.

The rest is the same as Embodiment 1, and will not be repeated here.

Comparative Example 2

The difference from Embodiment 1 is that: the positive tab 13 is welded on the blank positive current collector 11, the first groove 14 is not provided on the positive film 12, and the negative electrode tab 23 is welded on the blank negative current collector 21. The second groove 24 is not disposed on the diaphragm 22. The rest is the

same as Embodiment 1, and will not be described here.

Thirteen of each of the batteries of Examples 1-3 and Comparative Example 1 were selected for cycle testing. After 300 cycles, the number of short-circuited batteries was counted. The results are shown in Table 1.

Then, 10 cells from each of the batteries of Examples 1 to 3 and Comparative Example 1 were selected for the cycle test, and after 100 cycles, the batteries were disassembled to observe the lithium evolution status of the negative electrode sheet 2 and to count the occurrence of lithium evolution in the negative electrode sheet 2 . Quantity, the results obtained are shown in Table 1.

Table 1: Short-circuits and Lithium Separation of Negative Electrodes in Cyclical Cells of Examples 1-3 and Comparative Example 1

[image]

According to Table 1, the first insulating adhesive layer 15 is covered on the upper and lower surfaces of the positive electrode tab 13, and a second insulating adhesive layer is disposed on the surface of the positive electrode film 12 corresponding to the second recess 24. 16, can greatly improve the safety performance of the battery.

The batteries provided in Example 1 and Comparative Example 2 were subjected to capacity test, internal resistance test and volumetric energy density test. The results obtained are shown in Table 2. Among them, the capacity test and the internal resistance test are tested on a Hanger machine at 25° C. The capacity is 0.2C discharge capacity, the internal resistance is the impedance at 1000Hz, and the volume energy density is the minimum capacity × platform voltage/ The maximum volume.

Table 2: Capacity, internal resistance and volumetric energy density of the batteries of Example 1 and Comparative Example 2.

[image]

From Table 2, it can be seen that the pole piece structure of the present invention can solve the problem of non-

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uniform thickness of the whole cell, thereby making full use of the effective size space of the battery, improving the capacity and volume energy density of the battery, and reducing the internal volume of the full cell. Resistance.

A charge-discharge cycle test was performed on the batteries of Examples 2-5 (for convenience of explanation, an example in which the negative-electrode active material in Example 1 was changed to silicon was compared as Example 6), and after 50 cycles, the battery was disassembled and observed. The active material was peeled off at the edge of the second groove 24, and the results are shown in Table 3.

Table 3: Active material shedding at the edge of the groove after cycling of the cells of Examples 2-6

[image]

As can be seen from Table 3, if the active material used in the negative electrode sheet 2 is a substance such as silicon that is likely to undergo severe volume expansion, the first groove 14 and the second groove 24 are respectively disposed on the positive electrode sheet 1 and the negative electrode sheet 2 . The middle portion can also significantly improve the problem of active material shedding at the edge of the second groove 24 . This is because: the volumetric expansion of the negative electrode sheet 2 using silicon or the like as an active material is so severe that the design of the second recess 24 located at the end of the negative electrode sheet 2 cannot withstand the uneven stress condition at the second recess 24 , and it is implemented. The second grooves 24 of Examples 2, 3, and 6 are located in the middle position of the negative electrode sheet 2, and the force at both ends thereof is substantially the same, so the problem of active material shedding at the edge of the second groove 24 can be significantly improved.

Based on the above disclosure and teachings, those skilled in the art to which the present invention pertains can also make changes and modifications to the above embodiments. Therefore, the present invention is not limited to the above-mentioned specific embodiments. Any obvious improvement, replacement or modification made by those skilled in the art on the basis of the present invention belongs to the protection scope of the present invention. In addition, although some specific terms are used in this specification, these terms are only for convenience of description and do not impose any limit on the present invention.

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CLAIMS CN203733894

1.

A lithium ion battery includes a positive electrode sheet, a negative electrode sheet, a separator disposed between the positive electrode sheet and the negative electrode sheet, and an electrolyte. The positive electrode sheet includes a positive electrode collector and a positive electrode attached to the surface of the positive electrode collector. A diaphragm and a positive electrode tab, the negative electrode sheet comprising a negative electrode current collector, a negative electrode film attached to the negative electrode current collector surface, and a negative electrode tab. The positive electrode film has a first groove and a negative electrode film. A second groove is arranged on the chip, the positive pole tab is welded in the first groove, and the negative pole tab is welded in the second groove, which is characterized in that the positive pole tab is up and down The two surfaces are covered with a first insulating adhesive layer, and a surface of the positive electrode film corresponding to the second groove is affixed with a second insulating adhesive layer.

2.

The lithium ion battery according to claim 1, wherein the width of the second insulating adhesive layer is greater than the width of the second groove, and the length of the second insulating adhesive layer is greater than that of the second groove. length.

3.

The lithium ion battery according to claim 1 or 2, wherein the first insulating adhesive layer and the second insulating adhesive layer are all arranged as a green adhesive layer, a black adhesive layer, a yellow adhesive layer or a white adhesive layer. .

4.

The lithium ion battery according to claim 1, wherein the distance from the center of the first groove to one end of the positive electrode film is 1/4 to 3/4 of the length of the positive electrode film. The distance from the center of the second groove to one end of the negative electrode sheet is 1/4 to 3/4 of the length of the negative electrode sheet.

5.

The lithium ion battery according to claim 4, wherein the distance from the center of the first groove to the one end of the positive electrode film is 1/2 of the length of the positive electrode film, and the second The distance from the center of the groove to one end of the negative electrode sheet is 1/2 of the length of the negative electrode sheet.

6.

The lithium ion battery according to claim 1, wherein the length of the first groove is smaller than the length of the positive electrode tab by 1 to 100 mm, and the width of the first groove is greater than that of the positive electrode tab. The width of the second groove is 1 to 10 mm smaller than the length of the negative electrode tab, and the width of the second groove is 1 to 10 mm greater than the width of the negative electrode tab.

7.

The lithium ion battery according to claim 1, wherein the length of the first groove is smaller than the width of the positive film by 1 to 100 mm, and the length of the second groove is smaller than that of the negative film. The width is small 1~100mm.

8.

The lithium ion battery according to claim 1, wherein a depth of the first groove is less than or equal to a thickness of the positive electrode film, and a depth of the second groove is less than or equal to the negative electrode film. thickness of.

9.

The lithium ion battery according to claim 1, wherein the depth of the first groove is greater than the thickness of the positive electrode tab by 0.005-0.1 mm, and the depth of the second groove is greater than that of the negative electrode. The thickness of the ear is 0.005~0.1mm.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 203733894 U
(45)授权公告日 2014.07.23

(21)申请号 201420030319.4

(22)申请日 2014.01.17

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(51)Int.Cl.
H01M 10/0525(2010.01)
H01M 2/34(2006.01)

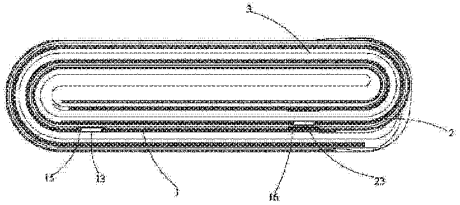
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(54)实用新型名称

锂离子电池

(57)摘要

本实用新型属于锂离子电池技术领域，尤其涉及一种锂离子电池，包括正极片、负极片、设置于正极片和负极片之间的隔膜，以及电解液，正极膜片上设置有第一凹槽，负极膜片上设置有第二凹槽，正极极耳焊接于第一凹槽内，负极极耳焊接于第二凹槽内，正极极耳的上下两个表面上覆盖有第一绝缘胶层，第二凹槽对应的正极膜片的表面贴有第二绝缘胶层。相对于现有技术，本实用新型通过在正极极耳的上下两个表面上覆盖第一绝缘胶层，并在第二凹槽对应的正极膜片的表面贴第二绝缘胶层，从而可以大大减少电池发生内短路和析锂的危险，进而在保证较高的能量密度的前提下提高电池的安全性能，从而可以实现在市场上的推广和应用。



CN 203733894 U

1. 锂离子电池，包括正极片、负极片、设置于所述正极片和所述负极片之间的隔膜，以及电解液，所述正极片包括正极集流体、附着在所述正极集流体表面的正极膜片和正极极耳，所述负极片包括负极集流体、附着在所述负极集流体表面的负极膜片和负极极耳，所述正极膜片上设置有第一凹槽，所述负极膜片上设置有第二凹槽，所述正极极耳焊接于所述第一凹槽内，所述负极极耳焊接于所述第二凹槽内，其特征在于：所述正极极耳的上下两个表面上覆盖有第一绝缘胶层，所述第二凹槽对应的所述正极膜片的表面贴有第二绝缘胶层。

2. 根据权利要求 1 所述的锂离子电池，其特征在于：所述第二绝缘胶层的宽度大于所述第二凹槽的宽度，所述第二绝缘胶层的长度大于所述第二凹槽的长度。

3. 根据权利要求 1 或 2 所述的锂离子电池，其特征在于：所述第一绝缘胶层和所述第二绝缘胶层均设置为绿胶层、黑胶层、黄胶层或白胶层。

4. 根据权利要求 1 所述的锂离子电池，其特征在于：所述第一凹槽的中心到所述正极膜片的一端的距离为所述正极膜片的长度的 1/4~3/4，所述第二凹槽的中心到所述负极膜片的一端的距离为所述负极膜片的长度的 1/4~3/4。

5. 根据权利要求 4 所述的锂离子电池，其特征在于：所述第一凹槽的中心到所述正极膜片的一端的距离为所述正极膜片的长度的 1/2，所述第二凹槽的中心到所述负极膜片的一端的距离为所述负极膜片的长度的 1/2。

6. 根据权利要求 1 所述的锂离子电池，其特征在于：所述第一凹槽的长度比所述正极极耳的长度小 1~100mm，所述第一凹槽的宽度比所述正极极耳的宽度大 1~10mm；所述第二凹槽的长度比所述负极极耳的长度小 1~100mm，所述第二凹槽的宽度比所述负极极耳的宽度大 1~10mm。

7. 根据权利要求 1 所述的锂离子电池，其特征在于：所述第一凹槽的长度比所述正极膜片的宽度小 1~100mm，所述第二凹槽的长度比所述负极膜片的宽度小 1~100mm。

8. 根据权利要求 1 所述的锂离子电池，其特征在于：所述第一凹槽的深度小于或等于所述正极膜片的厚度，所述第二凹槽的深度小于或等于所述负极膜片的厚度。

9. 根据权利要求 1 所述的锂离子电池，其特征在于：所述第一凹槽的深度比所述正极极耳的厚度大 0.005~0.1mm，所述第二凹槽的深度比所述负极极耳的厚度大 0.005~0.1mm。

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锂离子电池

技术领域

[0001] 本实用新型属于锂离子电池技术领域，尤其涉及一种锂离子电池。

背景技术

[0002] 现阶段的锂离子电池正朝着厚度更薄、能量密度更高的方向发展，这就要求电池在更薄的体积中提供尽可能多的能量。在传统的锂离子电池设计中，极耳是焊接在集流体上用于将电流导出的部件，无论电池采用卷绕(Jelly-roll)方式还是层叠方式制成，由于极耳的存在使得整个电池厚度增加，即使得电池的极耳焊接区域的厚度为电池的最大厚度，该部分的厚度通常占据卷绕成型后整个电池厚度的1~5%。因此，极耳的厚度对电池厚度的累加已经成为制约传统锂离子电池能量密度进一步提升的瓶颈之一。

[0003] 针对上述问题，公开号为CN202495523U和公开号为CN201087907Y的中国实用新型专利均提出在电极极片上设置凹槽，使电池极耳嵌入凹槽，这可以在一定程度上减少极耳厚度对电池厚度的累加，但是当把一个凹槽设置在极片长度方向的一端时，该凹槽周围的膜片厚度变化比远离凹槽的一端的膜片厚度变化大得多，特别是由于凹槽的设置导致该处有多个菱角，使得菱角处的膜片极易脱落，特别是当负极活性物质采用硅等易膨胀的物质时，这种情况尤为明显。而且这种结构还会使得电池的整体内阻较大，不能充分发挥锂离子电池的容量。此外，由于在正极凹槽区域或负极凹槽对应的正极区域并未贴绝缘层，使得电池有发生内短路和析锂的危险，难于在市场上推广应用。

实用新型内容

[0004] 本实用新型的目的在于：针对现有技术的不足，而提供一种能量密度高、安全性好的锂离子电池。

[0005] 为了达到上述目的，本实用新型采用如下技术方案：锂离子电池，包括正极片、负极片、设置于所述正极片和所述负极片之间的隔膜，以及电解液，所述正极片包括正极集流体、附着在所述正极集流体表面的正极膜片和正极极耳，所述负极片包括负极集流体、附着在所述负极集流体表面的负极膜片和负极极耳，所述正极膜片上设置有第一凹槽，所述负极膜片上设置有第二凹槽，所述正极极耳焊接于所述第一凹槽内，所述负极极耳焊接于所述第二凹槽内，所述正极极耳的上下两个表面上覆盖有第一绝缘胶层，所述第二凹槽对应的所述正极膜片的表面贴有第二绝缘胶层，位于正极极耳下表面的第一绝缘胶层要完全盖住第一凹槽处的空白的正极集流体。

[0006] 其中，正极极耳可完全纳入第一凹槽内，负极极耳可完全纳入第二凹槽内。本实用新型通过在正极片和负极片上分别设置第一凹槽和第二凹槽，并将正极极耳和负极极耳分别纳入第一凹槽和第二凹槽内，使得在厚度方向上，正(负)极极耳的厚度小于正(负)极片的厚度，这样就使得极耳的厚度不累加在电芯的整体厚度上，为电芯内活性物质提供了更多的空间，从而提升了电池的能量密度。

[0007] 第一凹槽和第二凹槽可以采用机械溶剂清洗或者激光清洗的方式来制得。

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[0008] 作为本实用新型锂离子电池的一种改进，所述第二绝缘胶层的宽度大于所述第二凹槽的宽度，所述第二绝缘胶层的长度大于所述第二凹槽的长度。

[0009] 作为本实用新型锂离子电池的一种改进，所述第一绝缘胶层和所述第二绝缘胶层均设置为绿胶层、黑胶层、黄胶层或白胶层。

[0010] 作为本实用新型锂离子电池的一种改进，所述第一凹槽的中心到所述正极膜片的一端（与正极集流体的长度方向相垂直的一端）的距离为所述正极膜片的长度的 1/4~3/4，所述第二凹槽的中心到所述负极膜片的一端（与负极集流体的长度方向相垂直的一端）的距离为所述负极膜片的长度的 1/4~3/4。

[0011] 即第一凹槽和第二凹槽分别设置在正极片和负极片的中间部分，这样就克服了当极片产生膨胀时凹槽设置在极片端部时带来的凹槽周围区域粘接不牢、厚度变化大和膜片易脱落等缺陷，同时降低了全电池的内阻，在不改变电芯尺寸的前提下，显著提升了电池的容量和能量密度。

[0012] 作为本实用新型锂离子电池的一种改进，所述第一凹槽的中心到所述正极膜片的一端的距离为所述正极膜片的长度的 1/2，所述第二凹槽的中心到所述负极膜片的一端的距离为所述负极膜片的长度的 1/2。

[0013] 作为本实用新型锂离子电池的一种改进，所述第一凹槽的长度比所述正极极耳的长度小 1~100mm，所述第一凹槽的宽度比所述正极极耳的宽度大 1~10mm；所述第二凹槽的长度比所述负极极耳的长度小 1~100mm，所述第二凹槽的宽度比所述负极极耳的宽度大 1~10mm。

[0014] 作为本实用新型锂离子电池的一种改进，所述第一凹槽的长度比所述正极膜片的宽度小 1~100mm，所述第二凹槽的长度比所述负极膜片的宽度小 1~100mm。

[0015] 作为本实用新型锂离子电池的一种改进，所述第一凹槽的深度小于或等于所述正极膜片的厚度，所述第二凹槽的深度小于或等于所述负极膜片的厚度。

[0016] 作为本实用新型锂离子电池的一种改进，所述第一凹槽的深度比所述正极极耳的厚度大 0.005~0.1mm，所述第二凹槽的深度比所述负极极耳的厚度大 0.005~0.1mm。

[0017] 相对于现有技术，本实用新型通过在正极极耳的上下两个表面上覆盖第一绝缘胶层，并在第二凹槽对应的正极膜片的表面贴第二绝缘胶层，从而可以大大减少电池发生内短路和析锂的危险，进而在保证较高的能量密度的前提下提高电池的安全性能，从而可以实现在市场上的推广和应用。

附图说明

[0018] 图 1 为本实用新型实施例 1 中的正极片的正视图。

[0019] 图 2 为本实用新型实施例 1 中的负极片的正视图。

[0020] 图 3 为本实用新型实施例 1 中的正极片的俯视图。

[0021] 图 4 为本实用新型实施例 1 中的负极片的俯视图。

[0022] 图 5 为本实用新型实施例 1 的剖视图。

具体实施方式

[0023] 下面结合实施例和说明书附图，对本实用新型及其有益效果进行进一步详细的说

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明，但是本实用新型的具体实施方式并不限于此。

[0024] 实施例 1

[0025] 如图 1 至图 5 所示，本实施例提供的一种锂离子电池，包括正极片 1、负极片 2、设置于正极片 1 和负极片 2 之间的隔膜 3，以及电解液，正极片 1 包括正极集流体 11、附着在正极集流体 11 表面的正极膜片 12 和正极极耳 13，负极片 2 包括负极集流体 21、附着在负极集流体 21 表面的负极膜片 22 和负极极耳 23，正极膜片 12 上设置有第一凹槽 14，负极膜片 22 上设置有第二凹槽 24，正极极耳 13 焊接于第一凹槽 14 内，负极极耳 23 焊接于第二凹槽 24 内，正极极耳 13 的上下两个表面上覆盖有第一绝缘胶层 15，第二凹槽 24 对应的正极膜片 12 的表面贴有第二绝缘胶层 16。

[0026] 其中，第二绝缘胶层 16 的宽度大于第二凹槽 24 的宽度，第二绝缘胶层 16 的长度大于第二凹槽 24 的长度。

[0027] 第一绝缘胶层 15 和第二绝缘胶层 16 均设置为绿胶层。

[0028] 第一凹槽 14 的中心到正极膜片 12 的一端（与正极集流体 11 的长度方向相垂直的一端，且该端未预留空白的正极集流体 11）的距离为正极膜片 12 的长度的 1/2，第二凹槽 24 的中心到负极膜片 22 的一端（与负极集流体 21 的长度方向相垂直的一端，且该端未预留空白的负极集流体 21）的距离为负极膜片 22 的长度的 1/2。

[0029] 第一凹槽 14 的长度比正极极耳 13 的长度小 25mm，第一凹槽 14 的宽度比正极极耳 13 的宽度大 4mm；第二凹槽 24 的长度比负极极耳 23 的长度小 25mm，第二凹槽 24 的宽度比负极极耳 23 的宽度大 4mm。

[0030] 第一凹槽 14 的长度比正极膜片 12 的宽度小 55mm，第二凹槽 24 的长度比负极膜片 22 的宽度小 57mm。

[0031] 第一凹槽 14 的深度小于正极膜片 12 的厚度，第二凹槽 24 的深度小于负极膜片 22 的厚度。

[0032] 第一凹槽 14 的深度比正极极耳 13 的厚度大 0.02mm，第二凹槽 24 的深度比负极极耳 23 的厚度大 0.02mm。

[0033] 以 303482 型号（成品电池的厚度为 3.0 毫米，宽度为 34 毫米，长度为 82 毫米）的方形锂离子电池为例，本实施例的锂离子电池的制备步骤如下：

[0034] 正极片的制备：以 NMP 为溶剂，将 95wt% 的正极活性物质钴酸锂、2wt% 的粘接剂 PVDF、3wt% 的导电剂石墨按比例加入 NMP 中，搅拌成粘度范围为 3000-6000pa.s 的正极浆料。将正极浆料涂布在 12μm 的铝箔上，干燥，冷压，得到压实密度为 4.1g/cm^3，长度为 277 毫米，宽度为 75 毫米，厚度为 0.114 毫米的正极片 1。采用激光清洗的方式将正极片 1 的中间位置（整个正极片 1 长度的 1/2 处）的正极膜片 12 清除形成第一凹槽 14。正极极耳 13 的规格为：厚度为 0.08 毫米，宽度为 6 毫米，长度为 45 毫米，清除形成的第一凹槽 14 的规格为：厚度为 0.10 毫米，宽度为 10 毫米，长度为 20 毫米。然后将正极极耳 13 激光焊接在第一凹槽 14 处，正极极耳 13 伸出正极片 1 的长度为 15 毫米。正极极耳 13 上下两个表面覆盖绿胶，并在卷绕时第二凹槽 24 对应的正极膜片 12 上贴绿胶，并且位于正极极耳 13 下表面的绿胶要完全盖住第一凹槽 14 处的空白的正极集流体 11。

[0035] 负极片的制备：以去离子水为溶剂，将 95wt% 的负极活性物质石墨、2wt% 的粘接剂 SBR、2wt% 的导电剂石墨和 1wt% 的增稠剂 CMC 加入去离子水中，搅拌成粘度范围为

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1000-3000pa.s 的负极浆料。将负极浆料涂布在 6μm 的铜箔上，干燥，冷压，得到压实密度为 1.6g/cm^3，长度为 285 毫米，宽度为 77 毫米，厚度为 0.135 毫米的负极片。采用机械清洗的方式将负极片 2 的中间位置（整个负极片 2 长度的 1/2 处）的活性物质清除形成第二凹槽 24。负极极耳 23 的规格为：厚度为 0.08 毫米，宽度为 6 毫米，长度为 45 毫米。清除形成的第二凹槽 24 的规格为：厚度为 0.10 毫米，宽度为 10 毫米，长度为 20 毫米。将负极极耳 23 激光焊接在第二凹槽 24 处，负极极耳 23 伸出负极片 2 的长度为 15 毫米。

[0036] 电解液的制备：碳酸甲乙酯（EMC）、碳酸二乙酯（DEC）、碳酸乙烯酯（EC）、碳酸丙烯酯（PC）按照 1 ： 1 ： 0.5 ： 0.5 的比例混合均匀，加入六氟磷酸锂（$LiPF_6$）作为溶质，使六氟磷酸锂（$LiPF_6$）的浓度为 1M，制成电解液基液。然后向电解液中加入重量比为 0.5% 的二氟草酸硼酸钾和重量比为 1% 的己二腈，使其充分溶解，即制得锂离子电池用电解液。

[0037] 电池的制备：将制得的正极片 1 和负极片 2 以及隔离膜 3（厚度为 0.013 毫米的聚乙烯膜）按照常规的卷绕工艺进行卷绕后制成裸电芯，裸电池的主体部分厚度均匀相等，电池主体平均厚度为 2.78 毫米，将裸电芯干燥、注入电解液、封装，最终制成电池。

[0038] 实施例 2

[0039] 与实施例 1 不同的是：

[0040] 第一凹槽 14 的中心到正极膜片 12 的一端（与正极集流体 11 的长度方向相垂直的一端，且该端未预留空白的正极集流体 11）的距离为正极膜片 12 的长度的 1/4，第二凹槽 24 的中心到负极膜片 22 的一端（与负极集流体 21 的长度方向相垂直的一端，且该端未预留空白的负极集流体 21）的距离为负极膜片 22 的长度的 1/4。

[0041] 第一凹槽 14 的长度比正极极耳 13 的长度小 75mm，第一凹槽 14 的宽度比正极极耳 13 的宽度大 2mm；第二凹槽 24 的长度比负极极耳 23 的长度小 75mm，第二凹槽 24 的宽度比负极极耳 23 的宽度大 2mm。

[0042] 第一凹槽 14 的长度比正极膜片 12 的宽度小 30mm，第二凹槽 24 的长度比负极膜片 22 的宽度小 33mm。

[0043] 第一凹槽 14 的深度比正极极耳 13 的厚度大 0.08mm，第二凹槽 24 的深度比负极极耳 23 的厚度大 0.08mm。

[0044] 负极活性物质为硅。

[0045] 第一绝缘胶层 15 和第二绝缘胶层 16 均设置为黑胶层。

[0046] 其余同实施例 1，这里不再赘述。

[0047] 实施例 3

[0048] 与实施例 1 不同的是：

[0049] 第一凹槽 14 的中心到正极膜片 12 的一端（与正极集流体 11 的长度方向相垂直的一端，且该端未预留空白的正极集流体 11）的距离为正极膜片 12 的长度的 3/4，第二凹槽 24 的中心到负极膜片 22 的一端（与负极集流体 21 的长度方向相垂直的一端，且该端未预留空白的负极集流体 21）的距离为负极膜片 22 的长度的 3/4。

[0050] 第一凹槽 14 的长度比正极极耳 13 的长度小 50mm，第一凹槽 14 的宽度比正极极耳 13 的宽度大 8mm；第二凹槽 24 的长度比负极极耳 23 的长度小 50mm，第二凹槽 24 的宽度比负极极耳 23 的宽度大 8mm。

[0051] 第一凹槽 14 的长度比正极膜片 12 的宽度小 70mm，第二凹槽 24 的长度比负极膜片

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22 的宽度小 73mm。

[0052] 第一凹槽 14 的深度比正极极耳 13 的厚度大 0.05mm，第二凹槽 24 的深度比负极极耳 23 的厚度大 0.05mm。

[0053] 负极活性物质为硅。

[0054] 第一绝缘胶层 15 和第二绝缘胶层 16 均设置为白胶层。

[0055] 其余同实施例 1，这里不再赘述。

[0056] 实施例 4

[0057] 与实施例 2 不同的是：

[0058] 第一凹槽 14 的中心到正极膜片 12 的一端（与正极集流体 11 的长度方向相垂直的一端，且该端未预留空白的正极集流体 11）的距离为正极膜片 12 的长度的 1/6，第二凹槽 24 的中心到负极膜片 22 的一端（与负极集流体 21 的长度方向相垂直的一端，且该端未预留空白的负极集流体 21）的距离为负极膜片 22 的长度的 1/6。第一绝缘胶层 15 和第二绝缘胶层 16 均设置为黄胶层。

[0059] 其余同实施例 2，这里不再赘述。

[0060] 实施例 5

[0061] 与实施例 3 不同的是：

[0062] 第一凹槽 14 的中心到正极膜片 12 的一端（与正极集流体 11 的长度方向相垂直的一端，且该端未预留空白的正极集流体 11）的距离为正极膜片 12 的长度的 4/5，第二凹槽 24 的中心到负极膜片 22 的一端（与负极集流体 21 的长度方向相垂直的一端，且该端未预留空白的负极集流体 21）的距离为负极膜片 22 的长度的 4/5。

[0063] 其余同实施例 3，这里不再赘述。

[0064] 对比例 1

[0065] 与实施例 1 不同的是：正极极耳 13 的上下两个表面上未覆盖第一绝缘胶层 15，第二凹槽 24 对应的正极膜片 12 的表面未贴设第二绝缘胶层 16。

[0066] 其余同实施例 1，这里不再赘述。

[0067] 对比例 2

[0068] 与实施例 1 不同的是：正极极耳 13 焊接在空白的正极集流体 11 上，正极膜片 12 上未设置第一凹槽 14；负极极耳 23 焊接在空白的负极集流体 21 上，负极膜片 22 上未设置第二凹槽 24，其余同实施例 1，这里不再赘述。

[0069] 分别从实施例 1-3 和对比例 1 的电池中各选取 10 只进行循环测试，循环 300 次后，统计发生短路的电池数量，所得结果见表 1。

[0070] 再分别从实施例 1-3 和对比例 1 的电池中各选取 10 只进行循环测试，循环 100 次后，拆解电池，观察负极片 2 的析锂状况，统计负极片 2 发生析锂的电池数量，所得结果见表 1。

[0071] 表 1：实施例 1-3 和对比例 1 的电池循环后发生短路和负极片发生析锂的情况

[0072]

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组别	循环 300 次后发生短路的电池数量	循环 100 次后负极片 2 发生析锂的电池数量
实施例 1	0	0
实施例 2	0	1
实施例 3	1	0
对比例 1	5	7

[0073] 由表 1 可知，本实用新型通过在正极极耳 13 的上下两个表面上覆盖第一绝缘胶层 15，和在第二凹槽 24 对应的正极膜片 12 的表面贴设第二绝缘胶层 16，可以大大提高电池的安全性能。

[0074] 对实施例 1 和对比例 2 提供的电池进行容量测试、内阻测试和体积能量密度测试，所得结果示于表 2。其中，容量测试和内阻测试都在 25℃环境下在杭可机上测试，容量取的是 0.2C 放电容量，内阻取的是 1000Hz 下的阻抗，体积能量密度 = 最小容量 × 平台电压 / 最大体积。

[0075] 表 2 ：实施例 1 和对比例 2 的电池的容量、内阻和体积能量密度。

[0076]

组别	直流内阻/mΩ	平均容量/mAh	平均厚度/mm	平均体积能量密度/Wh/L
实施例 1	55	1180	2.78	563
对比例 2	62	1170	2.84	546

[0077] 由表 2 可知，本实用新型中的极片结构可以解决电芯整体厚度不均匀的问题，从而更加充分的利用电池的有效尺寸空间，提升电池的容量和体积能量密度，同时降低全电池的内阻。

[0078] 对实施例 2-5 的电池进行充放电循环测试（为了便于说明，将实施例 1 中的负极活性物质换为硅的例子作为实施例 6 来进行比较），循环 50 次后拆解电池，观察第二凹槽 24 边缘处的活性物质脱落情况，所得结果见表 3。

[0079] 表 3 ：实施例 2-6 的电池在循环后凹槽边缘处的活性物质脱落情况

[0080]

	实施例 4	实施例 2	实施例 6	实施例 3	实施例 5
循环 50 次后第二凹槽处活性物质脱落情况	有明显的物质剥落现象	无明显的物质剥落现象	无物质剥落现象	无明显的物质剥落现象	有明显的物质剥落现象

[0081] 由表 3 可知，若负极片 2 中使用的活性物质是硅等容易发生严重的体积膨胀的物质时，将第一凹槽 14 和第二凹槽 24 分别设置在正极片 1 和负极片 2 的中部还可以明显改善第二凹槽 24 边缘处活性物质脱落的问题。这是因为 ：使用硅等作为活性物质的负极片 2 的体积膨胀严重，导致第二凹槽 24 位于负极片 2 端部的设计无法承受第二凹槽 24 处不均

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的受力状况，而实施例 2，3 和 6 的第二凹槽 24 位于负极片 2 的中间位置，其两端受力情况基本一致，所以可以明显改善第二凹槽 24 边缘处活性物质脱落的问题。

[0082] 根据上述说明书的揭示和教导，本实用新型所属领域的技术人员还能够对上述实施方式进行变更和修改。因此，本实用新型并不局限于上述的具体实施方式，凡是本领域技术人员在本实用新型的基础上所作出的任何显而易见的改进、替换或变型均属于本实用新型的保护范围。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本实用新型构成任何限制。

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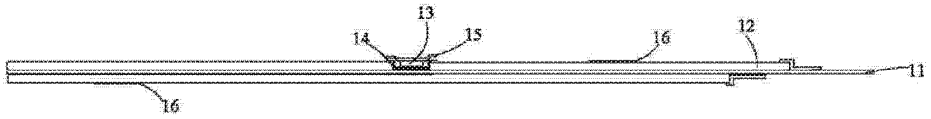


图 1

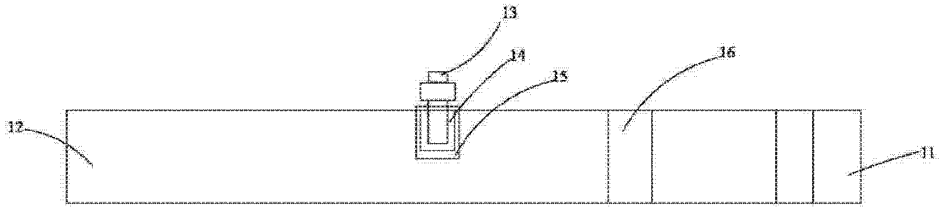


图 2

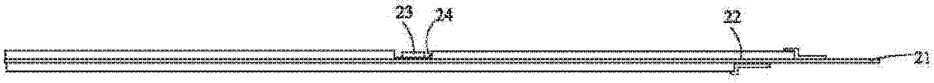


图 3

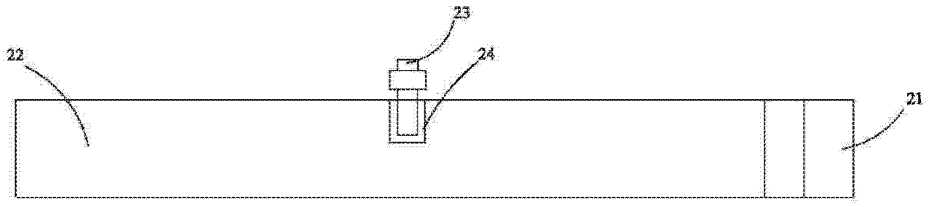


图 4

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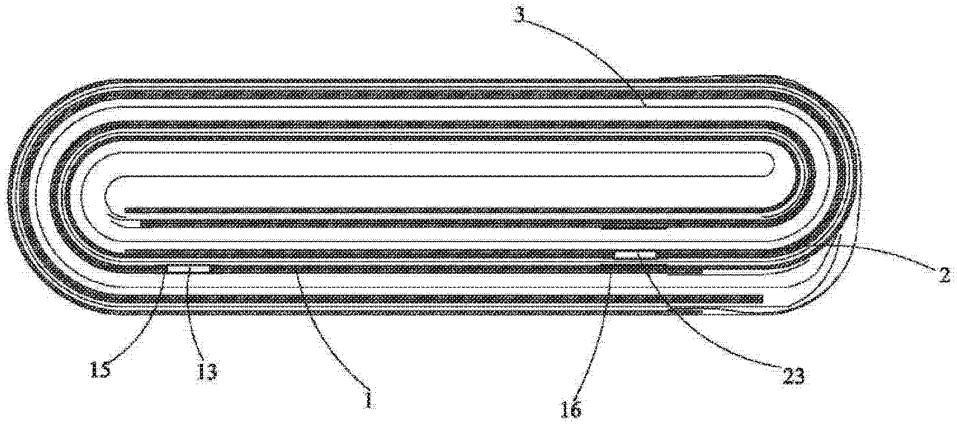


图 5

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Espacenet

Bibliographic data: CN204905336 (U) — 2015-12-23

Electrode pole piece and adopt electric core of this pole piece

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Applicant(s): NINGDE AMPEREX TECHNOLOGY LTD ± (NINGDE AMPEREX TECHNOLOGY LTD)

Classification: **- international:** ***H01M2/20; H01M2/26***
- cooperative:

Application number: CN20152467990U 20150702

Priority number (s): CN20152467990U 20150702

Abstract of CN204905336 (U)

The utility model relates to an energy storage device field especially relates to an electrode pole piece and adopt electric core of this pole piece, and the electrode pole piece including the mass flow body, active material layer and utmost point ear, still includes the trench, and the trench is seted up in the coating of the mass flow body has active material layer's region, and with the position one -to -one of the utmost point ear of positive pole and/or negative pole, the size of trench all is not less than utmost point ear that it corresponded and the connection zone's that distinguishes of coating corresponding size. The electricity core includes anodal pole piece and/or negative pole pole piece that barrier film and electrode pole piece constitute, and anodal pole piece, negative pole pole piece and barrier film constitute the electric core of coiling, and the trench quantity total on anodal pole piece and the negative pole pole piece be two, and the position one -to -one of two groove bit positions and the utmost point ear of positive pole and negative pole. The electric core that this application provided, the convex part of the regional institute of utmost point ear welding alright absorbed by the trench to reduce welding utmost point ear to the influence of electric core thickness, improved the volume energy density of battery.

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DESCRIPTION CN204905336

The present application relates to the field of energy storage devices, and in particular to an electrode pole piece and a core using the pole piece, an electrode pole piece including a current collector, an active material layer and a tab, and a slot, the slot being located at the collector In the region coated with the active material layer, and corresponding to the positions of the tabs of the positive electrode and/or the negative electrode, the size of the slot is not smaller than the corresponding size of the connecting region of the corresponding tab and the uncoated region. . The cell includes a separator and a positive electrode plate and/or a negative electrode plate formed of an electrode plate. The positive electrode plate, the negative electrode plate, and the separator constitute a wound cell. The sum of the number of the slots on the positive electrode plate and the negative electrode plate is Two, and the positions of the two slots are in one-to-one correspondence with the positions of the tabs of the positive electrode and the negative electrode. In the cell provided by the present application, the protruding portion of the tab welding region can be absorbed by the slot, thereby reducing the influence of the welding lug on the thickness of the cell, and increasing the volumetric energy density of the cell.

Electrode pole piece and battery core using the pole piece

Technical field

The present application relates to the field of energy storage devices, and in particular, to an electrode plate and a cell using the plate.

Background technique

In the related art, the positive pole piece and the negative pole piece of the lithium ion battery cell each include a current collector, an active material layer, and a tab. The active material layer is coated on the surface of the current collector and at both ends of the current collector in the length direction. All had uncoated areas, and the tabs were welded in an uncoated area.

Due to the presence of the tabs, after the cells are wound by the process, the thickest place of the cell is usually the place where the tabs are welded, thereby reducing the volumetric energy density of the cell.

Utility model content

The present application provides an electrode pole piece and a battery core using the same, which can reduce the problem of cell thickening due to welding lugs and increase the volumetric energy density of the battery.

A first aspect of the present application provides an electrode plate comprising a current collector, an active material layer, and a tab. The active material layer is coated on the surface of the current collector and is in the direction of the length of the current collector. An uncoated region is left at both ends, the tab is disposed in one of the uncoated regions, and further includes a slot, and the slot is located in an area where the current collector is coated with the active material layer. When the electrode plate is wound to form a cell, the positions of the slots are in one-to-one correspondence with the positions of the tabs of the positive electrode and/or the negative electrode, and the slots are closed on one side and opened on three sides. The configuration includes a wide side and two opposite long sides, and the size of the long side and the width of the wide side are not less than the corresponding connection area between the tab and the uncoated region. The corresponding size.

Preferably, both sides of the slot are provided with insulating glue, and the insulating glue is at least adhered to the outer sides of the two long sides of the slot, and strides across the slot in the extending direction of the wide side. Bit.

Preferably, the insulating glue completely covers the slot and is bonded to both the long sides of the slot and the outside of one of the wide sides.

Preferably, both surfaces of the current collector are coated with the active material layer, and the active material layer on one side surface of the current collector and the surface on the other side of the current collector are described. The projection of the active material layer on the current collector overlaps.

The slot is located in the overlap area, and the slot is in the area of the active material layer on both sides of the current collector at the same time.

Preferably, both surfaces of the current collector are coated with the active material layer, and the uncoated region on one side surface of the current collector and the surface on the other side of the current collector. The projection of the active material layer on the current collector overlaps.

The slot is located in the overlap region, and the slot is in the region of the active material layer on one side of the current collector and in the uncoated region on the other side of the current collector.

A second aspect of the present application provides a cell including a separator and a positive electrode plate and/or a negative electrode plate formed by the above electrode plates. The positive electrode plate, the negative electrode plate, and the The separator constitutes a wound cell. The sum of the number of the slots on the positive electrode tab and the negative electrode tab is two, and the position of the two slots and the tab of the positive electrode and the negative electrode are located. One to one correspondence.

Preferably, both of the slots are disposed on the positive pole piece.

Preferably, at least one of the slots is disposed on the negative pole piece, and a region opposite to the slot disposed on the negative pole piece and opposite to the isolation film is not exposed on the positive pole piece. The active material layer.

Preferably, the active material layer is not coated on a region of the positive electrode tab opposite to the slot provided on the negative electrode sheet across a layer of the separator.

Preferably, an outer side of the active material layer on a region where the positive electrode tab and the groove disposed on the negative electrode sheet are opposite to each other across a layer of the separator is covered with a shielding layer.

The technical solution provided by this application can achieve the following beneficial effects:

Since the cell provided in the present application has a slot corresponding to the tab on the electrode pole piece, the protruding portion of the tab welding area can be absorbed by the slot, thereby reducing the influence of the welding lug on the thickness of the battery core. Increases the volumetric energy density of the battery.

It should be understood that the foregoing general description and the following detailed description are exemplary only, and do not limit the present application.

Description of the drawings

FIG. 1 is a schematic structural diagram of an electrode pole provided by an embodiment of the present application; FIG.

FIG. 2 is a schematic diagram of a battery cell provided with a slot in a positive pole piece according to an embodiment of the present application; FIG.

FIG. 3 is a schematic diagram of the structure of a cell provided with a slot in a negative pole piece according to an embodiment of the present application; FIG.

FIG. 4 is a schematic diagram of a battery core structure of a comparative example 1 according to an embodiment of the present application; FIG.

FIG. 5 is a structural schematic view of an electrode pole piece of Comparative Example 2 provided in an embodiment of the present application; FIG.

FIG. 6 is a schematic diagram of the cell structure of Comparative Example 2 provided by an embodiment of the present application.

Description of the figures:

1

- Electrode pole pieces; 10 - Current collector; 100 - Uncoated area; 12 - Active material layer; 14 - Tab; 16 - Slot

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position; 18 - Insulative glue;

2
- Isolation film.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the application, and together with the description serve to explain the principles of the application.

detailed description

The present application will be further described in detail below through specific embodiments and with reference to the accompanying drawings.

The terms “front”, “back”, “left”, “right”, “upper”, and “lower” in the text are referenced to the placement state of the electrode pads in the drawing and the battery cells using the same.

As shown in FIG. 1, a first embodiment of the present application provides an electrode plate 1, including a current collector 10, an active material layer 12, a tab 14, a slot 16 and an insulating adhesive 18.

The active material layer 12 is coated on the surface of the current collector 10, and most of both surfaces of the current collector 10 are coated with the active material layer 12, leaving uncoated regions 100 at both ends in the length direction of the current collector 10. .

When the core is wound to form a cell, due to the polarity of the electrode plate 1 and the winding method, the positional difference between the active material layers 12 on both sides of the current collector 10 and other factors affect the active material layer 12 on both sides of the current collector 10 . The projections on the current collector 10 mostly overlap, but the position of the active material layer 12 on both sides and the termination position may be different at positions close to both ends, which may make uncoated on the side of the current collector 10 . There is an overlap in the projection of the coated region of the region 100 with the active material layer 12 on the other side of the current collector 10 on the current collector 10 .

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The slot 16 is opened in the area where the current collector 10 is coated with the active material layer 12, and when the electrode plate 1 is wound to form a cell, the position of the slot 16 is the same as the position of the tab 14 of the cathode or the anode. One correspondence. The tab 14 is generally fixedly attached to one of the uncoated regions 100 by welding. The slot 16 is a configuration in which three sides are closed and one side is open. The slot 16 includes a wide side 160 and two opposite long sides 162. The size of the long side 162 and the width of the wide side 160 are not smaller than the corresponding tabs 14 and 14. The corresponding size of the connection area of the uncoated area 100.

Wherein, the position of the slot 16 can be set in the region of the active material layer 12 on both sides of the current collector 10 at the same time, that is, in the region where the active material layers 12 on both sides are projected and overlapped. However, compared with the manner in which the slot 16 is not provided in the related art, the slot 16 is formed in such a manner that the slot 16 is set in the overlap region, which results in the coating area of the active material layer 12 on both sides of the electrode plate 1 at the same time. Reduction in the total impact of the battery's active material is significant.

In the present embodiment, the position of the slot 16 may also be located in the area where the active material layer 12 on the side of the current collector 10 overlaps with the uncoated region 100 on the other side, so that the opening of the slot 16 only affects The active material layer 12 on one side has a small influence on the total amount of the active material of the cell.

During the processing, the active material layer 12 may be coated on both sides of the current collector 10 in the usual manner. After that, the active material layer 12 is punched at the corresponding position by a die cutting technique, and the active material layer 12 and the current collector 10 are punched together to form a groove. Bit 16.

After punching out the formed slot 16, the strength of the electrode plate 1 at this place will be reduced, and the electrode plate 1 will be easily broken during the process of winding up and forming the cell. As shown in FIG. 1 , in order to prevent breakage when the electrode pole piece 1 is wound in this embodiment, insulating glues 18 are adhered on both sides of the slot 16 for structural reinforcement. The insulating adhesive 18 (eg, green glue, etc.) crosses the slot 16 in the extending direction of the wide side 160, and is adhered to the outer sides of the two long sides 162. Thus, the insulating adhesive 18 can provide a strong pulling force to prevent the electrode pole pieces from breaking at the slot 16 .

After the slot 16 is formed on the electrode pole piece 1, not only the pole piece may be easily broken, but also the exposed slot 16 edge may cause the battery to be short-circuited or lithium to be precipitated. Therefore, in a more preferable mode, it is preferable to completely cover the slot 16 with the insulating glue 18, and the

insulating glue 18 and the two long sides 162 of the slot 16 and the outer side of one wide side 160 are all bonded. In this way, the slot 16 can be completely closed by the insulating adhesive 18 on both sides, which reduces the risk of short-circuiting and lithium precipitation of the cell.

The size of the adhesive between the insulating glue 18 and the wide sides 160 of the slots 16 and the outer sides of the long sides 162 occupies approximately 5% of the corresponding width or length of the insulating adhesive 18 to ensure firm bonding.

As shown in FIG. 2 and FIG. 3, a second embodiment of the present application provides a battery core including the electrode plate 1 and the separator 2 provided in the first embodiment. Wherein, the electrode plate 1 provided in the first embodiment can be used as the positive electrode plate of the cell, or can also be used as the negative electrode plate of the cell, or the positive electrode and the negative electrode plate of the cell can also adopt the electrode provided in the embodiment of the present application. The pole piece 1, the positive electrode tab, the negative electrode tab, and the separator 2 constitute a wound cell. It should be noted that, regardless of whether the electrode core employs the electrode plate 1 provided by the first embodiment, the total number of the slots 16 in the cell is two, and the positions of the two slots 16 are to be positive There is a one-to-one correspondence between the positions of the tabs 14 and the negative poles. The two slots 16 may be in the same layer of the cell, or may be in different layers of the cell. In this way, the protruding portion of the welding region of the tab 14 can be absorbed by the slot 16, thereby reducing the effect of the welding lug 14 on the thickness of the cell and increasing the volumetric energy density of the cell.

In the related art, in order to improve the performance of the cell, the amount of negative electrode active material inside the cell generally requires an excess amount of the positive electrode active material. In the present embodiment, the slot 16 can be opened on the positive pole piece (see FIG. 2) or on the negative pole piece (see FIG. 3), but the slot 16 can be opened on the negative pole piece to make the negative active. The decrease in the amount of substances reduces the useability of the cells. Therefore, in the present embodiment, corresponding to the slot 16 opened on the negative pole piece, the area on the positive pole piece opposite to the slot 16 opposite to the isolation film 2 is processed so that the active material layer 12 is not exposed in the area. . This also reduces the amount of positive electrode active material, so that the useability of the cell can be improved. The non-exposed area of the active material layer 12 on the positive electrode plate is preferably not less than the area of the insulating paste 18 covered by the slot 16 on the negative electrode plate.

There are many ways to make the active material layer 12 not exposed on the corresponding area on the positive electrode plate. For example, the active material in the corresponding area of the positive electrode plate is removed by laser or other mechanical cleaning. It is also possible to use an insulating adhesive 18 or the like to shield the active material in the corresponding region of the positive electrode tab so that the active material in this region cannot participate in the reaction.

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However, regardless of how it is handled, placing the slot 16 on the negative electrode piece results in the simultaneous reduction of the positive electrode active material and the negative electrode active material, which greatly reduces the volumetric energy density of the cell. Therefore, it is the most preferable solution to place both slots 16 on the positive electrode tab.

The following specific experiments to verify the effectiveness of the electrode plate provided by this application:

Experimental Example 1

A rectangular battery using the 354798 model (3.5 mm thick, 47 mm wide, 98 mm long, and 10 winding layers) is used as an example. The preparation steps for the lithium ion battery in this experimental example are as follows:

As shown in FIG. 1 , the positive pole piece is prepared by adding 95% by weight of a positive electrode active material lithium cobaltate, 2% by weight binder PVDF, and 3% by weight of a conductive agent graphite to NMO in a ratio of NMP. Stir to a positive electrode active material having a viscosity in the range of 2500 to 8000 pas. The positive electrode active material was coated on a positive electrode collector aluminum foil to form a positive electrode active material layer, and uncoated regions were formed at both ends. After drying and cold pressing, a compacted density of 4.15 g/cc was obtained. A die-cutting method is used to die-cut the region where the positive pole piece is located in the first layer of the number of wound layers of the core and the positive electrode tab, and a slot corresponding to the positive electrode is made. The groove is located in both sides of the active material layer, the size of the groove is 25 (long side size) * 11 (broadside size) mm, and is pasted with green glue; then, the negative electrode is also die-cut. The area zone corresponding to the ear is punched to make a slot corresponding to the negative pole. The size of the negative slot is 25*11 mm and is pasted with green glue. The positive electrode tab was welded in the uncoated region. The width of the positive electrode tab was 6.0 mm, the thickness was 0.06 mm, and the length was 40.0 mm.

Preparation of negative pole piece: Using deionized water as a solvent, 95wt% of negative active material graphite, 2wt% of binder SBR, 2wt% of conductive agent graphite, and 1wt% of thickener CMC were added to deionized water and stirred. The negative electrode active material has a viscosity in the range of 1000 to 3500 pas. This negative electrode active material was coated on the negative current collector copper foil, dried, and cold pressed to obtain a tap density of 1.65 g/cc. The negative pole piece is not die cut and the negative pole tab is directly welded in the uncoated region 100. The width of the negative pole tab is 6.0 mm, the thickness is 0.06 mm, and the length is 40.0 mm.

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The thickness of the separator used was 11 μ m PP/PE/PP three-layer composite porous separator.

The electrolyte is a LiPF 6 solution with a concentration of 1 mol/L. The solvent is a mixed solvent of EC, PC, and DEC in a ratio of 1:1:1.

Assembly of the battery: After the positive pole piece, the separator and the negative electrode sheet are wound into the cell structure shown in FIG. 2 , a battery cell of type 354798 is formed, which is encapsulated, filled with liquid, formed into a gas, and gas-purged to obtain a high profile. Energy density secondary battery.

Experimental Example 2:

The difference from Experimental Example 1 is that:

The positive slot and the negative slot are located on the 8th layer of the battery winding layer.

Experimental Example 3:

The difference from Experimental Example 1 is that:

The positive slot and the negative slot are located on the 10th layer (the outermost layer) of the number of wound layers of the battery, and the coated area of the active material layer on the inner side of the positive and negative slots overlaps with the uncoated area on the outer side. within the area.

Experimental Example 4:

The difference from Experimental Example 1 is that:

The long side dimension of the positive and negative slots is 15 mm, the width of the positive and negative tabs is 6.0 mm, the thickness is 0.06 mm, and the length is 30 mm.

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Experimental Example 5:

The difference from Experimental Example 1 is that:

The length of the long side of the positive and negative slots is 10 mm, the width of the positive and negative tabs is 6.0 mm, the thickness is 0.06 mm, and the length is 25 mm.

Experimental Example 6:

The difference from Experimental Example 1 is that:

The width of the wide side of the positive and negative slots is 9 mm.

Experimental Example 7:

The difference from Experimental Example 1 is that:

The width of the wide side of the positive and negative slots is 7mm.

Comparative Example 1:

The difference from Experimental Example 1 is that:

The positive electrode sheet was not die-cut, ie, the positive and negative electrode slots 16 were not prepared, and winding was completed according to FIG. 4 .

Comparative Example 2:

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The difference from Experimental Example 1 is that:

The positive pole piece is not die cut. According to the technical scheme provided by the patent No. 201420030319.4, the active material in a certain area on the positive pole piece and the negative pole piece is removed by a laser or other mechanical cleaning method, and the positive pole and the negative pole are eliminated. The ears 14 are laser-welded in the free areas of the respective pole pieces after the active material is removed (see FIG. 5) and the insulating adhesive 18 is attached on both sides of the solder joint of the tabs 14 and is no longer at the time of winding to form the cells. The uncoated region for connecting the tabs 14 is reserved at the center of the cell, and the cell structure is as shown in FIG. 6 .

Performance comparisons were made between Experimental Examples 1 to 7 and Comparative Examples 1 and 2. The results are shown in the table below:

[image]

Comparing experimental example 1 and comparative example 1, the cell structure corresponding to experimental example 1 improved the effective use of the space of the battery, so that the energy density of the battery was improved.

Comparing Example 1 and Comparative Example 2, after 200 cls, the corresponding cell structure of Experimental Example 1 can improve the deformation problem during the cycling of the battery.

Comparing Experimental Example 1 and Experimental Example 3, the structure in which the slot 16 is in a region where the uncoated region 100 overlaps with the active material layer 12 and the slot 16 is in a region where the active material layers 12 are overlapped with each other, the battery The energy density can be higher.

Comparing experimental examples 1, 4, 5, 6, and 7, the size of the slot 16 is optimized. The smaller the size of the slot 16, the higher the energy density of the battery.

The foregoing descriptions are merely preferred embodiments of the present application and are not intended to limit the present application. For those skilled in the art, the present application may have various changes and

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variations. Any amendments, equivalent substitutions, improvements etc. within the spirit and principles of this application shall be included in the scope of protection of this application.

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CLAIMS CN204905336

1.
An electrode pole piece includes a current collector, an active material layer, and a tab, the active material layer is coated on the surface of the current collector, and uncoated is left at both ends of the current collector in the longitudinal direction. And the tabs are disposed in one of the uncoated areas, wherein the tabs are further characterized in that the slots are located in the area where the current collector is coated with the active material layer, and When the electrode pole pieces are wound to form a battery core, the positions of the slots are in one-to-one correspondence with the positions of the tabs of the positive electrode and/or the negative electrode, and the positions of the slots are three sides closed and one side is open, including A wide side and two opposite long sides, the size of the long side and the dimensions of the wide side are not smaller than the corresponding size of the connecting region of the tab and the uncoated region to which it corresponds.

2.
The electrode plate according to claim 1, wherein both sides of the slot are provided with insulating glue, and the insulating glue is adhered to at least the outer sides of the two long sides of the slot, and Crosses the slot in the direction of extension of the wide edge.

3.
The electrode pole piece according to claim 1, wherein the insulating glue completely covers the slot and is bonded to both the long sides of the slot and the outside of one of the wide sides. .

4.
The electrode plate according to claim 1, wherein both surfaces of the current collector are coated with the active

material layer, and the active material layer is located on one surface of the current collector. The projection of the active material layer on the other side surface of the current collector on the current collector overlaps, the slot position is set in the overlap region, and the slot position is at the same time on both sides of the current collector. In the area of the active material layer.

5.

The electrode plate according to claim 1, wherein both surfaces of the current collector are coated with the active material layer, and the uncoated region is located on one side surface of the current collector. The projection of the active material layer on the surface of the other side of the current collector on the current collector is overlapped, and the groove position is located in the overlapping area, and the groove position is on one side of the current collector. In the region of the active material layer, and in the uncoated region on the other side of the current collector.

6.

A battery cell, characterized in that it comprises a separator and a positive electrode plate and/or a negative electrode plate made of the electrode plate according to any one of claims 1 to 5, the positive electrode plate and the negative electrode The pole piece and the isolation film constitute a wound cell. The sum of the number of the slots on the cathode plate and the anode plate is two, and the positions of the two slots are associated with the positions of the cathode and the anode. Describe the position of the ears one to one.

7.

The cell according to claim 6, wherein both of the slots are disposed on the positive electrode tab.

8.

The cell according to claim 6, wherein at least one of said slots is disposed on said negative electrode plate, and said positive electrode plate is separated from said slot provided on said negative electrode plate. The area opposite to one layer of the separator does not expose the active material layer.

9.

The cell according to claim 8, wherein a region opposite to said isolation film disposed on said positive electrode plate and said slot provided on said negative electrode plate does not coat said region. Active material layer.

10.

The cell according to claim 8, characterized in that said active material in a region where said positive electrode tab and said slot provided on said negative electrode tab are opposite to each other across said one layer of said

separator. The outside of the layer is covered with a masking layer.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 204905336 U
(45)授权公告日 2015.12.23

(21)申请号 201520467990.X

(22)申请日 2015.07.02

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(51)Int.Cl.
H01M 2/20(2006.01)
H01M 2/26(2006.01)

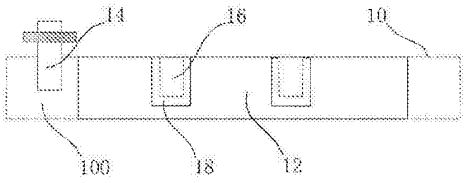
权利要求书1页 说明书6页 附图3页

(54)实用新型名称

电极极片及采用该极片的电芯

(57)摘要

本申请涉及储能器件领域，尤其涉及一种电极极片及采用该极片的电芯，电极极片，包括集流体、活性物质层以及极耳，还包括槽位，槽位开设于集流体涂覆有活性物质层的区域内，且与正极和/或负极的极耳的位置一一对应，槽位的尺寸均不小于其所对应的极耳与未涂覆区的连接区域的相应尺寸。电芯包括隔离膜以及电极极片构成的正极极片和/或负极极片，正极极片、负极极片以及隔离膜构成卷绕电芯，正极极片以及负极极片上的槽位数量总和为两个，且两个槽位的位置与正极和负极的极耳的位置一一对应。本申请所提供的电芯，极耳焊接区域所凸出的部分便可被槽位吸收，从而降低焊接极耳对电芯厚度的影响，提高了电池的体积能量密度。



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1. 一种电极极片，包括集流体、活性物质层以及极耳，所述活性物质层涂覆于所述集流体的表面，且在所述集流体的长度方向的两端均留有未涂覆区，所述极耳设置于一个所述未涂覆区内，其特征在于，还包括槽位，

所述槽位开设于所述集流体涂覆有所述活性物质层的区域内，且当所述电极极片卷绕形成电芯时，所述槽位的位置与正极和/或负极的所述极耳的位置一一对应，

所述槽位为三边封闭一边开口的构型，包括一个宽边以及两个相对的长边，所述长边的尺寸以及所述宽边的尺寸均不小于其所对应的所述极耳与所述未涂覆区的连接区域的相应尺寸。

2. 根据权利要求 1 所述的电极极片，其特征在于，所述槽位的两面均设置有绝缘胶，所述绝缘胶至少与所述槽位的两个所述长边的外侧粘接，并沿所述宽边的延伸方向跨越所述槽位。

3. 根据权利要求 1 所述的电极极片，其特征在于，所述绝缘胶完全覆盖所述槽位，且与所述槽位的两个所述长边以及一个所述宽边的外侧均粘接。

4. 根据权利要求 1 所述的电极极片，其特征在于，所述集流体的两侧表面均涂覆有所述活性物质层，且位于所述集流体的一侧表面的所述活性物质层与位于所述集流体另一侧表面的所述活性物质层在所述集流体上的投影存在重叠，

所述槽位开设于该重叠区域，所述槽位同时处于所述集流体两侧的所述活性物质层的区域内。

5. 根据权利要求 1 所述的电极极片，其特征在于，所述集流体的两侧表面均涂覆有所述活性物质层，且位于所述集流体的一侧表面的所述未涂覆区与位于所述集流体另一侧表面的所述活性物质层在所述集流体上的投影存在重叠，

所述槽位开设于该重叠区域，所述槽位处于所述集流体其中一侧的所述活性物质层的区域内，并处于所述集流体另一侧的所述未涂覆区内。

6. 一种电芯，其特征在于，包括隔离膜以及由权利要求 1 至 5 任一项所述的电极极片所构成的正极极片和/或负极极片，所述正极极片、所述负极极片以及所述隔离膜构成卷绕电芯，所述正极极片以及所述负极极片上的所述槽位数量总和为两个，且两个所述槽位的位置与正极和负极的所述极耳的位置一一对应。

7. 根据权利要求 6 所述的电芯，其特征在于，两个所述槽位均设置在所述正极极片上。

8. 根据权利要求 6 所述的电芯，其特征在于，至少一个所述槽位设置在所述负极极片上，在所述正极极片上与该设置在所述负极极片上的所述槽位隔着一层所述隔离膜相对的区域不外露所述活性物质层。

9. 根据权利要求 8 所述的电芯，其特征在于，在所述正极极片上与该设置在所述负极极片上的所述槽位隔着一层所述隔离膜相对的区域不涂覆所述活性物质层。

10. 根据权利要求 8 所述的电芯，其特征在于，在所述正极极片上与该设置在所述负极极片上的所述槽位隔着一层所述隔离膜相对的区域的所述活性物质层的外侧覆盖有遮蔽层。

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电极极片及采用该极片的电芯

技术领域

[0001] 本申请涉及储能器件领域，尤其涉及一种电极极片及采用该极片的电芯。

背景技术

[0002] 相关技术中，锂离子电池的电芯正极极片以及负极极片均包括集流体、活性物质层以及极耳，活性物质层涂覆于集流体的表面，且在集流体的长度方向的两端均留有未涂覆区，极耳焊接在于一个未涂覆区内。

[0003] 而由于极耳的存在，因此通过该工艺卷绕形成电芯后，电芯最厚的地方通常也就是焊接极耳之处，因而降低了电池的体积能量密度。

实用新型内容

[0004] 本申请提供了一种电极极片及采用该极片的电芯，能够减少因焊接极耳而带来的电芯加厚问题，提高电池的体积能量密度。

[0005] 本申请的第一方面提供了一种电极极片，包括集流体、活性物质层以及极耳，所述活性物质层涂覆于所述集流体的表面，且在所述集流体的长度方向的两端均留有未涂覆区，所述极耳设置于一个所述未涂覆区内，还包括槽位，所述槽位开设于所述集流体涂覆有所述活性物质层的区域内，且当所述电极极片卷绕形成电芯时，所述槽位的位置与正极和/或负极的所述极耳的位置一一对应，所述槽位为三边封闭一边开口的构型，包括一个宽边以及两个相对的长边，所述长边的尺寸以及所述宽边的尺寸均不小于其所对应的所述极耳与所述未涂覆区的连接区域的相应尺寸。

[0006] 优选地，所述槽位的两面均设置有绝缘胶，所述绝缘胶至少与所述槽位的两个所述长边的外侧粘接，并沿所述宽边的延伸方向跨越所述槽位。

[0007] 优选地，所述绝缘胶完全覆盖所述槽位，且与所述槽位的两个所述长边以及一个所述宽边的外侧均粘接。

[0008] 优选地，所述集流体的两侧表面均涂覆有所述活性物质层，且位于所述集流体的一侧表面的所述活性物质层与位于所述集流体另一侧表面的所述活性物质层在所述集流体上的投影存在重叠，

[0009] 所述槽位开设于该重叠区域，所述槽位同时处于所述集流体两侧的所述活性物质层的区域内。

[0010] 优选地，所述集流体的两侧表面均涂覆有所述活性物质层，且位于所述集流体的一侧表面的所述未涂覆区与位于所述集流体另一侧表面的所述活性物质层在所述集流体上的投影存在重叠，

[0011] 所述槽位开设于该重叠区域，所述槽位处于所述集流体其中一侧的所述活性物质层的区域内，并处于所述集流体另一侧的所述未涂覆区内。

[0012] 本申请的第二方面提供了一种电芯，包括隔离膜以及由上述的电极极片所构成的正极极片和/或负极极片，所述正极极片、所述负极极片以及所述隔离膜构成卷绕电芯，所

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述正极极片以及所述负极极片上的所述槽位数量总和为两个，且两个所述槽位的位置与正极和负极的所述极耳的位置一一对应。

[0013] 优选地，两个所述槽位均设置在所述正极极片上。

[0014] 优选地，至少一个所述槽位设置在所述负极极片上，在所述正极极片上与该设置在所述负极极片上的所述槽位隔着一层所述隔离膜相对的区域不外露所述活性物质层。

[0015] 优选地，在所述正极极片上与该设置在所述负极极片上的所述槽位隔着一层所述隔离膜相对的区域不涂覆所述活性物质层。

[0016] 优选地，在所述正极极片上与该设置在所述负极极片上的所述槽位隔着一层所述隔离膜相对的区域的所述活性物质层的外侧覆盖有遮蔽层。

[0017] 本申请提供的技术方案可以达到以下有益效果：

[0018] 本申请所提供的电芯由于在电极极片上设置了与极耳对应的槽位，极耳焊接区域所凸出的部分便可被槽位吸收，从而降低焊接极耳对电芯厚度的影响，提高了电池的体积能量密度。

[0019] 应当理解的是，以上的一般描述和后文的细节描述仅是示例性的，并不能限制本申请。

附图说明

[0020] 图 1 为本申请实施例所提供的电极极片的结构意图；

[0021] 图 2 为本申请实施例所提供的槽位设于正极极片的电芯结构意图；

[0022] 图 3 为本申请实施例所提供的槽位设于负极极片的电芯结构意图；

[0023] 图 4 为本申请实施例所提供的对比例 1 的电芯结构意图；

[0024] 图 5 为本申请实施例所提供的对比例 2 的电极极片的结构意图；

[0025] 图 6 为本申请实施例所提供的对比例 2 的电芯结构意图。

[0026] 附图说明：

[0027] 1- 电极极片；10- 集流体；100- 未涂覆区；12- 活性物质层；14- 极耳；16- 槽位；18- 绝缘胶；

[0028] 2- 隔离膜。

[0029] 此处的附图被并入说明书中并构成本说明书的一部分，示出了符合本申请的实施例，并与说明书一起用于解释本申请的原理。

具体实施方式

[0030] 下面通过具体的实施例并结合附图对本申请做进一步的详细描述。文中所述“前”、“后”、“左”、“右”、“上”、“下”均以附图中的电极极片及采用该极片的电芯的放置状态为参照。

[0031] 如图 1 所示，本申请实施例一提供了一种电极极片 1，包括集流体 10、活性物质层 12、极耳 14、槽位 16 以及绝缘胶 18。活性物质层 12 涂覆在集流体 10 的表面，集流体 10 的两侧表面大部分区域均涂覆活性物质层 12，而在集流体 10 的长度方向的两端均留出未涂覆区 100。

[0032] 在卷绕形成电芯时，由于电极极片 1 的极性以及卷绕方法不同，集流体 10 两侧的

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活性物质层 12 所处位置差异等因素影响，集流体 10 两侧的活性物质层 12 在集流体 10 上的投影大部分重叠，但在靠近两端的位置，两侧的活性物质层 12 的起始位置以及终止位置则可能不同，这就可能使位于集流体 10 一侧的未涂覆区 100 与位于集流体 10 另一侧的活性物质层 12 的涂覆区域在集流体 10 上的投影存在重叠。

[0033] 槽位 16 开设于集流体 10 涂覆有活性物质层 12 的区域内，并且，当电极极片 1 卷绕形成电芯时，槽位 16 的位置要与正极或负极的极耳 14 的位置一一对应。极耳 14 一般通过焊接的方式使其一部分与其中一个未涂覆区 100 固定连接。而槽位 16 为三边封闭一边开口的构型，包括一个宽边 160 以及两个相对的长边 162，长边 162 的尺寸以及宽边 160 的尺寸均不小于其所对应的极耳 14 与未涂覆区 100 的连接区域的相应尺寸。

[0034] 其中，槽位 16 的开设位置可以同时处于集流体 10 两侧的活性物质层 12 的区域内，也就是开设在两侧活性物质层 12 投影重叠的区域内。但这种开设槽位 16 的方式与相关技术不开设槽位 16 的方式相比，由于槽位 16 开设在重叠区域内，会导致电极极片 1 两侧的活性物质层 12 的涂覆面积同时减少，对电芯的活性物质的总量影响较大。

[0035] 在本实施例中，槽位 16 的开设位置也可以处于集流体 10 一侧的活性物质层 12 与另一侧的未涂覆区 100 重叠的区域内，这样槽位 16 的开设仅仅只会影响到一侧的活性物质层 12，因此对电芯的活性物质的总量影响较小。

[0036] 在加工时可以先按照一般方式在集流体 10 的两侧涂覆活性物质层 12，之后通过模切技术在相应的位置进行冲切，将活性物质层 12 以及集流体 10 一同冲切掉形成槽位 16。

[0037] 冲切形成的槽位 16 后，会导致电极极片 1 在该处的强度降低，在卷绕形成电芯的过程中容易造成电极极片 1 断裂。如图 1 所示，本实施例中为了防止电极极片 1 卷绕时出现断裂，在槽位 16 的两侧均粘接有绝缘胶 18 进行结构加固。绝缘胶 18（例如绿胶等）沿宽边 160 的延伸方向跨越槽位 16，并与两个长边 162 的外侧粘接。这样绝缘胶 18 可以提供较强的拉力，防止电极极片由槽位 16 处断裂。

[0038] 电极极片 1 上开设槽位 16 后，不仅会导致极片容易断裂，外露的槽位 16 边缘还可能会导致电池短路或者析锂。因此在更为优选的方式中，最好采用绝缘胶 18 完全覆盖槽位 16，绝缘胶 18 与槽位 16 的两个长边 162 以及一个宽边 160 的外侧均粘接。这样槽位 16 便可被两侧的绝缘胶 18 完全封闭，降低了电芯短路以及析锂的风险。

[0039] 绝缘胶 18 与槽位 16 的宽边 160 以及长边 162 的外侧的粘接的尺寸基本占绝缘胶 18 相应宽度或长度的 5% 左右，以保证粘接的牢固。

[0040] 如图 2 和图 3 所示，本申请实施例二提供了一种电芯，包括实施例一所提供的电极极片 1 以及隔离膜 2。其中，实施例一所提供的电极极片 1 可以作为电芯的正极极片，也可以作为电芯的负极极片，或者电芯的正极以及负极极片同时采用本申请实施例所提供的电极极片 1，正极极片、负极极片以及隔离膜 2 构成卷绕电芯。需要注意的是，无论电芯中采用了几个实施例一所提供的电极极片 1，但电芯中的槽位 16 的总数量为两个，且两个槽位 16 的位置要与正极和负极的极耳 14 的位置一一对应。两个槽位 16 可以处于电芯的同一层，也可处于电芯的不同层。这样极耳 14 的焊接区域所凸出的部分便可被槽位 16 吸收，从而降低焊接极耳 14 对电芯厚度的影响，提高了电池的体积能量密度。

[0041] 相关技术中，为了提高电芯的性能，电芯内部的负极活性物质数量一般需要多余正极活性物质数量。在本实施例中，槽位 16 可以开设在正极极片上（参见图 2），也可以开

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设在负极极片上（参见图3），但槽位16开设在负极极片上时，会使负极的活性物质数量减少，因此降低了电芯的使用性能。为此，本实施例中，对应负极极片上开设的槽位16，在正极极片上与该槽位16隔着一层隔离膜2相对的区域进行工艺处理，使该区域不外露活性物质层12。这样便也降低了正极活性物质的数量，从而能够提升电芯的使用性能。正极极片上活性物质层12的不外露区域最好不小于负极极片上的槽位16所覆盖的绝缘胶18的面积。

[0042] 使正极极片上相应区域不外露活性物质层12的方式有很多种，例如采用激光或者其它机械清洗的方式将正极极片相应区域内的活性物质清除。也可以采用绝缘胶18等将正极极片相应区域内的活性物质遮蔽住，使该区域内的活性物质不能参与反应。

[0043] 然而，无论怎样处理，将槽位16设置在负极极片上都会导致正极活性物质以及负极活性物质同时减少，大大降低了电芯的体积能量密度。因此，将两个槽位16均设置在正极极片上是最优选的方案。

[0044] 下面通过具体实验来验证本申请所提供的电极极片的效果：

[0045] 实验例1

[0046] 采用354798型号（成品电池的厚度为3.5毫米，宽度为47毫米，长度为98毫米，卷绕层数为10层）的方形电池为例，本实验例的锂离子电池制备步骤如下：

[0047] 如图1所示，正极极片的制备：以NMP为溶剂，将95％wt％的正极活性物质钴酸锂、2wt％的粘结剂PVDF、3％wt的导电剂石墨按比例加入NMO中，搅拌成粘度范围为2500～8000pa·s的正极活性物质。将该正极活性物质涂布在正极集流体铝箔上形成正极活性物质层，并在两端形成未涂覆区。经过干燥，冷压，得到压实密度为4.15g/cc。采用模切的方式将正极极片位于电芯卷绕层数第1层与正极极耳相对应的区域进行冲切，制成对应正极的槽位。该槽位同时处于两侧的活性物质层内，槽位的尺寸为25（长边尺寸）*11（宽边尺寸）毫米，并贴上绿胶；然后，同样采用模切的方式将负极极耳对应的区域区进行冲切，制成对应负极的槽位。该负极槽位的尺寸为25*11毫米，并贴上绿胶。将正极极耳焊接在未涂覆区内，正极极耳的宽度为6.0毫米，厚度为0.06毫米，长度为40.0mm。

[0048] 负极极片的制备：以去离子水为溶剂，将95wt％的负极活性物质石墨、2wt％的粘结剂SBR、2wt％的导电剂石墨和1wt％的增稠剂CMC加入去离子水中，搅拌成粘度范围为1000～3500pa·s的负极活性物质。将该负极活性物质涂布在负极集流体铜箔上面，干燥，冷压得到压实密度1.65g/cc。该负极极片不做模切处理，将负极极耳直接焊接在未涂覆区100内，负极极耳的宽度为6.0毫米，厚度为0.06毫米，长度为40.0mm。

[0049] 所采用的隔离膜厚度为11μm的PP/PE/PP三层复合多孔隔离膜。

[0050] 电解液是浓度为1mol/L的$LiPF_6$溶液。溶剂为EC、PC和DEC的混合溶剂，三者的比例为1:1:1。

[0051] 电池的组装：将正极极片，隔离膜及负极极片卷绕成图2所示的电芯结构后，形成型号为354798的电池芯，经过封装、注液、化成，抽气成型制得高能量密度二次电池。

[0052] 实验例2：

[0053] 与实验例1不同之处在于：

[0054] 正极槽位和负极槽位均位于电芯卷绕层数第8层。

[0055] 实验例3：

[0056] 与实验例1不同之处在于：

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[0057] 正极槽位和负极槽位均位于电芯卷绕层数第 10 层（最外层），正极槽位和负极槽位处于内侧的活性物质层的涂覆区域与外侧的未涂覆区重叠的区域内。

[0058] 实验例 4：

[0059] 与实验例 1 不同之处在于：

[0060] 正极槽位和负极槽位的长边尺寸为 15 毫米，正极和负极极耳的宽度为 6.0 毫米，厚度为 0.06 毫米，长度为 30mm。

[0061] 实验例 5：

[0062] 与实验例 1 不同之处在于：

[0063] 正极槽位和负极槽位的长边尺寸为 10 毫米，正极和负极极耳的宽度为 6.0 毫米，厚度为 0.06 毫米，长度为 25mm。

[0064] 实验例 6：

[0065] 与实验例 1 不同之处在于：

[0066] 正极槽位和负极槽位的宽边尺寸为 9 毫米。

[0067] 实验例 7：

[0068] 与实验例 1 不同之处在于：

[0069] 正极槽位和负极槽位的宽边尺寸为 7 毫米。

[0070] 对比例 1：

[0071] 与实验例 1 不同之处在于：

[0072] 未对正极极片进行模切处理，即未制备正极和负极的槽位 16，并按照图 4 完成卷绕。

[0073] 对比例 2：

[0074] 与实验例 1 不同之处在于：

[0075] 未对正极极片进行模切处理，按照专利号 201420030319.4 所提供的技术方案，采用激光或者其它机械清洗的方式将正极极片和负极极片上一定区域内的活性物质清除，将正极和负极的极耳 14 采用激光焊接在各自极片上清除活性物质后空出的区域内（参见图 5）并在极耳 14 的焊接处两侧粘贴绝缘胶 18，并且，在卷绕形成电芯时不再在电芯中心处保留用于连接极耳 14 的未涂覆区，电芯结构如图 6 所示。

[0076] 对实验例 1 至 7 以及对比例 1 和 2 进行性能比较。结果见下表：

[0077]

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不同设计结构电芯性能比较				
	槽位长度（mm）	槽位宽度（mm）	能量密度（Wh/L）	变形（200cls）
实验例1	25	11	669	No
实验例2	25	11	669	No
实验例3	25	11	678	No
实验例4	15	11	676	No
实验例5	10	11	680	No
实验例6	25	9	671	No
实验例7	25	7	674	No
对比例1	NG	NG	663	No
对比例2	25	11	669	Yes

[0078] 比较实验例1和对比例1，实验例1所对应的电芯结构，提高了电池有效利用空间，从而电池的能量密度得到提升。

[0079] 比较实施例1和对比例2，在200cls后，实验例1所对应的电芯结构可以改善电池循环过程中的变形问题。

[0080] 比较实验例1和实验例3，槽位16处于未涂覆区100与活性物质层12重叠的区域内的结构与槽位16处于两侧活性物质层12重叠的区域内的结构相比，电池的能量密度能得到更高。

[0081] 比较实验例1、4、5、6、7，对槽位16的尺寸进行优化，槽位16的尺寸越小，则电池的能量密度越高。

[0082] 以上所述仅为本申请的优选实施例而已，并不用于限制本申请，对于本领域的技术人员来说，本申请可以有各种更改和变化。凡在本申请的精神和原则之内，所作的任何修改、等同替换、改进等，均应包含在本申请的保护范围之内。

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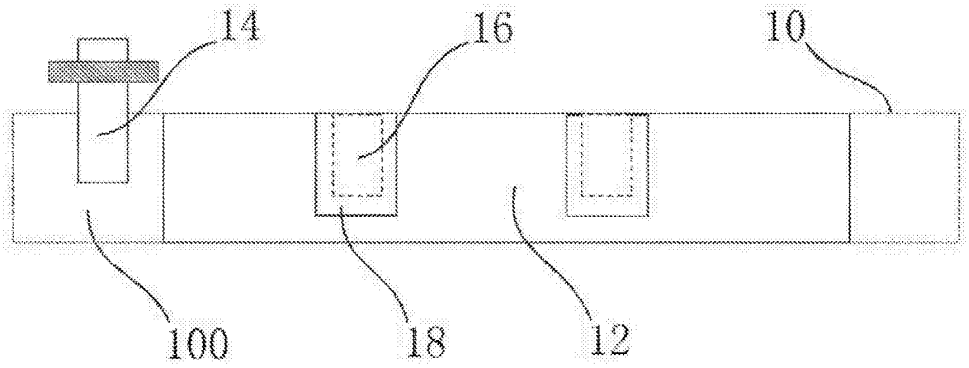


图 1

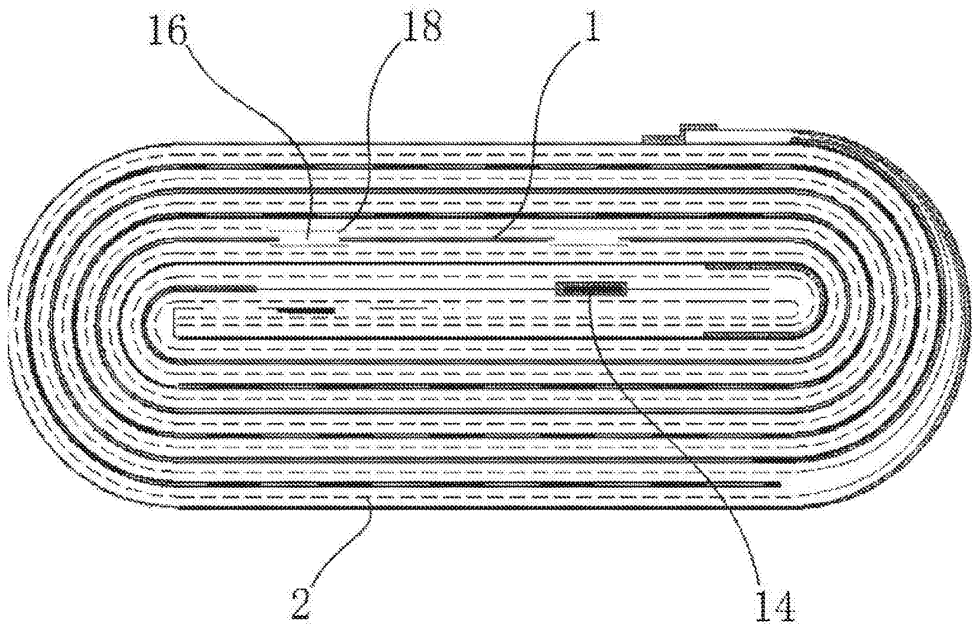


图 2

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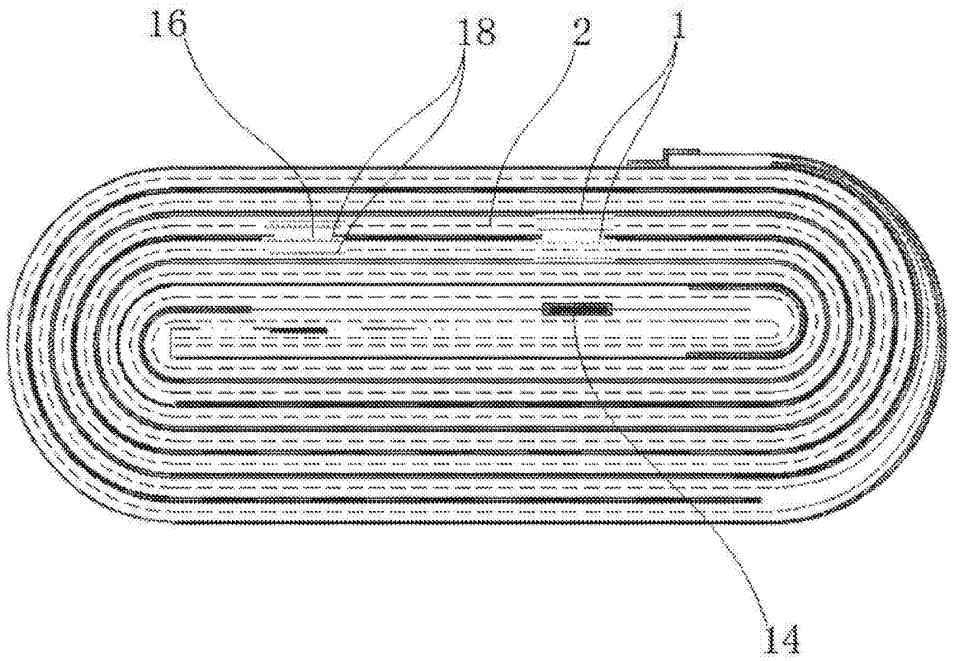


图 3

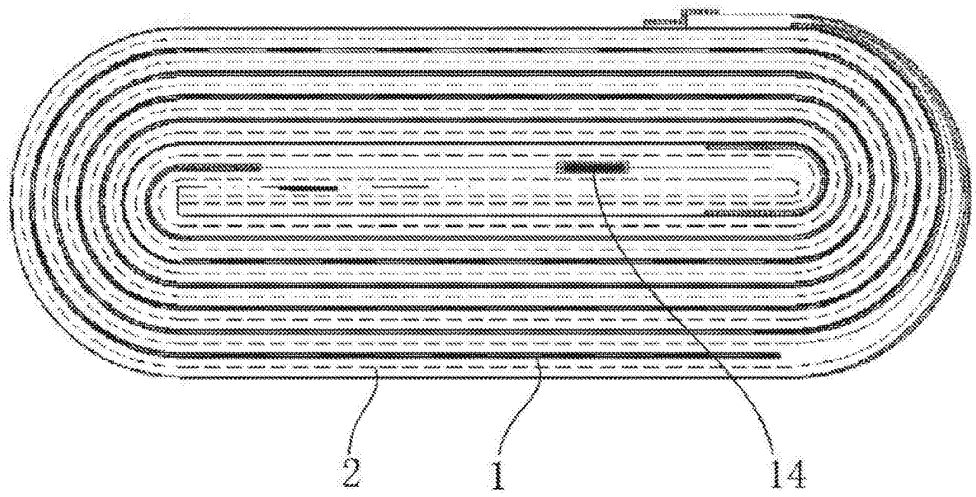


图 4

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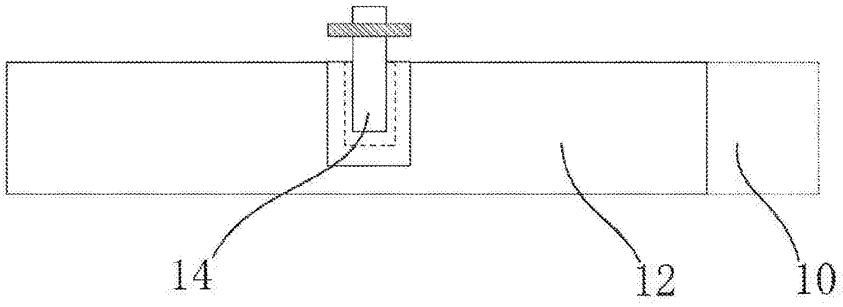


图 5

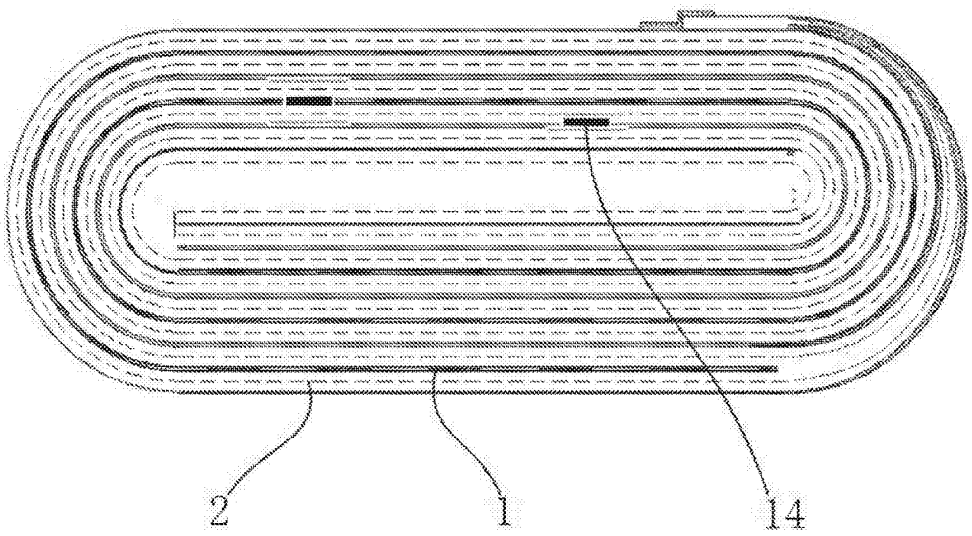


图 6

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Espacenet

Bibliographic data: CN205355186 (U) — 2016-06-29

Battery in winding structure

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Classification: - international: ***H01M10/0587; H01M2/26***
- cooperative: **H01M10/0587; H01M2/26**

Application number: CN201521115080U 20151229

Priority number(s): CN201521115080U 20151229

Also published as: WO2017113999 (A1)

Abstract of CN205355186 (U)

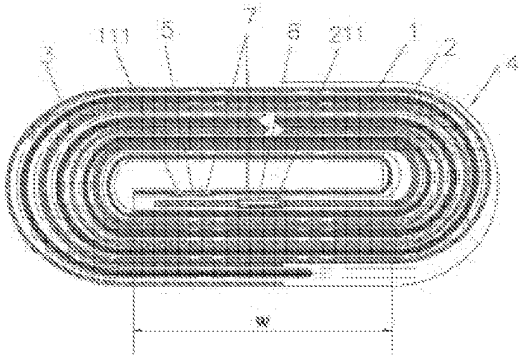


图3

The utility model relates to a battery technology field especially relates to a battery in winding structure, including first pole piece, barrier film and the second pole piece opposite with first pole piece electrical property stack gradually the electric core that the same orientation of back -porch was coiled and is formed, and electrolyte, first pole piece includes the first mass flow body and attached to a active material layer of first mass flow body surface face, the second pole piece includes the second mass flow body and attached to the 2nd active material layer of second mass flow body surface face, be provided with first recess on the active material layer, be provided with the second recess on the 2nd active material layer, first recess lies in the initiating terminal of the first pole piece of coiling, the second recess lies in the initiating terminal or the middle part of the second pole piece of coiling, the first ploe ear is inlayed in first recess, the second ploe ear is inlayed in the second recess. Compared with the prior art, the utility model discloses an optimize the position that utmost point ear is located the pole piece

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to improve that electric core hardness is low, yielding, symmetry subalternation problem, improve the percent of pass of battery abuse test.

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DESCRIPTION WO2017113999

Battery with winding structure

The utility model relates to the technical field of batteries, in particular to a battery with a winding structure.

Background technique

With the development of miniaturization and multi-functionalization of electronic products, the requirements for the hardness and energy density of batteries have become higher and higher. This requires the symmetry of batteries to be very good, and at the same time, to contribute more in the same space. More capacity. As shown in FIG. 1 , a blank collector is provided at the beginning of the positive and negative pole pieces of the conventional winding core, and the positive pole tab 5 ′ and the negative pole tab 6 ′ are generally directly welded on the positive and negative pole pieces. On the blank collector, although the battery has good symmetry and high hardness, the thickness of the battery is due to the accumulation of the thickness of the tab, so that the thickness of the welding lug region is the maximum thickness of the battery, and the thickness of the unsoldered tab region is Relatively small, this part of the space can not be fully utilized, resulting in a certain model size, the battery's energy density is difficult to further increase.

In view of this, it has been proposed that the core of the embedded ear structure (ETS), ie, the active material layer on the pole piece is provided with a groove, so that the battery tab is embedded in the groove, which relieves the thickness of the tab to a certain degree. Accumulation of battery thickness. Therefore, ETS cells have gradually become the new direction of research and development by the industry due to higher energy density and better dynamic structure; however, due to the structural design of the cell, ETS cells have lower hardness and are more easily deformed, resulting in Passage of battery abuse tests is low. As shown in Fig. 2, the current ETS

cell embeds the positive electrode tab 5' and the negative electrode tab 6' both in the center of the cell pole piece (M-M structure). The MM-structured cell has the following defects: 1) The mechanical symmetry of the cell is poor, resulting in the cell being more easily deformed during the cycle and the cyclic expansion rate being larger; 2) The bonding area between the separator and the pole piece The decrease leads to a decrease in the hardness of the core and the lower penetration rate of the impact test.

Therefore, under the premise of guaranteeing high energy density and good dynamic structure, it is of great significance to adjust and improve the structural design of the ETS cell in order to improve the deformation of the cell and improve the pass rate of the battery abuse test.

Utility model content

The purpose of the utility model is to provide a battery with a winding structure aiming at the defects of the prior art. While increasing the energy density of the cell, the structure and design of the cell are optimized by adjusting the position of the tab embedded in the wound pole piece, thereby improving the problem of low hardness, easy deformation, poor symmetry of the cell, and improving battery abuse testing. Passing rate.

In order to achieve the above object, the present invention provides the following solutions:

A battery with a wound structure includes a first pole piece, a separator, and a core formed by sequentially stacking a second pole piece oppositely electrically opposite to the first pole piece and wound in the same direction, and an electrolyte thereof. The pole piece includes a first current collector and a first active material layer attached to a surface of the first current collector, and a second pole piece includes a second current collector and a second active material layer attached to a surface of the second current collector. A first groove is disposed on the first active material layer of the first pole piece, a second groove is disposed on the second active material layer of the second pole piece, and the first groove is disposed on the first pole wound. The starting end of the sheet, the second groove is located at the beginning or the middle of the wound second pole piece, the first tab is embedded in the first groove and is electrically connected with the first current collector, and the second tab is electrically connected. Embedded in the second groove and electrically connected to the second current collector.

Wherein, the first pole piece is a positive pole piece or a negative pole piece, the second pole piece is a negative pole piece or a positive pole piece; the first tab is a positive pole tab or a negative pole tab, the first tab The dipole ear is a negative pole tab or a positive pole tab; the positive pole tab is an aluminum tab, and the cathode tab is a nickel tab. The positive electrode tab or the negative electrode tab may be embedded in the first recess on the first

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pole piece or the second recess on the second pole piece by laser welding, resistance welding, and ultrasonic welding. The utility model improves the symmetry of the battery core by adjusting the positions of the positive and negative electrode tabs at the winding pole pieces, reduces the loss of energy density, and avoids the occurrence of the green plastic in the same layer, thus improving the stickiness of the battery core. Junctions can significantly improve the hardness of the cell.

As a further improvement of the present invention, the battery of the wound structure further includes a glue layer disposed on the surface of the first tab and covering the entire first groove and/or disposed on the second pole. Ear surface and cover the entire second groove. The glue layer mainly plays the role of insulating and fixing the pole ears.

As a further improvement of the present invention, the adhesive layer is a hot melt adhesive layer or a green adhesive layer. A green adhesive layer is generally attached to protect and fix the tab, but at the same time, the bonding area between the tab and the separator is reduced, resulting in a lower hardness of the battery core. Compared with green glue, hot-melt adhesives are easily melted under high temperature conditions, and play a good role in the adhesion between the separator and the pole pieces, thereby improving the hardness of the batteries. Generally, the area covered by the melted hot melt is larger than the area to which the hot melt is covered. These areas covered by the hot melt cannot be normally deintercalated with lithium, resulting in partial capacity loss.

As a further improvement of the present invention, the thickness a of the first tab is smaller than or equal to the depth b of the first groove, and the thickness c of the second tab is smaller than or equal to the depth d of the second groove. If the thickness of the lug is greater than the depth of the groove, the battery thickness increases, resulting in a loss of battery energy density.

As a further improvement of the present invention, the length m of the first groove is smaller than the width n of the first pole piece, and the length p of the second groove is smaller than the width q of the second pole piece. When the first and second pole pieces of the battery are relatively wide, a large area of blank recessed areas on the first and second pole pieces cannot correspond to the first and second tabs, and not only will the recessed area correspond to the first, The unevenness of the second pole piece causes poor interface contact, which affects the performance of the battery, and wastes the space within the battery, so that the energy density of the battery cannot be optimized.

As a further improvement of the present invention, in the unfolded state of the second pole piece, the distance from the head to the tail of the second pole piece is defined as D1, and the middle of the wound second pole piece is defined as d1, d1. It is within the range of 1/10D1 to 7/10D1 calculated from the head of the second pole

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piece. The starting end of the wound first pole piece or second pole piece is defined as w, w is the area between the head of the first pole piece or the second pole piece and the midpoint of the first winding and bending.

As a further improvement of the present invention, the first groove is formed by removing the first active material layer by laser cleaning, mechanical cleaning or styrofoam cleaning to expose the first current collector.

As a further improvement of the present invention, the second groove is formed by removing the second active material layer by laser cleaning, mechanical cleaning or styrofoam cleaning to expose the second current collector.

As a further improvement of the present invention, the thickness of the hot melt adhesive layer or the green adhesive layer is set to 5 to 50 μm. The thickness of the adhesive layer is too thin to achieve insulation fixing and protection. If the thickness of the adhesive layer is too thick, the energy density of the battery may be lost.

The beneficial effect of the utility model lies in that, while increasing the energy density of the battery core, the structure and design of the battery core are optimized by adjusting the position of the tab embedded in the wound pole piece, so that the core has low hardness, easy deformation and poor symmetry. Waiting for questions to improve the passing rate of battery abuse tests.

Description of the drawings

FIG. 1 is a schematic structural view of a battery with a conventional winding structure in the prior art.

FIG. 2 is a schematic structural diagram of an embedded ear-type structure battery in the prior art.

FIG. 3 is a schematic structural diagram of a battery with a wound structure according to the present invention.

FIG. 4 is a second schematic structural view of a battery with a wound structure according to the present invention.

FIG. 5 is a schematic structural view of a first pole piece embedded in a first pole piece in the present invention.

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FIG.

FIG. 6 is a cross-sectional view of a first pole piece embedded in a first pole piece according to the present invention.

FIG. 7 is a cross-sectional view of the first tab embedded in the first pole piece of the present invention. FIG.

FIG. 8 is a schematic view of a second pole piece embedded in a second pole piece according to the present invention.

FIG. 9 is a cross-sectional view of a second pole piece embedded in a second pole piece according to the present invention.

FIG. 10 is a cross-sectional view of a second pole piece embedded in a second pole piece according to the present invention.

In the drawing: 1-first pole piece, 11-first active material layer, 111-first groove, 12-first current collector, 2-second pole piece, 21-second active material layer, 211-st Two notches, 22-second current collector, 3-insulation film, 4-cell, 5-first tab, 6-second tab, 5'-positive tab, 6'- negative tab, 7 - adhesive layer.

detailed description

The present invention and its beneficial effects will be further described in detail with reference to the specific embodiments and the accompanying drawings. However, the specific embodiments of the present invention are not limited thereto.

Embodiment 1

As shown in FIG. 3 to FIG. 10, a battery with a wound structure includes a first pole piece 1, a separator 3, and a second pole piece 2 electrically opposite to the first pole piece 1 stacked in sequence and wound in the same direction. The resulting cell 4 and electrolyte thereof, the first pole piece 1 includes a first current collector 12 and

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a first active material layer 11 attached to a surface of the first current collector 12, and the second pole piece 2 includes a second current collector. 22 and the second active material layer 21 attached to the surface of the second current collector 22, the first active material layer 11 of the first pole piece 1 is provided with a first groove 111, and the second active material layer of the second pole piece 2 is provided. A second groove 211 is disposed on the first groove 111. The first groove 111 is located at the starting end of the wound first pole piece 1, the second groove 211 is located at the middle of the second pole piece 2 wound around, and the first tab 5 is formed. Inserted in the first groove 111, the second tab 6 is embedded in the second groove 211. Wherein, the starting end w of the wound first pole piece 1 is the area between the head of the first pole piece 1 and the midpoint of the first winding and bending; the middle portion of the wound second pole piece 2 is defined as D1, in the unfolded state, the distance from the head to the tail of the second pole piece 2 is defined as D1, and d1 is in the range of 1/10D1 to 7/10D1 calculated from the head of the second pole piece 2.

The first groove 111 is formed by removing the first active material layer 11 by exposing the first current collector 12 by means of laser cleaning, mechanical cleaning, or styrofoam cleaning, and the second groove 211 is formed by the same method. Wherein, depths of the first recess 111 and the second recess 211 are both 0.1 mm, the first pole piece 1 is a positive pole piece, the second pole piece 2 is a negative pole piece, and the first tab 5 is a positive pole tab. The second tab 6 is a tab of a negative electrode. Thicknesses of the tabs of the tabs of the tabs are 0.1 mm, and thicknesses of the tabs of the tabs and the tabs of the tabs are both 0.5 mm. Among them, the positive tab is an aluminum tab and the negative tab is a nickel tab. The tab is also attached with a green adhesive layer. The green adhesive layer 7 is disposed on the surface of the first tab 5 and covers the entire first recess 111 and is disposed on the surface of the second tab 6 and covers the entire second recess 211. The thickness of the green adhesive layer is set to 10 [mu]m, and the purpose of applying the green adhesive layer mainly functions as insulation fixing and protection of the tab. Since the positive electrode tab is located at the center of the cell 4, this improves the symmetry of the cell 4 to a certain degree, and at the same time avoids the appearance of the green adhesive in the same layer, thus improving the adhesion of the cell 4, and The hardness of the cell 4 can be significantly improved.

The above-mentioned cells were packed in a battery package, and 1 mol/L of LiPF6/(EC+PC+DEC) electrolyte was injected thereinto. Among them, ethylene carbonate (EC), propylene carbonate (PC), and diethyl carbonate. The volume ratio of (DEC) was 1:1:1; the 616790 model (a finished battery having a thickness of 6.1 mm, a width of 67 mm, and a length of 90 mm) was fabricated by a process such as aging and aging.

Embodiment 2

The difference from Embodiment 1 is that the first groove 111 is located at the beginning of the wound first pole piece 1, and the second groove 211 is located at the beginning of the wound second pole piece 2. The starting end w of the wound second pole piece 2 is the area between the head of the second pole piece 2 and the midpoint of

the first winding and bending. Since the positive electrode tabs and the negative electrode tabs are located at the center of the cell 4, the symmetry of the cell 4 is increased and the hardness is increased, thereby reducing the loss of energy density.

The rest is the same as Embodiment 1, and will not be described again.

Implementation 3

The difference from Embodiment 1 is that the green adhesive layer to which both the first tab 5 and the second tab 6 are attached is replaced with a hot-melt adhesive layer, and the thickness of the hot-melt adhesive layer is set to 50 μm. The replacement of the green adhesive layer with the hot melt adhesive layer is due to the fact that the hot melt adhesive is easily melted under high temperature conditions and plays a good role in bonding between the separator 3 and the pole pieces, thereby improving the hardness of the battery core 4 .

The rest is the same as Embodiment 1, and will not be described again.

Contrast Implementation 1

As shown in FIG. 1 , a battery of a conventional winding structure includes a cell formed by winding a positive electrode tab, a separator and a negative electrode sheet in the same direction, and an electrolyte thereof. A blank current collector is provided at the beginning of the positive and negative pole pieces. The positive pole tab 5′ is directly welded on the blank collector of the positive pole piece, and the negative pole tab 6′ is directly welded on the blank collector of the negative pole piece. The thickness of the positive and negative electrode tabs is 0.1 mm, and the thickness of the positive and negative electrode tabs is 0.5 mm. Among them, the positive electrode lug is an aluminum lug, and the negative electrode lug is a nickel lug, and a green adhesive layer having a thickness of 10 μm is also attached to the positive and negative electrode lug welding positions. The above-mentioned cells were packed in a battery package, and 1 mol/L of LiPF6/(EC+PC+DEC) electrolyte was injected thereinto. Among them, ethylene carbonate (EC), propylene carbonate (PC), and diethyl carbonate. The volume ratio of (DEC) was 1:1:1; the 616790 model (a finished battery having a thickness of 6.1 mm, a width of 67 mm, and a length of 90 mm) was fabricated by a process such as aging and aging.

Contrast Implementation 2

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As shown in FIG. 2 , in the prior art, the battery with the embedded ear structure differs from Embodiment 1 in the position of the tab, and the positive tab 5 ′ and the negative tab 6 ′ are embedded in the wound pole piece. In the middle part, the rest is the same as Embodiment 1, and will not be repeated.

Battery performance test:

Cell impact test: Ten cell cores were selected for impact test of each of Examples 1 to 3 and Comparative Examples 1 to 2. The impact test was conducted in accordance with national standard GB 31241-2014.

Battery energy density test: The batteries of Embodiments 1 to 3 and Comparative Embodiments 1 to 2 are charged at a constant current of 0.5C to 4.35V at 25C, and then charged at a constant voltage to 0.05C; then discharged at 0.5C to 3.0V, Measure the volume energy density of the battery at this time.

The test results are shown in Table 1 below:

Table 1:

[image]

From the above test results, it can be seen that compared with a conventionally wound battery (Comparative Embodiment 1), the present invention adopts an embedded core-shaped battery core, which can significantly increase the energy density of the battery under the same size; Compared with the technical cell (Comparative Embodiment 2), the utility model optimizes the structure and design of the cell by adjusting the position of the tab embedded in the wound pole piece, thereby improving problems such as poor symmetry of the cell, low hardness, and easy deformation. The adoption rate of battery abuse tests has been significantly improved.

Based on the above disclosure and teachings, those skilled in the art to which the present invention pertains can also make changes and modifications to the above embodiments. Therefore, the present invention is not limited to the above specific embodiments. Any obvious improvement, replacement or modification made by those skilled in the art on the basis of the present invention belongs to the protection scope of the present invention. In addition, although some specific terms are used in this specification, these terms are only for convenience of description and do not impose any limit on the present invention.

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CLAIMS WO2017113999

1.
A battery with a winding structure includes a first pole piece (1), a separator (3) and a second pole piece (2) opposite to that of the first pole piece (1) laminated sequentially and then wound in the same direction The resulting cell (4), and its electrolyte, the first pole piece (1) includes a first current collector (12) and a first active material layer (11) attached to the surface of the first current collector (12). The second pole piece (2) includes a second current collector (22) and a second active material layer (21) attached to the surface of the second current collector (22), characterized in that the first pole piece (1) is A first groove (111) is disposed on the first active material layer (11), and a second groove (211) is disposed on the second active material layer (21) of the second pole piece (2). A first groove (111) is located at the starting end of the wound first pole piece (1), and the second groove (211) is located at the beginning or middle of the wound second pole piece (2). A tab (5) is embedded in the first groove (111) and is electrically connected to the first current collector (12), and a second tab (6) is embedded in the second groove (211) and is connected to the second tab (211). The current collector (22) is electrically connected.

2.
The battery with a wound structure according to claim 1, characterized in that the first pole piece (1) is a positive pole piece or a negative pole piece.

3.
The battery with a coiled structure according to claim 1, wherein the battery of the wound structure further comprises a glue layer (7), and the glue layer (7) is disposed on the first tab (5). The surface covers and covers the entire first groove (111) and/or is disposed on the surface of the second tab (6) and covers the entire second groove (211).

4.

The wound structure battery according to claim 3, characterized in that the glue layer (7) is a hot melt layer or a green glue layer.

5.

The battery with a coiled structure according to claim 1, characterized in that the thickness a of the first tab (5) is less than or equal to the depth b of the first recess (111), and the second tab The thickness c of (6) is less than or equal to the depth d of the second groove (211).

6.

The battery with a coiled structure according to claim 1, characterized in that the length m of the first groove (111) is smaller than the width n of the first pole piece (1), and the second groove (The length p of 211) is smaller than the width q of the second pole piece (2).

7.

A battery with a wound structure according to claim 1, characterized in that in the unfolded state of the second pole piece (2), the distance from the head to the tail of the second pole piece (2) is defined as D1. The middle portion of the wound second pole piece (2) is defined as d1, and d1 is in the range of 1/10D1 to 7/10D1 calculated from the head of the second pole piece (2).

8.

The battery with a coiled structure according to claim 1, characterized in that: the first groove (111) removes the first active material layer (11) by laser cleaning, mechanical cleaning or styrofoam cleaning to expose the first A set of fluids (12) is formed.

9.

The battery with a coiled structure according to claim 1, wherein the second groove (211) removes the second active material layer (21) by laser cleaning, mechanical cleaning or styrofoam cleaning to expose the second groove (211). The second fluid (22) is formed.

10.

A battery with a wound structure according to claim 4, characterized in that the thickness of the hot melt or green glue layer is set to 5 to 50 μm.

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(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 205355186 U
(45)授权公告日 2016.06.29

(21)申请号 201521115080.1

(22)申请日 2015.12.29

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(51)Int.Cl.
H01M 10/0587(2010.01)
H01M 2/26(2006.01)

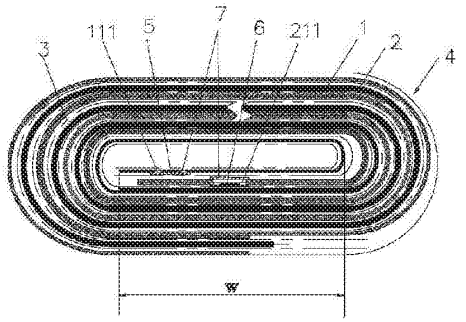
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(54)实用新型名称

一种卷绕结构的电池

(57)摘要

本实用新型涉及电池技术领域，尤其涉及一种卷绕结构的电池，包括第一极片、隔离膜和与第一极片电性相反的第二极片依次层叠后沿同一方向卷绕而成的电芯，及其电解液，第一极片包括第一集流体和附着在第一集流体表面的第一活性物质层，第二极片包括第二集流体和附着在第二集流体表面的第二活性物质层，第一活性物质层上设置有第一凹槽，第二活性物质层上设置有第二凹槽，第一凹槽位于卷绕的第一极片的起始端，第二凹槽位于卷绕的第二极片的起始端或者中部，第一极耳镶嵌于第一凹槽，第二极耳镶嵌于第二凹槽。与现有技术相比，本实用新型通过优化极耳位于极片的位置，从而改善电芯硬度低、易变形、对称性差等问题，提高电池滥用测试的通过率。



CN 205355186 U

1.一种卷绕结构的电池，包括第一极片(1)、隔离膜(3)和与第一极片(1)电性相反的第二极片(2)依次层叠后沿同一方向卷绕而成的电芯(4)，及其电解液，第一极片(1)包括第一集流体(12)和附着在第一集流体(12)表面的第一活性物质层(11)，第二极片(2)包括第二集流体(22)和附着在第二集流体(22)表面的第二活性物质层(21)，其特征在于：所述第一极片(1)的第一活性物质层(11)上设置有第一凹槽(111)，所述第二极片(2)的第二活性物质层(21)上设置有第二凹槽(211)，所述第一凹槽(111)位于卷绕的第一极片(1)的起始端，所述第二凹槽(211)位于卷绕的第二极片(2)的起始端或者中部，第一极耳(5)镶嵌于所述第一凹槽(111)并与第一集流体(12)电连接，第二极耳(6)镶嵌于所述第二凹槽(211)并与第二集流体(22)电连接。

2.根据权利要求1所述的卷绕结构的电池，其特征在于：所述第一极片(1)为正极极片或负极极片。

3.根据权利要求1所述的卷绕结构的电池，其特征在于：所述卷绕结构的电池还包括胶层(7)，所述胶层(7)设置在所述第一极耳(5)表面并覆盖整个第一凹槽(111)和/或设置在所述第二极耳(6)表面并覆盖整个第二凹槽(211)。

4.根据权利要求3所述的卷绕结构的电池，其特征在于：所述胶层(7)为热熔胶层或绿胶层。

5.根据权利要求1所述的卷绕结构的电池，其特征在于：所述第一极耳(5)的厚度a小于等于所述第一凹槽(111)的深度b，所述第二极耳(6)的厚度c小于等于所述第二凹槽(211)的深度d。

6.根据权利要求1所述的卷绕结构的电池，其特征在于：所述第一凹槽(111)的长度m小于所述第一极片(1)的宽度n，所述第二凹槽(211)的长度p小于所述第二极片(2)的宽度q。

7.根据权利要求1所述的卷绕结构的电池，其特征在于：所述第二极片(2)在展开状态下，第二极片(2)的头部至尾部的距离定义为D1，所述卷绕的第二极片(2)的中部定义为d1，d1处于自第二极片(2)的头部起计算的1/10D1~7/10D1的范围内。

8.根据权利要求1所述的卷绕结构的电池，其特征在于：所述第一凹槽(111)通过激光清洗、机械清洗或发泡胶清洗将第一活性物质层(11)去除以露出第一集流体(12)而形成。

9.根据权利要求1所述的卷绕结构的电池，其特征在于：所述第二凹槽(211)通过激光清洗、机械清洗或发泡胶清洗将第二活性物质层(21)去除以露出第二集流体(22)而形成。

10.根据权利要求4所述的卷绕结构的电池，其特征在于：所述热熔胶层或绿胶层的厚度设置为5~50μm。

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一种卷绕结构的电池

技术领域

[0001] 本实用新型涉及电池技术领域，尤其涉及一种卷绕结构的电池。

背景技术

[0002] 随着电子产品向小型化、多功能化发展，其对电池的硬度以及能量密度要求也越来越高，这就要求电芯的对称性要很好，同时在同样的空间内要贡献出更多的容量。如图1所示，传统卷绕结构的电芯，正、负极极片的起始端都设有空白集流体，正极极耳5'和负极极耳6'一般直接焊接在正、负极极片上的空白集流体上，这样的电池虽然对称性较好，硬度较高，但其厚度由于极耳厚度的累加，使得焊接极耳区域的厚度为电池的最大厚度，而未焊接极耳区域的厚度则相对较小，这部分空间不能被充分利用，导致在一定型号尺寸内，电池的能量密度难以进一步提高。

[0003] 鉴于此，有人提出了嵌入式极耳结构(ETS)的电芯，即，在极片上的活性物质层设置凹槽，使电池极耳嵌入凹槽，这在一定程度上缓解了极耳厚度对电池厚度的累加。因此，ETS电芯由于更高的能量密度和更好的动力学结构逐渐成为了业界新研发的方向；但由于电芯结构设计的缘故，ETS电芯硬度更低，更容易变形，导致其在电池滥用测试的通过率较低。如图2所示，目前的ETS电芯把正极极耳5'和负极极耳6'都嵌入电芯极片的中部(M-M结构)。M-M结构的电芯具有以下缺陷：1)电芯在力学上的对称性较差，导致电芯在循环过程中更容易变形，循环膨胀率较大；2)隔离膜与极片的粘结面积减少，导致电芯硬度下降，撞击测试通过率较低。

[0004] 因此，在保证其高能量密度和良好动力学结构的前提下，如何调整完善ETS电芯的结构设计，以改善电芯的变形和提高电池滥用测试的通过率，具有重要的意义。

实用新型内容

[0005] 本实用新型的目的在于：针对现有技术的不足，而提供一种卷绕结构的电池。在增大电芯能量密度的同时，通过调整极耳嵌入卷绕极片的位置来优化电芯的结构和设计，从而改善电芯硬度低、易变形、对称性差等问题，提高电池滥用测试的通过率。

[0006] 为了实现上述目的，本实用新型提供以下解决方案：

[0007] 一种卷绕结构的电池，包括第一极片、隔离膜和与第一极片电性相反的第二极片依次层叠后沿同一方向卷绕而成的电芯，及其电解液，第一极片包括第一集流体和附着在第一集流体表面的第一活性物质层，第二极片包括第二集流体和附着在第二集流体表面的第二活性物质层，所述第一极片的第一活性物质层上设置有第一凹槽，所述第二极片的第二活性物质层上设置有第二凹槽，所述第一凹槽位于卷绕的第一极片的起始端，所述第二凹槽位于卷绕的第二极片的起始端或者中部，第一极耳镶嵌于所述第一凹槽并与第一集流体电连接，第二极耳镶嵌于所述第二凹槽并与第二集流体电连接。

[0008] 其中，所述第一极片为正极极片或负极极片，所述第二极片为负极极片或者正极极片；所述第一极耳为正极极耳或负极极耳，所述第二极耳为负极极耳或者正极极耳；所述

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正极极耳为铝极耳，所述负极极耳为镍极耳。所述正极极耳或负极极耳均可以通过激光焊接、电阻焊接、和超声波焊接等方式镶嵌于所述第一极片上的第一凹槽或者所述第二极片上的第二凹槽。本实用新型通过调整正、负极极耳位于卷绕极片的位置改善了电芯的对称性，减少能量密度的损失，同时避免了绿胶在同一层出现的情况，这样提高了电芯的粘结性，可以显著改善电芯的硬度。

[0009] 作为本实用新型的进一步改进，所述卷绕结构的电池还包括胶层，所述胶层设置在所述第一极耳表面并覆盖整个第一凹槽和/或设置在所述第二极耳表面并覆盖整个第二凹槽。胶层主要起到对极耳的绝缘保护和固定作用。

[0010] 作为本实用新型的进一步改进，所述胶层为热熔胶层或绿胶层。一般贴有绿胶层以保护和固定极耳，但同时降低了极片与隔离膜的粘结面积，导致电芯的硬度较低。相比于绿胶，热熔胶易在高温条件下融化，在隔离膜和极片之间起到了良好的粘结作用，从而提高电芯的硬度。通常热熔胶融化后所覆盖的面积要大于贴胶面积，这些被热熔胶覆盖的区域无法正常脱嵌锂，会导致部分容量损失。

[0011] 作为本实用新型的进一步改进，所述第一极耳的厚度a小于等于所述第一凹槽的深度b，所述第二极耳的厚度c小于等于所述第二凹槽的深度d。若极耳的厚度大于凹槽的深度会使电池厚度增加，造成电池能量密度的损失。

[0012] 作为本实用新型的进一步改进，所述第一凹槽的长度m小于所述第一极片的宽度n，所述第二凹槽的长度p小于所述第二极片的宽度q。当电池的第一、第二极片较宽时，第一、第二极片上有大面积的空白凹槽区域不能对应第一、第二极耳，不仅会使该凹陷区域对应的第一、第二极片受力不均，造成界面接触变差，影响电池性能，而且浪费了电池内的空间，不能使电池的能量密度达到最优。

[0013] 作为本实用新型的进一步改进，所述第二极片在展开状态下，第二极片的头部至尾部的距离定义为D1，所述卷绕的第二极片的中部定义为d1，d1处于自第二极片的头部起计算的1/10D1～7/10D1的范围内。所述卷绕的第一极片或者第二极片的起始端定义为w，w为第一极片或者第二极片头部与第一次卷绕弯折的中点之间的区域。

[0014] 作为本实用新型的进一步改进，所述第一凹槽通过激光清洗、机械清洗或发泡胶清洗将第一活性物质层去除以露出第一集流体而形成。

[0015] 作为本实用新型的进一步改进，所述第二凹槽通过激光清洗、机械清洗或发泡胶清洗将第二活性物质层去除以露出第二集流体而形成。

[0016] 作为本实用新型的进一步改进，所述热熔胶层或绿胶层的厚度设置为5～50μm。胶层厚度太薄，起不到绝缘固定和保护作用；胶层厚度太厚，会造成电池能量密度损失。

[0017] 本实用新型的有益效果在于：在增大电芯能量密度的同时，通过调整极耳嵌入卷绕极片的位置来优化电芯的结构和设计，从而改善电芯硬度低、易变形、对称性差等问题，提高电池滥用测试的通过率。

附图说明

[0018] 图1为现有技术中传统卷绕结构的电池的结构示意图。

[0019] 图2为现有技术中嵌入式极耳结构电池的结构示意图。

[0020] 图3为本实用新型卷绕结构的电池的结构示意图之一。

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[0021] 图4为本实用新型卷绕结构的电池的结构示意图之二。

[0022] 图5为本实用新型中第一极耳镶嵌于第一极片的结构示意图。

[0023] 图6为本实用新型中第一极耳镶嵌于第一极片的剖视图之一。

[0024] 图7为本实用新型中第一极耳镶嵌于第一极片的剖视图之二。

[0025] 图8为本实用新型中第二极耳镶嵌于第二极片的结构示意图。

[0026] 图9为本实用新型中第二极耳镶嵌于第二极片的剖视图之一。

[0027] 图10为本实用新型中第二极耳镶嵌于第二极片的剖视图之二。

[0028] 图中：1-第一极片，11-第一活性物质层，111-第一凹槽，12-第一集流体，2-第二极片，21-第二活性物质层，211-第二凹槽，22-第二集流体，3-隔离膜，4-电芯，5-第一极耳，6-第二极耳，5'-正极极耳，6'-负极极耳，7-胶层。

具体实施方式

[0029] 下面将结合具体实施方式和说明书附图对本实用新型及其有益效果作进一步详细说明，但是，本实用新型的具体实施方式并不局限于此。

[0030] 实施方式1

[0031] 如图3～10所示，一种卷绕结构的电池，包括第一极片1、隔离膜3和与第一极片1电性相反的第二极片2依次层叠后沿同一方向卷绕而成的电芯4，及其电解液，第一极片1包括第一集流体12和附着在第一集流体12表面的第一活性物质层11，第二极片2包括第二集流体22和附着在第二集流体22表面的第二活性物质层21，第一极片1的第一活性物质层11上设置有第一凹槽111，第二极片2的第二活性物质层21上设置有第二凹槽211，第一凹槽111位于卷绕的第一极片1的起始端，第二凹槽211位于卷绕的第二极片2的中部，第一极耳5镶嵌于第一凹槽111并与第一集流体12电连接，第二极耳6镶嵌于第二凹槽211并与第二集流体22电连接。其中，卷绕的第一极片1的起始端w为第一极片1的头部与第一次卷绕弯折的中点之间的区域；卷绕的第二极片2的中部定义为d1，在展开状态下，第二极片2的头部至尾部的距离定义为D1，d1处于自第二极片2的头部起计算的1/10D1～7/10D1的范围内。

[0032] 第一凹槽111通过激光清洗、机械清洗或发泡胶清洗等方式将第一活性物质层11去除以露出第一集流体12而形成，用同样的方法制作第二凹槽211。其中，第一凹槽111和第二凹槽211的深度均为0.1mm，第一极片1为正极极片，第二极片2为负极极片，第一极耳5为正极极耳，第二极耳6为负极极耳，正极极耳与负极极耳的厚度均为0.1mm，正极极片与负极极片的厚度均为0.5mm。其中，正极极耳为铝极耳，负极极耳为镍极耳。极耳还贴有绿胶层，绿胶层7设置在第一极耳5表面并覆盖整个第一凹槽111和设置在第二极耳6表面并覆盖整个第二凹槽211。绿胶层的厚度设置为10μm，贴绿胶层的目的主要起到绝缘固定和保护极耳的作用。由于正极极耳位于电芯4的中心，这在一定程度上，改善了电芯4的对称性，同时避免了绿胶在同一层出现的情况，这样提高了电芯4的粘结性，并可以显著改善电芯4的硬度。

[0033] 将上述电芯装入电池包装壳中，向其内注入1mol/L的$LiPF_6$/(EC+PC+DEC)电解液，其中碳酸乙烯酯(EC)、碳酸丙烯酯(PC)、碳酸二乙酯(DEC)的体积比为1:1:1；再经化成，陈化等工艺制得616790型号(成品电池的厚度为6.1毫米，宽度为67毫米，长度为90毫米)的方形电池。

[0034] 实施方式2

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[0035] 与实施方式1不同的是：第一凹槽111位于卷绕的第一极片1的起始端，第二凹槽211位于卷绕的第二极片2的起始端。其中，卷绕的第二极片2的起始端w为第二极片2的头部与第一次卷绕弯折的中点之间的区域。由于正极极耳和负极极耳均位于电芯4的中心，使得电芯4的对称性提高、硬度增加，减少能量密度的损失。

[0036] 其余同实施方式1，不再赘述。

[0037] 实施方式3

[0038] 与实施方式1不同的是：将第一极耳5和第二极耳6均贴有的绿胶层更换为热熔胶层，热熔胶层的厚度设置为50μm。将绿胶层更换为热熔胶层，是由于热熔胶易在高温条件下融化，在隔离膜3和极片之间起到良好的粘结作用，从而提高电芯4的硬度。

[0039] 其余同实施方式1，不再赘述。

[0040] 对比实施方式1

[0041] 如图1所示，传统卷绕结构的电池，包括正极极片、隔离膜和负极极片依次层叠后沿同一方向卷绕而成的电芯，及其电解液。其中，正、负极极片的起始端均设有空白集流体，正极极耳5'直接焊接在正极极片的空白集流体上，负极极耳6'直接焊接在负极极片的空白集流体上，正极极耳与负极极耳的厚度均为0.1mm，正极极片与负极极片的厚度均为0.5mm。其中，正极极耳为铝极耳，负极极耳为镍极耳，而且正、负极极耳焊接处还贴有厚度为10μm的绿胶层。将上述电芯装入电池包装壳中，向其内注入1mol/L的$LiPF_6$/(EC+PC+DEC)电解液，其中碳酸乙烯酯(EC)、碳酸丙烯酯(PC)、碳酸二乙酯(DEC)的体积比为1:1:1；再经化成，陈化等工艺制得616790型号(成品电池的厚度为6.1毫米，宽度为67毫米，长度为90毫米)的方形电池。

[0042] 对比实施方式2

[0043] 如图2所示，现有技术中嵌入式极耳结构的电池，与实施方式1不同的是：极耳的位置，正极极耳5'和负极极耳6'均嵌入卷绕电芯极片的中部，其余同实施方式1，不再赘述。

[0044] 电池性能测试：

[0045] 电芯冲击试验：对实施方式1～3和对比实施方式1～2均选取10个电芯进行冲击试验，冲击试验按照国标GB 31241-2014进行。

[0046] 电池能量密度试验：对实施方式1～3和对比实施方式1～2的电池在25℃，0.5C恒流充电到4.35V，然后恒压充电到0.05C；然后0.5C放电到3.0V，测得此时电池的体积能量密度。

[0047] 试验结果如下表：

[0048]

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组别	电芯冲击试验通过个数		体积能量密度
	沿垂直极耳方向冲击	沿极耳方向冲击	
实施方式 1	9	8	670Wh/L
实施方式 2	10	10	680Wh/L
实施方式 3	10	10	675Wh/L
对比实施方式 1	10	9	660Wh/L
对比实施方式 2	6	5	680Wh/L

[0049] 由上述测试结果可知：与传统卷绕结构的电池(对比实施方式1)相比，本实用新型采用嵌入式极耳结构的电芯，可以显著提高电池在相同尺寸下的能量密度；与现有技术的电芯(对比实施方式2)相比，本实用新型通过调整极耳嵌入卷绕极片的位置来优化电芯的结构和设计，从而改善电芯对称性差、硬度低、易变形等问题，其电池滥用测试的通过率明显提高。

[0050] 根据上述说明书的揭示和教导，本实用新型所属领域的技术人员还能够对上述实施方式进行变更和修改。因此，本实用新型并不限于上述的具体实施方式，凡是本领域技术人员在本实用新型的基础上所作出的任何显而易见的改进、替换或变型均属于本实用新型的保护范围。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本实用新型构成任何限制。

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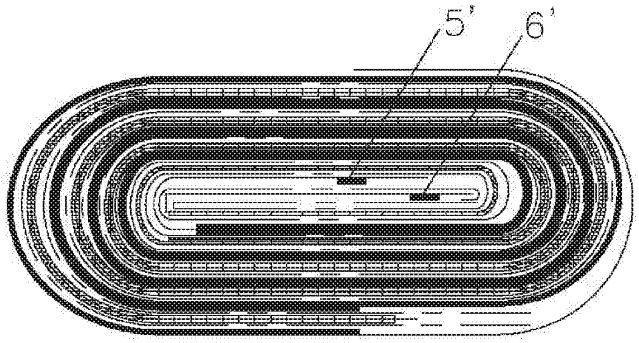


图1

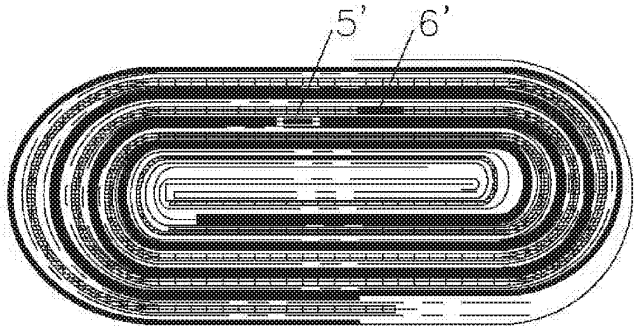


图2

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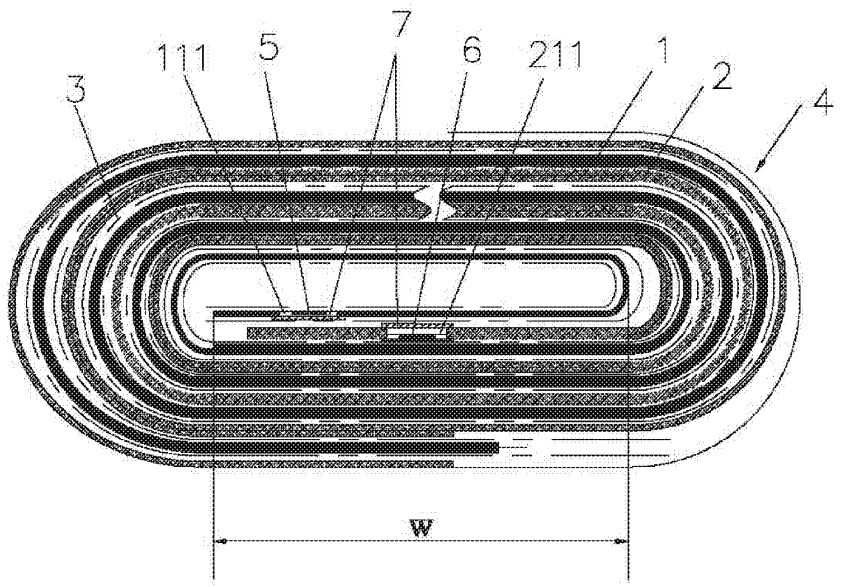


图3

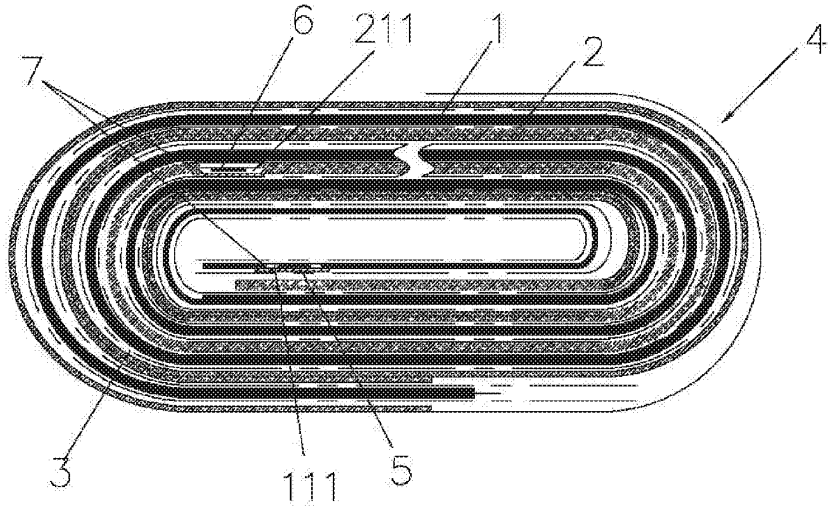


图4

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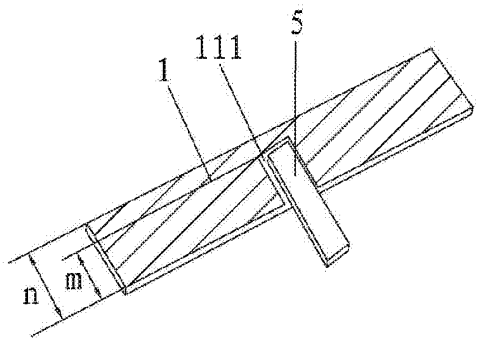


图5

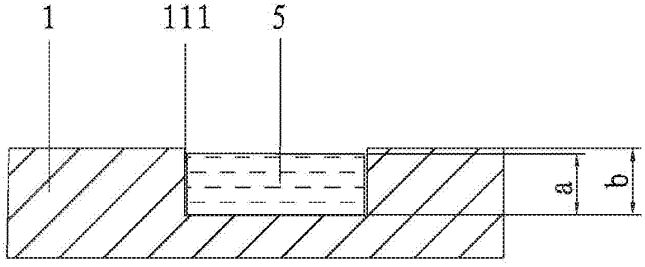


图6

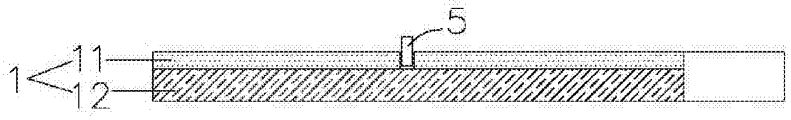


图7

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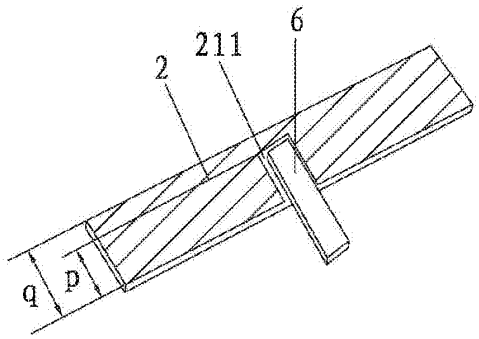


图8

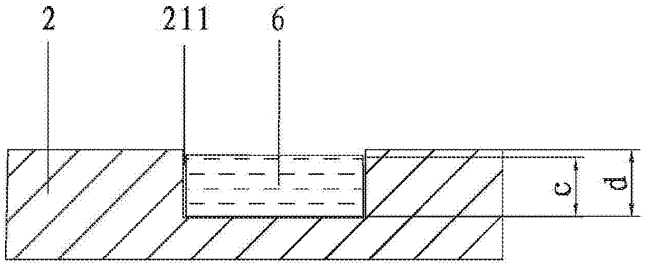


图9

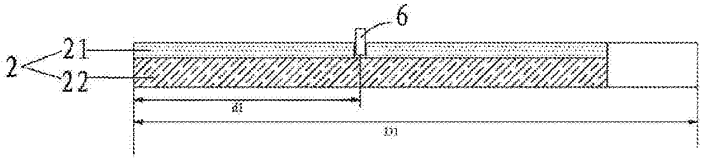


图10

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Electronic Acknowledgement Receipt	
EFS ID:	32788038
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	20995
Filer:	David Michael Dremann/Blake Morgan
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.001C1
Receipt Date:	01-JUN-2018
Filing Date:	28-FEB-2018
Time Stamp:	20:46:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	DHNG001001C1_IDS_Trans.pdf	47753 c2586f78d1b88554fe0ac198b848ed023af18833	no	2
Warnings:					

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	DHNG001001C1_IDS_List.pdf	26569 abf5adbd4fd42c3959ab8cbb365639c9c6cd0f96	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	CN105406028A_MT.PDF	1354080 2c8b377123c5dc28c8482a3c6e21883f4b0fc921	no	20
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Information:					
4	Foreign Reference	CN_105990612A_MT.PDF	2365551 cb1fc4e2b423dd87bc99e5a1c0002b23cc9a91d0	no	25
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Information:					

Total Files Size (in bytes):	10651137

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT

First Inventor	:	Peipei Guo
App. No.	:	15/908327
Filed	:	February 28, 2018
For	:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
Examiner	:	Cano, Milton I.
Art Unit	:	1723
Conf. No.	:	2611

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Pursuant to 37 CFR 1.56, an Information Disclosure Statement listing references is provided herewith. Copies of any listed foreign and non-patent literature references are being submitted. Any foreign references may also include English abstract(s) and/or machine translation(s), but no representation is made as to their accuracy.

If the Examiner would like additional information regarding these references or if anything is unclear, the Examiner is invited to contact the undersigned for assistance.

No Disclaimers

To the extent that anything in the Information Disclosure Statement or the listed references could be construed as a disclaimer of any subject matter supported by the present application, Applicant hereby rescinds and retracts such disclaimer.

Timing of Disclosure

This Information Disclosure Statement is being filed within three months of the filing date or date of national phase entry, with an RCE or before receipt of a First Office Action after an RCE, and no fee is believed to be required.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: June 1, 2018

By: _____

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28282013

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/908,327	02/28/2018	Peipei Guo	DHNG001.001C1

CONFIRMATION NO. 2611

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PUBLICATION NOTICE



Title:SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

Publication No.US-2018-0190963-A1
Publication Date:07/05/2018

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor	:	Peipei Guo
App. No.	:	15/908327
Filed	:	February 28, 2018
For	:	SECONDARY BATTERY
Examiner	:	Cano, Milton I.
Art Unit	:	1723
Conf. No.	:	2611

PRELIMINARY AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Prior to examination on the merits, please amend the above-identified patent application as set forth on the following pages.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks/Arguments begin on page 7 of this paper.

SECONDARY ~~BATTERY CELL~~BATTERY ~~AND WINDING FORMATION SYSTEM THEREOF~~

FIELD OF THE INVENTION

The present invention relates to the field of secondary batteries, in particular to a structure of the~~a~~ secondary ~~battery cell~~battery ~~and winding formation system thereof~~.

BACKGROUND OF THE INVENTION

The lithium ion battery (one kind of secondary batteries) is widely used in the fields of electronic products, automobiles, electric vehicles, aerospace, micro-electromechanical systems, energy storage and the like. As the application environment and conditions tend to be more complex and rigorous, high requirements are proposed to the usage safety performance, energy density and manufacturing cost of the lithium-ion battery.

In the prior art, the purpose of improving energy density is achieved by configuring a groove on an electrode plate and welding an electrode tab in the groove. However, the process is realized by independent laser cleaning device and welding-winding device respectively at the present stage. The comprehensive cost of the devices is high, and the factory buildings occupy large space, with the result the manufacturing cost of the entire lithium battery is high. Furthermore, the laser cleaned groove on the electrode plate has an overheated perforation or a burned hole on the edge due to focal length fluctuation and deviation, such that a plenty of burrs are formed on a current collector on the edge of the groove; if the electrode plate with burrs is directly manufactured into a cell without processing, then the burrs will pierce the separator to cause internal short circuit, a fire disaster and other severe potential safety hazards. In the prior art, a thick adhesive tape is stuck in the groove to prevent the burrs from piercing the separator. However, sticking an adhesive tape in the groove will certainly increase the thickness of the cell, thus causing loss to energy density.

SUMMARY OF THE INVENTION

To solve the problems in the prior art, the object of the present invention is to provide a secondary ~~battery cell~~battery, which can prevent the secondary ~~battery cell~~battery from generating internal short circuit while improving the energy density of the secondary ~~battery cell~~battery, thus improving the safety performance of the secondary ~~battery cell~~battery.

Another object of the present invention is to provide a secondary ~~battery cell~~battery winding formation system, which can reduce the volume of the secondary ~~battery cell~~battery winding formation system, save the floor area of a factory building, reduce the manufacturing cost of the secondary ~~battery cell~~battery, and improve the energy density and safety performance of the manufactured secondary ~~battery cell~~battery.

To achieve the above objects, in a first aspect, the present invention provides a secondary ~~battery cell~~battery, comprising an anode electrode plate, an anode electrode tab, a cathode electrode plate, a cathode electrode tab and a separator.

The anode electrode plate comprises: an anode current collector; and an anode ~~slurry layer~~active layer disposed on the surface of the anode current collector.

The cathode electrode plate comprises: a cathode current collector; and a cathode ~~slurry~~

~~layer~~active layer disposed on the surface of the cathode current collector.

The separator is disposed between the anode electrode plate and the cathode electrode plate.

The anode electrode plate is formed with: an anode electrode tab receiving groove, provided with the anode current collector at the bottom and the anode ~~slurry layer~~active layer on the periphery, the anode electrode tab_is received in the anode electrode tab_receiving groove_and is electrically connected to the anode current collector at the anode electrode tab receiving groove.

The cathode electrode plate is formed with: a cathode electrode tab receiving groove, provided with the cathode current collector at the bottom and the cathode ~~slurry layer~~active layer on the periphery, the cathode electrode tab_is received in the cathode electrode tab_receiving groove_and is electrically connected to the cathode current collector at the cathode electrode tab receiving groove.

The anode electrode plate is further formed with: an anode electrode plate die-cut notch, located on the side edge of the anode electrode tab receiving groove and extending through the anode electrode plate.

The cathode electrode plate is further formed with: a cathode electrode plate die-cut notch, located on the side edge of the cathode electrode tab receiving groove and extending through the cathode electrode plate.

~~To achieve the above object, in a second aspect, the present invention provides a secondary battery cell winding formation system, comprising a working platform, a winding mechanism, an anode electrode plate unwinding roller, an anode electrode plate cleaning mechanism, an anode electrode plate die-cutting mechanism, an anode electrode tab supply mechanism, an anode electrode tab connection mechanism, an anode electrode plate convey mechanism, a cathode electrode plate unwinding roller, a cathode electrode plate cleaning mechanism, a cathode electrode plate die-cutting mechanism, a cathode electrode tab supply mechanism, a cathode electrode tab connection mechanism, a cathode electrode plate convey mechanism, a first separator unwinding roller, a second separator unwinding roller, a first separator convey mechanism and a second separator convey mechanism.~~

~~The working platform is fixed immovably.~~

~~The winding mechanism is disposed on the working platform.~~

~~The anode electrode plate unwinding roller is disposed on the working platform, and is wound with an anode electrode plate, wherein the anode electrode plate comprises: an anode current collector; and an anode slurry layer disposed on the surface of the anode current collector.~~

~~The anode electrode plate cleaning mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate unwinding roller, and is used for cleaning out, on the anode electrode plate, an anode electrode tab receiving groove provided with the anode current collector at the bottom and the anode slurry layer on the periphery.~~

~~The anode electrode plate die-cutting mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate cleaning mechanism, and is used for, on the side edge of the anode electrode tab receiving groove, die-cutting the anode electrode plate to form an anode electrode plate die-cut notch extending through the anode electrode plate.~~

~~The anode electrode tab supply mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate die-cutting mechanism, is wound with an anode electrode tab, and is used for supplying the anode electrode tab to the anode electrode tab receiving groove of the anode electrode plate of the anode electrode plate die-cut notch, such~~

thatthe anode electrode tabis received in the anode electrode tab receiving groove.

The anode electrode tab connection mechanism is disposed on the working platform, is located at the downstream of the anode electrode plate die cutting mechanism, and is used for electrically connecting and fixing the anode electrode tab received in the anode electrode tab receiving groove with the anode current collector at the anode electrode tab receiving groove.

The anode electrode plate convey mechanism is disposed on the working platform, and is used for conveying the anode electrode plate unwound from the anode electrode plate unwinding roller to the winding mechanism sequentially via the anode electrode plate cleaning mechanism, the anode electrode plate die cutting mechanism and the anode electrode tab connection mechanism.

The cathode electrode plate unwinding roller is disposed on the working platform, and is wound with a cathode electrode plate, wherein the cathode electrode plate comprises: a cathode current collector; and a cathode slurry layer disposed on the surface of the cathode current collector.

The cathode electrode plate cleaning mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate unwinding roller, and is used for cleaning out, on the cathode electrode plate, a cathode electrode tab receiving groove provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery.

The cathode electrode plate die cutting mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate cleaning mechanism, and is used for, on the side edge of the cathode electrode tab receiving groove, die cutting the cathode electrode plate to form a cathode electrode plate die cut notch extending through the cathode electrode plate.

The cathode electrode tab supply mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate die cutting mechanism, is wound with a cathode electrode tab, and is used for supplying the cathode electrode tab to the cathode electrode tab receiving groove of the cathode electrode plate having die cut out the cathode electrode plate die cut notch, such that the cathode electrode tabis received in the cathode electrode tab receiving groove.

The cathode electrode tab connection mechanism is disposed on the working platform, is located at the downstream of the cathode electrode plate die cutting mechanism, and is used for electrically connecting and fixing the cathode electrode tab received in the cathode electrode tab receiving groove with the cathode current collector at the cathode electrode tab receiving groove.

The cathode electrode plate convey mechanism is disposed on the working platform, and is used for conveying the cathode electrode plate unwound from the cathode electrode plate unwinding roller to the winding mechanism sequentially via the cathode electrode plate cleaning mechanism, the cathode electrode plate die cutting mechanism and the cathode electrode tab connection mechanism.

The first separator unwinding roller is disposed on the working platform, and is wound with a separator.

The second separator unwinding roller is disposed on the working platform, and is wound with another separator.

The first separator convey mechanism is disposed on the working platform, and is used for conveying the corresponding separator unwound from the first separator unwinding roller to the winding mechanism, and enabling the corresponding separator to be configured between the

~~anode electrode plate and the cathode electrode plate after the secondary battery cell is wound and formed.~~

~~The second separator convey mechanism is disposed on the working platform, and is used for conveying the corresponding separator unwound from the second separator unwinding roller to the winding mechanism, and enabling the corresponding separator to be configured between the anode electrode plate and the cathode electrode plate after the secondary battery cell is wound and formed.~~

The beneficial effects of the present invention are as follows:

In the secondary ~~battery cell~~battery according to the present invention, the anode electrode tab is received in the anode electrode tab receiving groove, and the cathode electrode tab is received in the cathode electrode tab receiving groove, thus effectively improving the energy density of the secondary ~~battery cell~~battery; the anode electrode plate die-cut notch can remove the burrs formed on the current collector on the edge part of the anode electrode tab receiving groove during formation, and the cathode electrode plate die-cut notch can effectively remove the burrs formed on the current collector on the edge part of the cathode electrode tab receiving groove during formation, thus effectively preventing the secondary ~~battery cell~~battery from generating internal short circuit, and improving the safety performance of the secondary ~~battery cell~~battery while ensuring a high energy density.

~~In the secondary battery cell winding formation system according to the present invention, the winding mechanism, the anode electrode plate unwinding roller, the anode electrode plate cleaning mechanism, the anode electrode plate die-cutting mechanism, the anode electrode tab supply mechanism, the anode electrode tab connection mechanism, the anode electrode plate convey mechanism, the cathode electrode plate unwinding roller, the cathode electrode plate cleaning mechanism, the cathode electrode plate die-cutting mechanism, the cathode electrode tab supply mechanism, the cathode electrode tab connection mechanism, the cathode electrode plate convey mechanism, the first separator unwinding roller, the second separator unwinding roller, the first separator convey mechanism and the second separator convey mechanism are integrated on one working platform, thus reducing the volume of the secondary battery cell winding formation system, saving the floor area of a factory building, and reducing the manufacturing cost of the secondary battery cell; the anode electrode plate die-cutting mechanism can remove burrs cleaned out by the anode electrode plate cleaning mechanism and located on the current collector on the edge part of the anode electrode tab receiving groove, and the cathode electrode plate die-cutting mechanism can remove burrs cleaned out by the cathode electrode plate cleaning mechanism and located on the current collector on the edge part of the cathode electrode tab receiving groove, thus effectively preventing the manufactured secondary battery cell from generating internal short circuit, and improving the safety performance of the manufactured secondary battery cell.~~

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view of the secondary ~~battery cell~~battery winding formation system of the present invention;

Fig. 2 is a schematic view of the welded anode electrode plate and electrode tab of the secondary ~~battery cell~~battery of the present invention, ~~wherein~~wherein, Fig. (a) is a sectional view of the welded anode electrode plate and electrode tab, and Fig. (b) is a top view of the anode electrode plate as shown in Fig. (a);

Fig. 3 is a schematic view of the welded cathode electrode plate and electrode tab of the secondary ~~battery cell~~battery of the present invention, ~~wherein~~wherein, Fig. (a) is a sectional view of the welded cathode electrode plate and electrode tab, and Fig. (b) is a bottom view of the cathode electrode plate as shown in Fig. (a);

Fig. 4 is a schematic view showing the die-cutting process of the electrode plates of the secondary ~~battery cell~~battery of the present invention, ~~wherein~~wherein, Fig. (a) is a schematic view showing the die-cutting process of the anode electrode plate, and Fig. (b) is a schematic view showing the die-cutting process of the cathode electrode plate;

Fig. 5 is a schematic view of the electrode plates of the secondary ~~battery cell~~battery of the present invention, ~~wherein~~wherein, Fig. (a) is a schematic view of the anode electrode plate, and Fig. (b) is a schematic view of the cathode electrode plate; and

Fig. 6 is a schematic view of the electrode plates of a secondary ~~battery cell~~battery in the prior art, ~~wherein~~wherein, Fig. (a) is a schematic view of the anode electrode plate, and Fig. (b) is a schematic view of the cathode electrode plate.

~~Wherein the reference numbers are described as follows:~~

~~1 Secondary battery cell~~

- ~~101 Anode electrode plate~~
  - ~~1011 Anode current collector~~
  - ~~1012 Anode slurry layer~~
  - ~~1013 Anode electrode tab receiving groove~~
  - ~~1014 Anode electrode plate die-cut notch~~
  - ~~1015 Anode paired recess~~
- ~~102 Anode electrode tab~~
- ~~103 Cathode electrode plate~~
  - ~~1031 Cathode current collector~~
  - ~~1032 Cathode slurry layer~~
  - ~~1033 Cathode electrode tab receiving groove~~
  - ~~1034 Cathode electrode plate die-cut notch~~
  - ~~1035 Cathode paired recess~~
- ~~104 Cathode electrode tab~~
- ~~105 Separator~~

~~2 Secondary battery cell winding formation system~~

- ~~201 Working platform~~
- ~~202 Winding mechanism~~
  - ~~2021 Dust remover~~
  - ~~2022 Winding device~~
- ~~203 Anode electrode plate unwinding roller~~
- ~~204 Anode electrode plate cleaning mechanism~~
  - ~~2041 Anode electrode plate laser cleaning system~~
  - ~~2042 Anode electrode plate dust removal mechanism~~
  - ~~2043 Anode electrode plate adsorption and cooling auxiliary platform~~
- ~~205 Anode electrode plate die-cutting mechanism~~
  - ~~2051 Anode electrode plate die-cutting male die mechanism~~

2052 Anode electrode plate die-cutting female die mechanism
2053 Anode electrode plate die-cut waste collection mechanism
206 Anode electrode tab supply mechanism
207 Anode electrode tab connection mechanism
2071 Anode electrode tab welding head mechanism
2072 Anode electrode tab welding base mechanism
208 Anode electrode plate convey mechanism
2081 Fixed roller
2082 Main drive mechanism
2083 Main drive corrective mechanism
209 Cathode electrode plate unwinding roller
210 Cathode electrode plate cleaning mechanism
2101 Cathode electrode plate laser cleaning system
2102 Cathode electrode plate dust removal mechanism
2103 Cathode electrode plate adsorption and cooling auxiliary platform
211 Cathode electrode plate die-cutting mechanism
2111 Cathode electrode plate die-cutting male die mechanism
2112 Cathode electrode plate die-cutting female die mechanism
2113 Cathode electrode plate die-cut waste collection mechanism
212 Cathode electrode tab supply mechanism
213 Cathode electrode tab connection mechanism
2131 Cathode electrode tab welding head mechanism
2132 Cathode electrode tab welding base mechanism
214 Cathode electrode plate convey mechanism
2141 Fixed roller
2142 Main drive mechanism
2143 Main drive corrective mechanism
215A First separator unwinding roller
215B Second separator unwinding roller
216A First separator convey mechanism
216A1 Fixed roller
216B Second separator convey mechanism
216B1 Fixed roller
217 Central control mechanism
218A First cathode electrode plate sticking mechanism
218B Second cathode electrode plate sticking mechanism
219 Anode electrode plate sensing mechanism
220 Anode electrode plate correctivemechanism
221 Cathode electrode plate sensing mechanism
222 Cathode electrode plate correctivemechanism
223 Separator sensing mechanism
224 Anode electrode plate dust removal portion
225 Cathode electrode plate dust removal portion
T1 First insulating adhesive tape

~~T2 Second insulating adhesive tape~~

~~T3 Third insulating adhesive tape~~

~~T4 Fourth insulating adhesive tape~~

~~L Length direction~~

~~W Width direction~~

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The secondary ~~battery cell~~battery and winding formation system thereof of the present invention will be elaborated hereafter with reference to the drawings.

First, the secondary ~~battery cell~~battery according to the first aspect of the present invention is elaborated.

With reference to Fig. 2-5, the secondary ~~battery cell~~battery 1 according to the present invention comprises an anode electrode plate **101**, an anode electrode tab 102, a cathode electrode plate 103, a cathode electrode tab 104 and a separator 105.

The anode electrode plate 101 comprises: an anode current collector 1011; and an anode ~~slurry layer~~active layer 1012 disposed on the surface of the anode current collector 1011.

The cathode electrode plate 103 comprises: a cathode current collector 1031; and a cathode ~~slurry layer~~active layer 1032 disposed on the surface of the cathode current collector 1031.

The separator 105 is disposed between the anode electrode plate 101 and the cathode electrode plate 103.

The anode electrode plate 101 is formed with: an anode electrode tab receiving groove 1013, provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery, and receiving the anode electrode tab 102 therein, ~~wherein~~wherein, the anode electrode tab 102 is electrically connected to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

The cathode electrode plate 103 is formed with: a cathode electrode tab receiving groove 1033, provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery, and receiving the cathode electrode tab 104 therein, ~~wherein~~wherein, the cathode electrode tab 104 is electrically connected to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

The anode electrode plate 101 is further formed with: an anode electrode plate die-cut notch 1014, located on the side edge of the anode electrode tab receiving groove 1013 and extending through the anode electrode plate 101;

The cathode electrode plate 103 is further formed with: a cathode electrode plate die-cut notch 1034, located on the side edge of the cathode electrode tab receiving groove 1033 and extending through the cathode electrode plate 103.

In the secondary ~~battery cell~~battery 1 according to the present invention, the anode electrode tab 102 is received in the anode electrode tab receiving groove 1013, and the cathode electrode tab 104 is received in the cathode electrode tab receiving groove 1033, thus effectively improving the energy density of the secondary ~~battery cell~~battery 1; the anode electrode plate die-cut notch 1014 can remove the burrs formed on the current collector 1011 of the edge part of the anode electrode tab receiving groove 1013 during formation, and the cathode electrode plate die-cut notch 1034 can effectively remove the burrs formed on the current collector 1031 of the edge part of the cathode electrode tab receiving groove 1033 during formation, thus effectively preventing the

secondary ~~battery cell~~battery 1 from generating internal short circuit, and in turn improving the safety performance of the secondary ~~battery cell~~battery 1 while ensuring a high energy density.

In the secondary ~~battery cell~~battery 1 according to the present invention, the secondary ~~battery cell~~battery 1 is a wound-type cell.

In the secondary ~~battery cell~~battery 1 according to the present invention, with reference to Fig. 5(a), in one embodiment, the length of the anode electrode plate die-cut notch 1014 in the length direction L is 0.9-1.2 times of the length of the anode electrode tab receiving groove 1013; and the width of the anode electrode plate die-cut notch 1014 in the width direction W is 0.2-0.8 times of the width of the anode electrode tab receiving groove 1013.

In the secondary ~~battery cell~~battery 1 according to the present invention, with reference to Fig. 5(b), in one embodiment, the length of the cathode electrode plate die-cut notch 1034 in the length direction L is 0.9-1.2 times of the length of the cathode electrode tab receiving groove 1033; and the width of the cathode electrode plate die-cut notch 1034 in the width direction W is 0.2-0.8 times of the width of the cathode electrode tab receiving groove 1033.

In the secondary ~~battery cell~~battery 1 according to the present invention, with reference to Fig. 2, in one embodiment, the anode electrode plate 101 may not stick an insulating adhesive tape T. Sticking an insulating adhesive tape T on the anode electrode plate 101 could not improve the secondary ~~battery cell~~battery 1, but on the contrary may probably increase the thickness of the secondary ~~battery cell~~battery 1, and reduce the energy density of the secondary ~~battery cell~~battery 1.

In the secondary ~~battery cell~~battery 1 according to the present invention, with reference to Fig. 3, in one embodiment, the secondary ~~battery cell~~battery 1 further comprises: a first insulating adhesive tape T1, stuck at the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; and a second insulating adhesive tape T2, stuck on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary ~~battery cell~~battery 1 is wound and formed. Since the second insulating adhesive tape T2 is stuck, the cathode active substance of the cathode ~~slurry layer~~active layer 1032 dissociating to the anode electrode tab102 is reduced; the cathode active substance of the cathode ~~slurry layer~~active layer 1032 dissociating and diffusing to the aligned anode electrode tab 102 is reduced; further, the cathode active substance of the cathode ~~slurry layer~~active layer 1032 concentrating at the anode electrode tab 102 during the charging and discharging processes of the secondary battery is alleviated; and finally, the problem that the cathode active substance is separated out at the anode electrode tab 102 is alleviated, and in the meanwhile contacting and generating internal short circuit of the anode electrode tab 102 and the cathode electrode plate 103 is avoided when the burrs at the anode electrode tab 102 pierce the separator 105.

In the secondary ~~battery cell~~battery 1 according to the present invention, with reference to Fig. 2(a), in one embodiment, the anode electrode plate 101 is further formed with an anode ~~paired recessdent~~concave 1015, provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery, and located exactly on the back side of the anode electrode tab receiving groove 1013; and with reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary ~~battery cell~~battery 1 further comprises: a third insulating adhesive tape T3, stuck on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode ~~paired recessdent~~concave 1015 after the secondary ~~battery cell~~battery 1 is wound and formed.

In the secondary ~~battery cell~~battery 1 according to the present invention, with reference to

Fig. 3(a), in one embodiment, the cathode electrode plate 103 is further formed with a cathode ~~paired recessdent~~concave 1035, provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove 1033; and with reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary ~~battery cell~~battery 1 further comprises: a fourth insulating adhesive tape T4, stuck on the cathode ~~paired recessdent~~concave 1035.

In the secondary ~~battery cell~~battery 1 according to the present invention, in one embodiment, the anode electrode plate 101 is further formed with an anode ~~paired recessdent~~concave 1015, provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery, and located exactly on the back side of the anode electrode tab receiving groove 1013, as shown in Fig. 2(a); and the cathode electrode plate 103 is further formed with a cathode ~~paired recessdent~~concave 1035, provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove 1033, as shown in Fig. 3(a). With reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary ~~battery cell~~battery 1 further comprises: a third insulating adhesive tape T3, stuck on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode ~~paired recessdent~~concave 1015 after the secondary ~~battery cell~~battery 1 is wound and formed; and a fourth insulating adhesive tape T4, stuck on the cathode ~~paired recessdent~~concave 1035.

In the secondary ~~battery cell~~battery 1 according to the present invention, the first insulating adhesive tape T1, the second insulating adhesive tape T2, the third insulating adhesive tape T3 and the fourth insulating adhesive tape T4 are single-sided insulating adhesive tape or double-sided insulating adhesive tape. When double-sided insulating adhesive tapes are adopted, the double-sided insulating adhesive tape sticking areas are denser than the sticking areas when single-sided insulating adhesive tapes are used, such that the integrity of the secondary ~~battery cell~~battery is enhanced, thus avoiding the area from protruding and becoming the largest deformation area after a reforming process of the secondary ~~battery cell~~battery and the secondary ~~battery cell~~battery expands due to charging and discharging.

Second, the secondary ~~battery cell~~battery winding formation system according to the second aspect of the present invention is elaborated.

With reference to Fig. 1, the secondary ~~battery cell~~battery winding formation system according to the present invention comprises a working platform 201, a winding mechanism 202, an anode electrode plate unwinding roller 203, an anode electrode plate cleaning mechanism 204, an anode electrode plate die-cutting mechanism 205, an anode electrode tab supply mechanism 206, an anode electrode tab connection mechanism 207, an anode electrode plate convey mechanism 208, a cathode electrode plate unwinding roller 209, a cathode electrode plate cleaning mechanism 210, a cathode electrode plate die-cutting mechanism 211, a cathode electrode tab supply mechanism 212, a cathode electrode tab connection mechanism 213, a cathode electrode plate convey mechanism 214, a first separator unwinding roller 215A, a second separator unwinding roller 215B, a first separator convey mechanism 216A and a second separator convey mechanism 216B.

The working platform 201 is fixed immovably.

The winding mechanism 202 is disposed on the working platform 201.

The anode electrode plate unwinding roller 203 is disposed on the working platform 201, and

is wound with anode electrode plate 101, ~~wherein~~wherein, the anode electrode plate 101 comprises: an anode current collector 1011; and an anode ~~slurry layer~~active layer 1012 disposed on the surface of the anode current collector 1011.

The anode electrode plate cleaning mechanism 204 is disposed on the working platform 201, is located at the downstream of the anode electrode plate unwinding roller 203, and is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery.

The anode electrode plate die-cutting mechanism 205 is disposed on the working platform 201, is located at the downstream of the anode electrode plate cleaning mechanism 204, and is used for, at the side edge of the anode electrode tab receiving groove 1013, die-cutting the anode electrode plate 101 to form an anode electrode plate die-cut notch 1014 extending through the anode electrode plate 101.

The anode electrode tab supply mechanism 206 is disposed on the working platform 201, is located at the downstream of the anode electrode plate die-cutting mechanism 205, is wound with an anode electrode tab 102, and is used for supplying the anode electrode tab 102 to the anode electrode tab receiving groove 1013 of the anode electrode plate 101 of the anode electrode plate die-cut notch 1014, such that the anode electrode tab 102 is received in the anode electrode tab receiving groove 1013.

The anode electrode tab connection mechanism 207 is disposed on the working platform 201, is located at the downstream of the anode electrode plate die-cutting mechanism 205, and is used for electrically connecting and fixing the anode electrode tab 102 received in the anode electrode tab receiving groove 1013 to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

The anode electrode plate convey mechanism 208 is disposed on the working platform 201, and is used for conveying the anode electrode plate 101 unwound from the anode electrode plate unwinding roller 203 to the winding mechanism 202 sequentially via the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207. The cathode electrode plate unwinding roller 209 is disposed on the working platform 201, and is wound with a cathode electrode plate103, ~~wherein~~wherein, the cathode electrode plate103 comprises: a cathode current collector 1031; and a cathode ~~slurry layer~~active layer 1032 disposed on the surface of the cathode current collector 1031.

The cathode electrode plate cleaning mechanism 210 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate unwinding roller 209, and is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery.

The cathode electrode plate die-cutting mechanism 211 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate cleaning mechanism 210, and is used for, on the side edge of the cathode electrode tab receiving groove 1033, die-cutting the cathode electrode plate 103 to form a cathode electrode plate die-cut notch 1034 extending through the cathode electrode plate 103.

The cathode electrode tab supply mechanism 212 is disposed on the working platform 201, is

located at the downstream of the cathode electrode plate die-cutting mechanism 211, is wound with a cathode electrode tab 104, and is used for supplying the cathode electrode tab 104 to the cathode electrode tab receiving groove 1033 of the cathode electrode plate 103 having die-cut out the cathode electrode plate die-cut notch 1034, such that the cathode electrode tab 104 is received in the cathode electrode tab receiving groove 1033.

The cathode electrode tab connection mechanism 213 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate die-cutting mechanism 211, and is used for electrically connecting and fixing the cathode electrode tab 104 received in the cathode electrode tab receiving groove 1033 to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

The cathode electrode plate convey mechanism 214 is disposed on the working platform 201, and is used for conveying the cathode electrode plate 103 unwound from the cathode electrode plate unwinding roller 209 to the winding mechanism 202 sequentially via the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213.

The first separator unwinding roller 215A is disposed on the working platform 201, and is wound with a separator105.

The second separator unwinding roller 215B is disposed on the working platform 201, and is wound with another separator 105.

The first separator convey mechanism 216A is disposed on the working platform 201, and is used for conveying the corresponding separator 105 unwound from the first separator unwinding roller 215A to the winding mechanism 202, such that the corresponding separator 105 is configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary ~~battery cell~~battery is wound and formed.

The second separator convey mechanism 216B is disposed on the working platform 201, and is used for conveying the corresponding separator 105 unwound from the second separator unwinding roller 215B to the winding mechanism 202, such that the corresponding separator 105 is configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary ~~battery cell~~battery is wound and formed.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, the winding mechanism 202, the anode electrode plate unwinding roller 203, the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205, the anode electrode tab supply mechanism 206, the anode electrode tab connection mechanism 207, the anode electrode plate convey mechanism 208, the cathode electrode plate unwinding roller 209, the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211, the cathode electrode tab supply mechanism 212, the cathode electrode tab connection mechanism 213, the cathode electrode plate convey mechanism 214, the first separator unwinding roller 215A, the second separator unwinding roller 215B, the first separator convey mechanism 216A and the second separator convey mechanism 216B are integrated on one working platform 201, thus reducing the volume of the secondary ~~battery cell~~battery winding formation system 2, saving the floor area of a factory building, and reducing the manufacturing cost of the secondary ~~battery cell~~battery 1; the anode electrode plate die-cutting mechanism 205 can remove burrs cleaned out by the anode electrode plate cleaning mechanism 204 and located on the current collector 1011 on the edge part of the anode electrode tab receiving groove 1013, and

the cathode electrode plate die-cutting mechanism 211 can remove burrs cleaned out by the cathode electrode plate cleaning mechanism 210 and located on the current collector 1031 on the edge part of the cathode electrode tab receiving groove 1033, thus effectively preventing the manufactured secondary ~~battery cell~~battery 1 from generating internal short circuit, and improving the safety performance of the manufactured secondary ~~battery cell~~battery 1.

In one embodiment, the anode electrode tab receiving groove 1013 and the anode ~~paired recessdent~~concave 1015 are respectively cleaned out on the two surfaces of the anode electrode plate 101; and the anode electrode plate convey mechanism 208 can lead and change the convey direction of the anode electrode plate 101, thus realizing a double-side cleaning effect.

In one embodiment, the cathode electrode tab receiving groove 1033 and the cathode ~~paired recessdent~~concave 1035 are respectively cleaned out on the two surfaces of the cathode electrode plate 103; and the cathode electrode plate convey mechanism 214 can lead and change the convey direction of the cathode electrode plate 103, thus realizing a double-side cleaning effect.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary ~~battery cell~~battery winding formation system 2 further comprises a central control mechanism 217, in communication connection with and for controlling at least one selected from the anode electrode plate unwinding roller 203, the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205, the anode electrode tab supply mechanism 206, the anode electrode tab connection mechanism 207, the cathode electrode plate unwinding roller 209, the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211, the cathode electrode tab supply mechanism 212, the cathode electrode tab connection mechanism 213 and the winding mechanism 202.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1 and Fig. 3, in one embodiment, the secondary ~~battery cell~~battery winding formation system 2 further comprises: a first cathode electrode plate sticking mechanism 218A, disposed on the working platform 201, located at the downstream of the cathode electrode tab connection mechanism 213, and used for sticking a first insulating adhesive tape T1 on the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; and a second cathode electrode plate sticking mechanism 218B, disposed on the working platform 201, located between the first cathode electrode plate sticking mechanism 218A and the winding mechanism 202, and used for sticking a second insulating adhesive tape T2 on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary ~~battery cell~~battery 1 is wound and formed.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanisms 204 are two, ~~wherein~~wherein, one anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery; and the other anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode ~~paired recessdent~~concave 1015 provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery and located exactly on the back side of the anode electrode tab receiving groove 1013; and with reference to Fig. 1 and Fig. 3, in the present embodiment, the second

cathode electrode plate sticking mechanism 218B is further used for sticking a third insulating adhesive tape T3 on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode ~~paired recessdent~~concave 1015.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate cleaning mechanisms 210 are two, ~~wherein~~wherein, one cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery; and the other cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode ~~paired recessdent~~concave 1035 provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery and located exactly on the back side of the cathode electrode tab receiving groove 1033; and with reference to Fig. 1 and Fig. 3, in the present embodiment, the first cathode electrode plate sticking mechanism 218A is further used for sticking a fourth insulating adhesive tape T4 on the cathode ~~paired recessdent~~concave 1035.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanisms 204 are two, ~~wherein~~wherein, one anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery; and the other anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode ~~paired recessdent~~concave 1015 provided with the anode current collector 1011 at the bottom and the anode ~~slurry layer~~active layer 1012 on the periphery and located exactly on the back side of the anode electrode tab receiving groove 1013; with reference to Fig. 1, in the present embodiment, the cathode electrode plate cleaning mechanisms 210 are two, ~~wherein~~wherein, one cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery; and the other cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode ~~paired recessdent~~concave 1035 provided with the cathode current collector 1031 at the bottom and the cathode ~~slurry layer~~active layer 1032 on the periphery and located exactly on the back side of the cathode electrode tab receiving groove 1033; with reference to Fig. 1 and Fig. 3, in the present embodiment, the first cathode electrode plate sticking mechanism 218A is further used for sticking a fourth insulating adhesive tape T4 on the cathode ~~paired recessdent~~concave 1035; and the second cathode electrode plate sticking mechanism 218B is further used for sticking a third insulating adhesive tape T3 on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode ~~paired recessdent~~concave 1015.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second ~~battery cell~~battery winding formation system 2 further comprises: a plurality of anode electrode plate sensing mechanisms 219, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode 101 starting from the anode electrode plate unwinding roller 203 and passing through the anode electrode plate cleaning

mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for sensing the position of the anode electrode plate 101 on the convey path; and a plurality of anode electrode plate corrective mechanisms 220, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode plate 101starting from the anode electrode plate unwinding roller 203 and passing through the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for correcting the anode electrode plate 101.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second ~~battery cell~~battery winding formation system 2 further comprises: a plurality of cathode electrode plate sensing mechanisms 221, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate unwinding roller 209 and passing through the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for sensing the position of the cathode electrode plate 103 on the convey path; and a plurality of cathode electrode plate corrective mechanisms 222, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate unwinding roller 209 and passing through the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for correcting the cathode electrode plate 103.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second ~~battery cell~~battery winding formation system 2 further comprises: a plurality of separator sensing mechanisms 223, disposed on the working platform 201, in communication connection with the central control mechanism 217, respectively located on a convey path of the corresponding separator 105 from the first separator unwinding roller 215A to the winding mechanism 202 and another convey path from the second separator unwinding roller 215B to the winding mechanism 202, and used for sensing the position of the corresponding separator 105 on the convey path.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate unwinding roller 203, the cathode electrode plate unwinding roller 209, the first separator unwinding roller 215A and the second separator unwinding roller 215B can all extend and retract in a direction perpendicular to the working platform 201. The first separator unwinding roller 215A and the second separator unwinding roller 215B extending and retracting in a direction perpendicular to the working platform 201 may cooperate with the separator sensing mechanism 223 to realize deviation correction. Therefore, the feeding of the separator does not add an independent separator corrective mechanism.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanism 204 comprises: an anode electrode plate laser cleaning system 2041, for

correspondingly cleaning the anode ~~slurry layer~~active layer 1012 of the passing anode electrode plate 101; an anode electrode plate dust removal mechanism 2042, for removing anode ~~slurry layer~~active layer 1012 particles generated when the anode electrode plate laser cleaning system 2041 performs cleaning; and an anode electrode plate adsorption and cooling auxiliary platform 2043, for adsorbing, fixing and cooling the anode electrode plate 101 passing through the anode electrode plate laser cleaning system 2041.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate adsorption and cooling auxiliary platform 2043 can be vacuum pumping adsorption.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate cleaning mechanism 210 comprises: a cathode electrode plate_laser cleaning system 2101, for correspondingly cleaning the cathode ~~slurry layer~~active layer 1032 of the passing cathode electrode plate 103; a cathode electrode plate dust removal mechanism 2102, for removing cathode ~~slurry layer~~active layer 1032 particles generated when the cathode electrode plate laser cleaning system 2101 performs cleaning; and a cathode electrode plate adsorption and cooling auxiliary platform 2103, for adsorbing, fixing and cooling the cathode electrode plate 103 passing through the cathode electrode plate laser cleaning system 2101.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate adsorption and cooling auxiliary platform 2103 can be vacuum pumping adsorption.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate die-cutting mechanism 205 comprises: an anode electrode plate die-cutting male die mechanism 2051; and an anode electrode plate die-cutting female die mechanism 2052, for cooperating with the anode electrode plate die-cutting male die mechanism 2051 to, when the anode electrode plate 101 passes through the anode electrode plate die-cutting mechanism 205, die-cut, on the side edge of the anode electrode tab receiving groove 1013, the anode electrode plate 101 to form an anode electrode plate die-cut notch 1014 extending through the anode electrode plate 101; and an anode electrode plate die-cut waste collection mechanism 2053, for collecting the wastes die-cut off from the anode electrode plate 101.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate die-cutting mechanism 211 comprises: a cathode electrode plate die-cutting male die mechanism 2111; and a cathode electrode plate die-cutting female die mechanism 2112, for cooperating with the cathode electrode plate die-cutting male die mechanism 2111 to, when the cathode electrode plate 103 passes through the cathode electrode plate die-cutting mechanism 211, die-cut, on the side edge of the cathode electrode tab receiving groove 1033, the cathode electrode plate 103 to form a cathode electrode plate die-cut notch 1034 extending through the cathode electrode plate 103; and a cathode electrode plate die-cut waste collection mechanism 2113, for collecting the wastes die-cut off from the cathode electrode plate 103.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode tab connection mechanism 207 comprises: an anode electrode tab welding head mechanism 2071; and an anode

electrode tab welding base mechanism 2072, for cooperating with the anode electrode tab welding head mechanism 2071 to weld the anode electrode tab 102 to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode tab connection mechanism 213 comprises: a cathode electrode tab welding head mechanism 2131; and a cathode electrode tab welding base mechanism 2132, for cooperating with the cathode electrode tab welding head mechanism 2131 to weld the cathode electrode tab 104 to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the winding mechanism 202 comprises: a dust remover 2021, for removing the dust of the anode electrode plate 101, the cathode electrode plate 103 and the two separators 105 conveyed to the winding mechanism 202; and a winding device 2022, for stacking up the anode electrode plate 101, the cathode electrode plate 103 and the two separators 105 conveyed to the winding mechanism 202, and enabling the corresponding separator 105 to be configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary ~~battery cell~~battery is wound and formed by the winding mechanism 202.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate convey mechanism 208 comprises: a fixed roller 2081, for passively enabling the anode electrode plate 101 to pass thereon; a main drive mechanism 2082, for actively driving and conveying the anode electrode plate 101; and a main drive corrective mechanism 2083, located at the upstream of the winding mechanism 202 and used for correcting the anode electrode plate 101 having entered the winding mechanism 202.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate convey mechanism 214 comprises: a fixed roller 2141, for passively enabling the cathode electrode plate 103 to pass thereon; a main drive mechanism 2142, for actively driving and conveying the cathode electrode plate 103; and a main drive corrective mechanism 2143, located at the upstream of the winding mechanism 202 and used for correcting the cathode electrode plate 103 having entered the winding mechanism 202.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the first separator convey mechanism 216A comprises a fixed roller 216A1 for passively enabling the corresponding separator 105 to pass thereon and conveying to the winding mechanism 202; and the second separator convey mechanism 216B comprises a fixed roller 216B1 for passively enabling the corresponding separator 105 to pass thereon and conveying to the winding mechanism 202.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary ~~battery cell~~battery winding formation system 2 further comprises: a plurality of anode electrode plate dust removal portions 224, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode plate 101 starting from the anode electrode plate cleaning mechanism 204 and passing through the anode electrode plate die-cutting

mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for removing the anode ~~slurry layer~~active layer 1012 particles generated after the anode electrode plate is cleaned and the electrode tab is welded.

In the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary ~~battery cell~~battery winding formation system 2 further comprises: a plurality of cathode electrode plate dust removal portions 225, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate cleaning mechanism 210 and passing through the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for removing the cathode ~~slurry layer~~active layer 1032 particles generated after the cathode electrode plate is cleaned and the electrode tab is welded.

A comparison is performed hereafter between the performance of the secondary ~~battery cell~~battery manufactured by the secondary ~~battery cell~~battery winding formation system 2 of the present invention and the performance of the secondary ~~battery cell~~battery manufactured by the prior art.

Embodiment 1 takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example. In the secondary ~~battery cell~~battery 1 manufactured by the secondary ~~battery cell~~battery winding formation system 2 according to the present invention, with reference to Fig. 2-5, the anode electrode plate cleaning mechanism 204 and the cathode electrode plate cleaning mechanism 210 are used to respectively clean out an anode electrode tab receiving groove 1013 and a cathode electrode tab receiving groove 1033 which are 12mm length (in the length direction L) and 8mm width (in the width direction W) at preset positions on the anode electrode plate 101 and the cathode electrode plate 103; the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 are die-cut by the anode electrode plate die-cutting mechanism 205 and the cathode electrode plate die-cutting mechanism 211 to form an anode electrode plate die-cut notch 1014 and a cathode electrode plate die-cut notch 1034 which are 12mm length and 3mm width; the long sides of the anode electrode plate die-cut notch 1014 and the cathode electrode plate die-cut notch are coincident with the corresponding long sides of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033; the anode electrode tab 102 and the cathode electrode tab 104 which are 6mm width are respectively welded in the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033. The first insulating adhesive tape T1 is stuck on the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; the second insulating adhesive tape T2 is stuck on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary ~~battery cell~~battery 1 is wound and formed; the third insulating adhesive tape T3 is stuck on the cathode ~~slurry layer~~active layer 1032 at a position aligned with the anode ~~paired recessdent~~concave 1015 after the secondary ~~battery cell~~battery 1 is wound and formed; the fourth insulating adhesive tape T4 is stuck on the cathode ~~paired recessdent~~concave 1035; and the insulating adhesive tapes T1-T4 are 10μm thickness, 15mm length and 24mm width. The insulating adhesive tape is not stuck on the anode electrode plate 101. The secondary ~~battery cell~~battery structure according to one embodiment of the present invention is manufactured as above.

Comparison example 1 also takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example, and uses the conventional independent laser cleaning device, welding device and winding device in the prior art to manufacture a secondary ~~battery cell~~battery. With reference to Fig. 6, except that the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 are not die-cut and removed and that T1-T4 adopt a 35μm thickness insulating adhesive tape, the others are the same as the embodiment 1.

Comparison example 2 also takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example, ~~wherein~~wherein, except thatT1-T4 adopt a 10μm thickness insulating adhesive tape, the others are the same as the comparison example 1.

Twenty pouch cell lithium ion battery samples are respectively selected from the embodiment 1, the comparison example 1 and the comparison example 2 to perform capacity test and thickness measurement; and then the tested pouch cell lithium ion battery samples are dismantled to observe the internal short circuit situation of the cleaning grooves. The results are as shown in table 1.

Table 1: the test results of the embodiment 1 and the comparison examples 1-2

	Average capacity mAh	Average volume energy density Wh/L	Average thickness mm	The number of samples generating internal short circuit
Embodiment 1	3027.5	937	3.28	0
Comparison example 1	3027.3	925	3.32	0
Comparison example 2	3027.4	937	3.28	12

It can be seen from the above table 1 that: in the embodiment 1, the secondary ~~battery cell~~batterys manufactured by the secondary ~~battery cell~~battery winding formation system 2 of the present invention ensure a high average volume energy density while none of the cells generates internal short circuit; in the comparison example 1, similarly, none of the cells generates the internal short circuit problem, however the average volume energy density is obviously reduced because a thick insulating adhesive tape is stuck; and in the comparison example 2, a high average volume energy density is ensured, however a high ratio of cells generate internal short circuit.

Therefore, in the embodiment 1, the electrode plate structure using die-cutting offthe burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 can completely solve the internal short circuit problem caused by the burrs, thus improving the safety use performance of the cell; furthermore, the secondary ~~battery cell~~battery winding formation system 2 can reduce the comprehensive manufacturing cost of the cell.

ABSTRACT OF THE DISCLOSURE

The present invention provides a secondary ~~battery cell~~battery ~~and winding formation system thereof~~. The secondary ~~battery cell~~battery comprises a first electrode tab and a first electrode plate. The first electrode plate first electrode plate comprises a first current collector, a first active layer, a first electrode tab receiving groove and a first electrode plate notch. The first active layer is disposed on a surface of the first current collector. The first electrode tab receiving groove is configured to receive the first electrode tab, andthe first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove. The first electrode plate notch is disposed on an edge of the first electrode tab receiving groove. ~~an anode electrode plate, an anode electrode tab, a cathode electrode plate, a cathode electrode tab and a separator. The secondary battery cell winding formation system comprises a working platform, a winding mechanism, an anode electrode plate unwinding roller, an anode electrode plate cleaning mechanism, an anode electrode plate die cutting mechanism, an anode electrode tab supply mechanism, an anode electrode tab connection mechanism, an anode electrode plate convey mechanism, a cathode electrode plate unwinding roller, a cathode electrode plate cleaning mechanism, a cathode electrode plate die cutting mechanism, a cathode electrode tab supply mechanism, a cathode electrode tab connection mechanism, a cathode electrode plate convey mechanism, a first separator unwinding roller, a second separator unwinding roller, a first separator convey mechanism and a second separator convey mechanism. The secondary battery cell manufactured by the secondary battery cell winding formation system of the present invention can effectively prevent the secondary battery cell from generating internal short circuit, thus improving the safety performance of the secondary battery cell while ensuring a high energy density.~~

Please Direct All Correspondence to Customer Number 20995

TRANSMITTAL

Inventor	:	Peipei Guo
App. No.	:	15/908327
Filed	:	February 28, 2018
For	:	SECONDARY BATTERY
Art Unit	:	1723
Conf No.	:	2611

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Enclosed in compliance with 37 CFR 1.53(f) are the following:

(X) A Preliminary Amendment

(X) A Marked-up and Clean Substitute Specification. Applicant believes no new matter is added.

The Commissioner is hereby authorized to charge any additional fees which may be required, now or in the future, or credit any overpayment, to Account No. 11-1410.

/Daniel J. Fischer/
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30526848

Electronic Acknowledgement Receipt	
EFS ID:	36030712
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	20995
Filer:	Daniel J. Fischer/Gustavo Lopez
Filer Authorized By:	Daniel J. Fischer
Attorney Docket Number:	DHNG001.001C1
Receipt Date:	16-MAY-2019
Filing Date:	28-FEB-2018
Time Stamp:	14:37:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		DHNG001006C1_PA.pdf	37392 bdda77778262fd9668c920259bbd6177fce982a8	yes	7

	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Applicant Arguments/Remarks Made in an Amendment		7	7	
	Claims		3	6	
	Specification		2	2	
	Preliminary Amendment		1	1	
Warnings:					
Information:					
2	Specification	DHNG001006C1_Clean_Spec.pdf	150919 bcb7c44d1f46434db618ac5cd8b6d5acf5f96655	no	15
Warnings:					
Information:					
3	Specification	DHNG001006C1_Marked_Spec.pdf	173832 f0588a2a458d3942cb00fb8b5875edd4afa20104	no	19
Warnings:					
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4	Transmittal Letter	DHNG001006C1_Transmittal.pdf	16849 aeabca8a5e9b32082ce8dbe47edf4cb9909d5fbf	no	1
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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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REMARKS

Applicant respectfully requests entry of the above amendments to the claims prior to examination on the merits. Claims 1-3, 5, 6, 8-10, and 12 have been amended. Applicant believes that these claims are fully supported by the originally-filed disclosure and that no new matter is added. Claims 4, 7, 11, and 13-20 have been cancelled without prejudice or disclaimer. Accordingly, Claims 1-3, 5, 6, 8-10, and 12 remain pending. Applicant is also submitting a substitute Specification and believes no new matter is added.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: May 16, 2019

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PREAMEND

28857268

AMENDMENTS TO THE CLAIMS

1. (**Currently Amended**) A secondary ~~battery cell~~ battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; ~~and~~

a first ~~slurry layer~~ active layer, disposed on a ~~the~~ surface of the first current collector;

~~wherein thefirstelectrode platefurthercomprising,~~:

a first electrode tab receiving groove, ~~provided with the firstcurrent collector at the bottom and the firstslurry layer on the periphery,~~ configured to receive the first electrode tab, wherein, the first electrode tab is ~~is received in thefirstelectrode tab receiving groove and the firstelectrode tabis electrically connected to~~ electrically connected with the first current collector through the first electrode tab receiving groove;

a first electrode plate ~~die cut~~ notch, disposed ~~located~~ on ~~the~~ an edge of the first electrode tab receiving groove ~~and extending through the first electrode plate~~.[;]

2. (**Currently Amended**) The secondary ~~battery cell~~ battery according to claim 1, further comprising:

~~a second electrode plate, comprising:~~

~~asecond current collector; and~~

~~asecond slurry layer, disposed on the surface of thesecond current collectors;~~

a second electrode tab;

~~wherein~~

[[the]] a second electrode plate, comprising:

a second current collector;

a second active layer, disposed on a surface of the second current collector;

a second electrode tab receiving groove~~, provided with the second current collector at the bottom and the second slurry layer on the periphery~~, configured to receive the second electrode tab, wherein ~~is received in thesecondelectrode tab~~

~~receiving groove and~~ the second electrode tab is electrically connected [[to]] with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch, ~~located~~ disposed on [[the]] an edge of the second electrode tab receiving groove. ~~and extending through the second electrode plate;~~

3. (**Currently Amended**) The secondary ~~battery cell~~battery according to claim 2, wherein,

the first electrode plate is ~~anodeelectrode~~ an anode electric plate;

the first ~~slurry~~ active layer is an anode active~~slurry~~ layer;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active ~~slurry~~ layer is a cathode active ~~slurry~~ layer;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove;

the second electrode plate notch is a cathode electrode plate notch.

4. (**Cancelled**)

5. (**Currently Amended**) The secondary ~~battery cell~~battery according to claim [[4]]3, wherein, the secondary ~~battery cell~~battery is a wound-type battery~~cell~~.

6. (**Currently Amended**) The secondary ~~battery cell~~battery according to claim [[4]]3, wherein,

[[the]] a length of the ~~anode~~ first electrode plate notch ~~in the length direction~~ is 0.9-1.2 times ~~of the~~ a length of the ~~anode~~ first electrode tab receiving groove along a length direction of the first electrode plate; and

[[the]]a width of the ~~anode~~ first electrode plate notch ~~in the width direction~~ is 0.2-0.8 times [[of]] a [[the]] width of the ~~anode~~ first electrode tab receiving groove along a width direction of the first electrode plate.

7. (**Cancelled**)

8. (**Currently Amended**) The secondary battery ~~cell~~ according to claim [[4]]3, ~~wherein, the secondary batter cell~~ further comprising ~~comprises~~:

a first insulating adhesive tape, ~~stuck~~ disposed on the ~~cathode~~ second electrode tab receiving groove ~~having received the cathode electrode tab~~; and

a second insulating adhesive tape, ~~stuck~~ disposed on the ~~cathode~~ second ~~slurry~~ active layer and facing the first electrode tab receiving groove ~~at a position aligned with the anode electrode tab receiving groove after the secondary battery cell is wound and formed~~.

9. (**Currently Amended**) The secondary battery ~~cell~~ according to claim 8, ~~wherein,~~ further comprising:

a third insulating adhesive tape;

the anode electrode plate comprising an anode concave, wherein, the anode concave and the anode electrode tab receiving groove are relatively deposed on both sides of the anode current collector;

the anode active layer is not deposed on the anode concave, the third insulating adhesive tape is disposed on the anode concave ~~is further formed with: an anode paired recess, provided with the anode current collector at the bottom and the anode slurry layer on the periphery, and located exactly on the back side of the anode electrode tab receiving groove; and~~

~~thesecondary battery cell further comprises: a third insulating adhesive tape, stuck on the cathode slurry layer at a position aligned with the anode paired recess after the secondary battery cell is wound and formed~~.

10. (**Currently Amended**) The secondary battery ~~cell~~ according to claim 8, further comprising: ~~wherein,~~

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode concave, wherein, the cathode concave and the cathode electrode tab receiving groove are relatively deposed on both sides of the cathode current collector;

cathode active layer is not deposed on the cathode concave, the fourth insulating adhesive tape is disposed on the cathode concave ~~is further formed with: a cathode paired recess, provided with the cathode current collector at the bottom and the cathode slurry layer on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove; and~~

~~thesecondary battery cell further comprises: a fourth insulating adhesive tape, stuck on the cathode paired recess~~.

11. (**Cancelled**)

12. (**Currently Amended**) The secondary battery ~~cell~~ according to claim [[11]]10, wherein, each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape and the fourth insulating adhesive tape [[are]] is a single-sided insulating adhesive tape ~~or double-sided insulating adhesive tape~~.

13-20. (**Cancelled**)

AMENDMENTS TO THE SPECIFICATION

Please replace the Specification with the marked-up and clean versions of the Specification being filed herewith. Applicant submits no new matter is added.

SECONDARY BATTERY

FIELD OF THE INVENTION

The present invention relates to the field of secondary batteries, in particular to a structure of the secondary battery.

BACKGROUND OF THE INVENTION

The lithium ion battery (one kind of secondary batteries) is widely used in the fields of electronic products, automobiles, electric vehicles, aerospace, micro-electromechanical systems, energy storage and the like. As the application environment and conditions tend to be more complex and rigorous, high requirements are proposed to the usage safety performance, energy density and manufacturing cost of the lithium-ion battery.

In the prior art, the purpose of improving energy density is achieved by configuring a groove on an electrode plate and welding an electrode tab in the groove. However, the process is realized by independent laser cleaning device and welding-winding device respectively at the present stage. The comprehensive cost of the devices is high, and the factory buildings occupy large space, with the result the manufacturing cost of the entire lithium battery is high. Furthermore, the laser cleaned groove on the electrode plate has an overheated perforation or a burned hole on the edge due to focal length fluctuation and deviation, such that a plenty of burrs are formed on a current collector on the edge of the groove; if the electrode plate with burrs is directly manufactured into a cell without processing, then the burrs will pierce the separator to cause internal short circuit, a fire disaster and other severe potential safety hazards. In the prior art, a thick adhesive tape is stuck in the groove to prevent the burrs from piercing the separator. However, sticking an adhesive tape in the groove will certainly increase the thickness of the cell, thus causing loss to energy density.

SUMMARY OF THE INVENTION

To solve the problems in the prior art, the object of the present invention is to provide a secondary battery, which can prevent the secondary battery from generating internal short circuit while improving the energy density of the secondary battery, thus improving the safety performance of the secondary battery.

Another object of the present invention is to provide a secondary battery winding formation system, which can reduce the volume of the secondary battery winding formation system, save the floor area of a factory building, reduce the manufacturing cost of the secondary battery, and improve the energy density and safety performance of the manufactured secondary battery.

To achieve the above objects, in a first aspect, the present invention provides a secondary battery, comprising an anode electrode plate, an anode electrode tab, a cathode electrode plate, a cathode electrode tab and a separator.

The anode electrode plate comprises: an anode current collector; and an anode active layer disposed on the surface of the anode current collector.

The cathode electrode plate comprises: a cathode current collector; and a cathode active layer disposed on the surface of the cathode current collector.

The separator is disposed between the anode electrode plate and the cathode electrode plate.

The anode electrode plate is formed with: an anode electrode tab receiving groove, provided

with the anode current collector at the bottom and the anode active layer on the periphery, the anode electrode tab is received in the anode electrode tab receiving groove and is electrically connected to the anode current collector at the anode electrode tab receiving groove.

The cathode electrode plate is formed with: a cathode electrode tab receiving groove, provided with the cathode current collector at the bottom and the cathode active layer on the periphery, the cathode electrode tab is received in the cathode electrode tab receiving groove and is electrically connected to the cathode current collector at the cathode electrode tab receiving groove.

The anode electrode plate is further formed with: an anode electrode plate die-cut notch, located on the side edge of the anode electrode tab receiving groove and extending through the anode electrode plate.

The cathode electrode plate is further formed with: a cathode electrode plate die-cut notch, located on the side edge of the cathode electrode tab receiving groove and extending through the cathode electrode plate.

The beneficial effects of the present invention are as follows:

In the secondary battery according to the present invention, the anode electrode tab is received in the anode electrode tab receiving groove, and the cathode electrode tab is received in the cathode electrode tab receiving groove, thus effectively improving the energy density of the secondary battery; the anode electrode plate die-cut notch can remove the burrs formed on the current collector on the edge part of the anode electrode tab receiving groove during formation, and the cathode electrode plate die-cut notch can effectively remove the burrs formed on the current collector on the edge part of the cathode electrode tab receiving groove during formation, thus effectively preventing the secondary battery from generating internal short circuit, and improving the safety performance of the secondary battery while ensuring a high energy density.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view of the secondary battery winding formation system of the present invention;

Fig. 2 is a schematic view of the welded anode electrode plate and electrode tab of the secondary battery of the present invention, wherein, Fig. (a) is a sectional view of the welded anode electrode plate and electrode tab, and Fig. (b) is a top view of the anode electrode plate as shown in Fig. (a);

Fig. 3 is a schematic view of the welded cathode electrode plate and electrode tab of the secondary battery of the present invention, wherein, Fig. (a) is a sectional view of the welded cathode electrode plate and electrode tab, and Fig. (b) is a bottom view of the cathode electrode plate as shown in Fig. (a);

Fig. 4 is a schematic view showing the die-cutting process of the electrode plates of the secondary battery of the present invention, wherein, Fig. (a) is a schematic view showing the die-cutting process of the anode electrode plate, and Fig. (b) is a schematic view showing the die-cutting process of the cathode electrode plate;

Fig. 5 is a schematic view of the electrode plates of the secondary battery of the present invention, wherein, Fig. (a) is a schematic view of the anode electrode plate, and Fig. (b) is a schematic view of the cathode electrode plate; and

Fig. 6 is a schematic view of the electrode plates of a secondary battery in the prior art,

wherein, Fig. (a) is a schematic view of the anode electrode plate, and Fig. (b) is a schematic view of the cathode electrode plate.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The secondary battery and winding formation system thereof of the present invention will be elaborated hereafter with reference to the drawings.

First, the secondary battery according to the first aspect of the present invention is elaborated.

With reference to Fig. 2-5, the secondary battery 1 according to the present invention comprises an anode electrode plate **101**, an anode electrode tab 102, a cathode electrode plate 103, a cathode electrode tab 104 and a separator 105.

The anode electrode plate 101 comprises: an anode current collector 1011; and an anode active layer 1012 disposed on the surface of the anode current collector 1011.

The cathode electrode plate 103 comprises: a cathode current collector 1031; and a cathode active layer 1032 disposed on the surface of the cathode current collector 1031.

The separator 105 is disposed between the anode electrode plate 101 and the cathode electrode plate 103.

The anode electrode plate 101 is formed with: an anode electrode tab receiving groove 1013, provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery, and receiving the anode electrode tab 102 therein, wherein, the anode electrode tab 102 is electrically connected to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

The cathode electrode plate 103 is formed with: a cathode electrode tab receiving groove 1033, provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery, and receiving the cathode electrode tab 104 therein, wherein, the cathode electrode tab 104 is electrically connected to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

The anode electrode plate 101 is further formed with: an anode electrode plate die-cut notch 1014, located on the side edge of the anode electrode tab receiving groove 1013 and extending through the anode electrode plate 101;

The cathode electrode plate 103 is further formed with: a cathode electrode plate die-cut notch 1034, located on the side edge of the cathode electrode tab receiving groove 1033 and extending through the cathode electrode plate 103.

In the secondary battery 1 according to the present invention, the anode electrode tab 102 is received in the anode electrode tab receiving groove 1013, and the cathode electrode tab 104 is received in the cathode electrode tab receiving groove 1033, thus effectively improving the energy density of the secondary battery 1; the anode electrode plate die-cut notch 1014 can remove the burrs formed on the current collector 1011 of the edge part of the anode electrode tab receiving groove 1013 during formation, and the cathode electrode plate die-cut notch 1034 can effectively remove the burrs formed on the current collector 1031 of the edge part of the cathode electrode tab receiving groove 1033 during formation, thus effectively preventing the secondary battery 1 from generating internal short circuit, and in turn improving the safety performance of the secondary battery 1 while ensuring a high energy density.

In the secondary battery 1 according to the present invention, the secondary battery 1 is a wound-type cell.

In the secondary battery 1 according to the present invention, with reference to Fig. 5(a), in one embodiment, the length of the anode electrode plate die-cut notch 1014 in the length direction L is 0.9-1.2 times of the length of the anode electrode tab receiving groove 1013; and the width of the anode electrode plate die-cut notch 1014 in the width direction W is 0.2-0.8 times of the width of the anode electrode tab receiving groove 1013.

In the secondary battery 1 according to the present invention, with reference to Fig. 5(b), in one embodiment, the length of the cathode electrode plate die-cut notch 1034 in the length direction L is 0.9-1.2 times of the length of the cathode electrode tab receiving groove 1033; and the width of the cathode electrode plate die-cut notch 1034 in the width direction W is 0.2-0.8 times of the width of the cathode electrode tab receiving groove 1033.

In the secondary battery 1 according to the present invention, with reference to Fig. 2, in one embodiment, the anode electrode plate 101 may not stick an insulating adhesive tape T. Sticking an insulating adhesive tape T on the anode electrode plate 101 could not improve the secondary battery 1, but on the contrary may probably increase the thickness of the secondary battery 1, and reduce the energy density of the secondary battery 1.

In the secondary battery 1 according to the present invention, with reference to Fig. 3, in one embodiment, the secondary battery 1 further comprises: a first insulating adhesive tape T1, stuck at the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; and a second insulating adhesive tape T2, stuck on the cathode active layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary battery 1 is wound and formed. Since the second insulating adhesive tape T2 is stuck, the cathode active substance of the cathode active layer 1032 dissociating to the anode electrode tab102 is reduced; the cathode active substance of the cathode active layer 1032 dissociating and diffusing to the aligned anode electrode tab 102 is reduced; further, the cathode active substance of the cathode active layer 1032 concentrating at the anode electrode tab 102 during the charging and discharging processes of the secondary battery is alleviated; and finally, the problem that the cathode active substance is separated out at the anode electrode tab 102 is alleviated, and in the meanwhile contacting and generating internal short circuit of the anode electrode tab 102 and the cathode electrode plate 103 is avoided when the burrs at the anode electrode tab 102 pierce the separator 105.

In the secondary battery 1 according to the present invention, with reference to Fig. 2(a), in one embodiment, the anode electrode plate 101 is further formed with an anode concave 1015, provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery, and located exactly on the back side of the anode electrode tab receiving groove 1013; and with reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary battery 1 further comprises: a third insulating adhesive tape T3, stuck on the cathode active layer 1032 at a position aligned with the anode concave 1015 after the secondary battery 1 is wound and formed.

In the secondary battery 1 according to the present invention, with reference to Fig. 3(a), in one embodiment, the cathode electrode plate 103 is further formed with a cathode concave 1035, provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove 1033; and with reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary battery 1 further comprises: a fourth insulating adhesive tape T4, stuck on the cathode concave 1035.

In the secondary battery 1 according to the present invention, in one embodiment, the anode

electrode plate 101 is further formed with an anode concave 1015, provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery, and located exactly on the back side of the anode electrode tab receiving groove 1013, as shown in Fig. 2(a); and the cathode electrode plate 103 is further formed with a cathode concave 1035, provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery, and located exactly on the back side of the cathode electrode tab receiving groove 1033, as shown in Fig. 3(a). With reference to Fig. 3(a) and 3(b), in the present embodiment, the secondary battery 1 further comprises: a third insulating adhesive tape T3, stuck on the cathode active layer 1032 at a position aligned with the anode concave 1015 after the secondary battery 1 is wound and formed; and a fourth insulating adhesive tape T4, stuck on the cathode concave 1035.

In the secondary battery 1 according to the present invention, the first insulating adhesive tape T1, the second insulating adhesive tape T2, the third insulating adhesive tape T3 and the fourth insulating adhesive tape T4 are single-sided insulating adhesive tape or double-sided insulating adhesive tape. When double-sided insulating adhesive tapes are adopted, the double-sided insulating adhesive tape sticking areas are denser than the sticking areas when single-sided insulating adhesive tapes are used, such that the integrity of the secondary battery is enhanced, thus avoiding the area from protruding and becoming the largest deformation area after a reforming process of the secondary battery and the secondary battery expands due to charging and discharging.

Second, the secondary battery winding formation system according to the second aspect of the present invention is elaborated.

With reference to Fig. 1, the secondary battery winding formation system according to the present invention comprises a working platform 201, a winding mechanism 202, an anode electrode plate unwinding roller 203, an anode electrode plate cleaning mechanism 204, an anode electrode plate die-cutting mechanism 205, an anode electrode tab supply mechanism 206, an anode electrode tab connection mechanism 207, an anode electrode plate convey mechanism 208, a cathode electrode plate unwinding roller 209, a cathode electrode plate cleaning mechanism 210, a cathode electrode plate die-cutting mechanism 211, a cathode electrode tab supply mechanism 212, a cathode electrode tab connection mechanism 213, a cathode electrode plate convey mechanism 214, a first separator unwinding roller 215A, a second separator unwinding roller 215B, a first separator convey mechanism 216A and a second separator convey mechanism 216B.

The working platform 201 is fixed immovably.

The winding mechanism 202 is disposed on the working platform 201.

The anode electrode plate unwinding roller 203 is disposed on the working platform 201, and is wound with anode electrode plate 101, wherein, the anode electrode plate 101 comprises: an anode current collector 1011; and an anode active layer 1012 disposed on the surface of the anode current collector 1011.

The anode electrode plate cleaning mechanism 204 is disposed on the working platform 201, is located at the downstream of the anode electrode plate unwinding roller 203, and is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery.

The anode electrode plate die-cutting mechanism 205 is disposed on the working platform 201, is located at the downstream of the anode electrode plate cleaning mechanism 204, and is

used for, at the side edge of the anode electrode tab receiving groove 1013, die-cutting the anode electrode plate 101 to form an anode electrode plate die-cut notch 1014 extending through the anode electrode plate 101.

The anode electrode tab supply mechanism 206 is disposed on the working platform 201, is located at the downstream of the anode electrode plate die-cutting mechanism 205, is wound with an anode electrode tab 102, and is used for supplying the anode electrode tab 102 to the anode electrode tab receiving groove 1013 of the anode electrode plate 101 of the anode electrode plate die-cut notch 1014, such that the anode electrode tab 102 is received in the anode electrode tab receiving groove 1013.

The anode electrode tab connection mechanism 207 is disposed on the working platform 201, is located at the downstream of the anode electrode plate die-cutting mechanism 205, and is used for electrically connecting and fixing the anode electrode tab 102 received in the anode electrode tab receiving groove 1013 to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

The anode electrode plate convey mechanism 208 is disposed on the working platform 201, and is used for conveying the anode electrode plate 101 unwound from the anode electrode plate unwinding roller 203 to the winding mechanism 202 sequentially via the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207. The cathode electrode plate unwinding roller 209 is disposed on the working platform 201, and is wound with a cathode electrode plate103, wherein, the cathode electrode plate103 comprises: a cathode current collector 1031; and a cathode active layer 1032 disposed on the surface of the cathode current collector 1031.

The cathode electrode plate cleaning mechanism 210 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate unwinding roller 209, and is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery.

The cathode electrode plate die-cutting mechanism 211 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate cleaning mechanism 210, and is used for, on the side edge of the cathode electrode tab receiving groove 1033, die-cutting the cathode electrode plate 103 to form a cathode electrode plate die-cut notch 1034 extending through the cathode electrode plate 103.

The cathode electrode tab supply mechanism 212 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate die-cutting mechanism 211, is wound with a cathode electrode tab 104, and is used for supplying the cathode electrode tab 104 to the cathode electrode tab receiving groove 1033 of the cathode electrode plate 103 having die-cut out the cathode electrode plate die-cut notch 1034, such that the cathode electrode tab 104 is received in the cathode electrode tab receiving groove 1033.

The cathode electrode tab connection mechanism 213 is disposed on the working platform 201, is located at the downstream of the cathode electrode plate die-cutting mechanism 211, and is used for electrically connecting and fixing the cathode electrode tab 104 received in the cathode electrode tab receiving groove 1033 to the cathode current collector 1031 at the cathode electrode tab_receiving groove 1033.

The cathode electrode plate convey mechanism 214 is disposed on the working platform 201,

and is used for conveying the cathode electrode plate 103 unwound from the cathode electrode plate unwinding roller 209 to the winding mechanism 202 sequentially via the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213.

The first separator unwinding roller 215A is disposed on the working platform 201, and is wound with a separator105.

The second separator unwinding roller 215B is disposed on the working platform 201, and is wound with another separator 105.

The first separator convey mechanism 216A is disposed on the working platform 201, and is used for conveying the corresponding separator 105 unwound from the first separator unwinding roller 215A to the winding mechanism 202, such that the corresponding separator 105 is configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary battery is wound and formed.

The second separator convey mechanism 216B is disposed on the working platform 201, and is used for conveying the corresponding separator 105 unwound from the second separator unwinding roller 215B to the winding mechanism 202, such that the corresponding separator 105 is configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary battery is wound and formed.

In the secondary battery winding formation system 2 according to the present invention, the winding mechanism 202, the anode electrode plate unwinding roller 203, the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205, the anode electrode tab supply mechanism 206, the anode electrode tab connection mechanism 207, the anode electrode plate convey mechanism 208, the cathode electrode plate unwinding roller 209, the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211, the cathode electrode tab supply mechanism 212, the cathode electrode tab connection mechanism 213, the cathode electrode plate convey mechanism 214, the first separator unwinding roller 215A, the second separator unwinding roller 215B, the first separator convey mechanism 216A and the second separator convey mechanism 216B are integrated on one working platform 201, thus reducing the volume of the secondary battery winding formation system 2, saving the floor area of a factory building, and reducing the manufacturing cost of the secondary battery 1; the anode electrode plate die-cutting mechanism 205 can remove burrs cleaned out by the anode electrode plate cleaning mechanism 204 and located on the current collector 1011 on the edge part of the anode electrode tab receiving groove 1013, and the cathode electrode plate die-cutting mechanism 211 can remove burrs cleaned out by the cathode electrode plate cleaning mechanism 210 and located on the current collector 1031 on the edge part of the cathode electrode tab receiving groove 1033, thus effectively preventing the manufactured secondary battery 1 from generating internal short circuit, and improving the safety performance of the manufactured secondary battery 1.

In one embodiment, the anode electrode tab receiving groove 1013 and the anode concave 1015 are respectively cleaned out on the two surfaces of the anode electrode plate 101; and the anode electrode plate convey mechanism 208 can lead and change the convey direction of the anode electrode plate 101, thus realizing a double-side cleaning effect.

In one embodiment, the cathode electrode tab receiving groove 1033 and the cathode concave 1035 are respectively cleaned out on the two surfaces of the cathode electrode plate 103; and the

cathode electrode plate convey mechanism 214 can lead and change the convey direction of the cathode electrode plate 103, thus realizing a double-side cleaning effect.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary battery winding formation system 2 further comprises a central control mechanism 217, in communication connection with and for controlling at least one selected from the anode electrode plate unwinding roller 203, the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205, the anode electrode tab supply mechanism 206, the anode electrode tab connection mechanism 207, the cathode electrode plate unwinding roller 209, the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211, the cathode electrode tab supply mechanism 212, the cathode electrode tab connection mechanism 213 and the winding mechanism 202.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1 and Fig. 3, in one embodiment, the secondary battery winding formation system 2 further comprises: a first cathode electrode plate sticking mechanism 218A, disposed on the working platform 201, located at the downstream of the cathode electrode tab connection mechanism 213, and used for sticking a first insulating adhesive tape T1 on the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; and a second cathode electrode plate sticking mechanism 218B, disposed on the working platform 201, located between the first cathode electrode plate sticking mechanism 218A and the winding mechanism 202, and used for sticking a second insulating adhesive tape T2 on the cathode active layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary battery 1 is wound and formed.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanisms 204 are two, wherein, one anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery; and the other anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode concave 1015 provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery and located exactly on the back side of the anode electrode tab receiving groove 1013; and with reference to Fig. 1 and Fig. 3, in the present embodiment, the second cathode electrode plate sticking mechanism 218B is further used for sticking a third insulating adhesive tape T3 on the cathode active layer 1032 at a position aligned with the anode concave 1015.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate cleaning mechanisms 210 are two, wherein, one cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery; and the other cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode battery concave 1035 provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery and located exactly on the back side of the cathode electrode tab receiving groove 1033; and with reference to

Fig. 1 and Fig. 3, in the present embodiment, the first cathode electrode plate sticking mechanism 218A is further used for sticking a fourth insulating adhesive tape T4 on the cathode concave 1035.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanisms 204 are two, wherein, one anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode electrode tab receiving groove 1013 provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery; and the other anode electrode plate cleaning mechanism 204 is used for cleaning out, on the anode electrode plate 101, an anode concave 1015 provided with the anode current collector 1011 at the bottom and the anode active layer 1012 on the periphery and located exactly on the back side of the anode electrode tab receiving groove 1013; with reference to Fig. 1, in the present embodiment, the cathode electrode plate cleaning mechanisms 210 are two, wherein, one cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode electrode tab receiving groove 1033 provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery; and the other cathode electrode plate cleaning mechanism 210 is used for cleaning out, on the cathode electrode plate 103, a cathode concave 1035 provided with the cathode current collector 1031 at the bottom and the cathode active layer 1032 on the periphery and located exactly on the back side of the cathode electrode tab receiving groove 1033; with reference to Fig. 1 and Fig. 3, in the present embodiment, the first cathode electrode plate sticking mechanism 218A is further used for sticking a fourth insulating adhesive tape T4 on the cathode concave 1035; and the second cathode electrode plate sticking mechanism 218B is further used for sticking a third insulating adhesive tape T3 on the cathode active layer 1032 at a position aligned with the anode concave 1015.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second battery winding formation system 2 further comprises: a plurality of anode electrode plate sensing mechanisms 219, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode 101 starting from the anode electrode plate unwinding roller 203 and passing through the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for sensing the position of the anode electrode plate 101 on the convey path; and a plurality of anode electrode plate corrective mechanisms 220, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode plate 101starting from the anode electrode plate unwinding roller 203 and passing through the anode electrode plate cleaning mechanism 204, the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for correcting the anode electrode plate 101.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second battery winding formation system 2 further comprises: a plurality of cathode electrode plate sensing mechanisms 221, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode

plate unwinding roller 209 and passing through the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for sensing the position of the cathode electrode plate 103 on the convey path; and a plurality of cathode electrode plate corrective mechanisms 222, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate unwinding roller 209 and passing through the cathode electrode plate cleaning mechanism 210, the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for correcting the cathode electrode plate 103.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the second battery winding formation system 2 further comprises: a plurality of separator sensing mechanisms 223, disposed on the working platform 201, in communication connection with the central control mechanism 217, respectively located on a convey path of the corresponding separator 105 from the first separator unwinding roller 215A to the winding mechanism 202 and another convey path from the second separator unwinding roller 215B to the winding mechanism 202, and used for sensing the position of the corresponding separator 105 on the convey path.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate unwinding roller 203, the cathode electrode plate unwinding roller 209, the first separator unwinding roller 215A and the second separator unwinding roller 215B can all extend and retract in a direction perpendicular to the working platform 201. The first separator unwinding roller 215A and the second separator unwinding roller 215B extending and retracting in a direction perpendicular to the working platform 201 may cooperate with the separator sensing mechanism 223 to realize deviation correction. Therefore, the feeding of the separator does not add an independent separator corrective mechanism.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate cleaning mechanism 204 comprises: an anode electrode plate laser cleaning system 2041, for correspondingly cleaning the anode active layer 1012 of the passing anode electrode plate 101; an anode electrode plate dust removal mechanism 2042, for removing anode active layer 1012 particles generated when the anode electrode plate laser cleaning system 2041 performs cleaning; and an anode electrode plate adsorption and cooling auxiliary platform 2043, for adsorbing, fixing and cooling the anode electrode plate 101 passing through the anode electrode plate laser cleaning system 2041.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate adsorption and cooling auxiliary platform 2043 can be vacuum pumping adsorption.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate cleaning mechanism 210 comprises: a cathode electrode plate laser cleaning system 2101, for correspondingly cleaning the cathode active layer 1032 of the passing cathode electrode plate 103; a cathode electrode plate dust removal mechanism 2102, for removing cathode active layer 1032 particles generated when the cathode electrode plate laser cleaning system 2101 performs cleaning; and a cathode electrode

plate adsorption and cooling auxiliary platform 2103, for adsorbing, fixing and cooling the cathode electrode plate 103 passing through the cathode electrode plate laser cleaning system 2101.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate adsorption and cooling auxiliary platform 2103 can be vacuum pumping adsorption.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate die-cutting mechanism 205 comprises: an anode electrode plate die-cutting male die mechanism 2051; and an anode electrode plate die-cutting female die mechanism 2052, for cooperating with the anode electrode plate die-cutting male die mechanism 2051 to, when the anode electrode plate 101 passes through the anode electrode plate die-cutting mechanism 205, die-cut, on the side edge of the anode electrode tab receiving groove 1013, the anode electrode plate 101 to form an anode electrode plate die-cut notch 1014 extending through the anode electrode plate 101; and an anode electrode plate die-cut waste collection mechanism 2053, for collecting the wastes die-cut off from the anode electrode plate 101.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate die-cutting mechanism 211 comprises: a cathode electrode plate die-cutting male die mechanism 2111; and a cathode electrode plate die-cutting female die mechanism 2112, for cooperating with the cathode electrode plate die-cutting male die mechanism 2111 to, when the cathode electrode plate 103 passes through the cathode electrode plate die-cutting mechanism 211, die-cut, on the side edge of the cathode electrode tab receiving groove 1033, the cathode electrode plate 103 to form a cathode electrode plate die-cut notch 1034 extending through the cathode electrode plate 103; and a cathode electrode plate die-cut waste collection mechanism 2113, for collecting the wastes die-cut off from the cathode electrode plate 103.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode tab connection mechanism 207 comprises: an anode electrode tab welding head mechanism 2071; and an anode electrode tab welding base mechanism 2072, for cooperating with the anode electrode tab welding head mechanism 2071 to weld the anode electrode tab 102 to the anode current collector 1011 at the anode electrode tab receiving groove 1013.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode tab connection mechanism 213 comprises: a cathode electrode tab welding head mechanism 2131; and a cathode electrode tab welding base mechanism 2132, for cooperating with the cathode electrode tab welding head mechanism 2131 to weld the cathode electrode tab 104 to the cathode current collector 1031 at the cathode electrode tab receiving groove 1033.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the winding mechanism 202 comprises: a dust remover 2021, for removing the dust of the anode electrode plate 101, the cathode electrode plate 103 and the two separators 105 conveyed to the winding mechanism 202; and a winding device 2022, for stacking up the anode electrode plate 101, the cathode electrode plate 103 and the two separators 105 conveyed to the winding mechanism 202, and enabling the corresponding separator 105 to be

configured between the anode electrode plate 101 and the cathode electrode plate 103 after the secondary battery is wound and formed by the winding mechanism 202.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the anode electrode plate convey mechanism 208 comprises: a fixed roller 2081, for passively enabling the anode electrode plate 101 to pass thereon; a main drive mechanism 2082, for actively driving and conveying the anode electrode plate 101; and a main drive corrective mechanism 2083, located at the upstream of the winding mechanism 202 and used for correcting the anode electrode plate 101 having entered the winding mechanism 202.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the cathode electrode plate convey mechanism 214 comprises: a fixed roller 2141, for passively enabling the cathode electrode plate 103 to pass thereon; a main drive mechanism 2142, for actively driving and conveying the cathode electrode plate 103; and a main drive corrective mechanism 2143, located at the upstream of the winding mechanism 202 and used for correcting the cathode electrode plate 103 having entered the winding mechanism 202.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the first separator convey mechanism 216A comprises a fixed roller 216A1 for passively enabling the corresponding separator 105 to pass thereon and conveying to the winding mechanism 202; and the second separator convey mechanism 216B comprises a fixed roller 216B1 for passively enabling the corresponding separator 105 to pass thereon and conveying to the winding mechanism 202.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary battery winding formation system 2 further comprises: a plurality of anode electrode plate dust removal portions 224, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the anode electrode plate 101 starting from the anode electrode plate cleaning mechanism 204 and passing through the anode electrode plate die-cutting mechanism 205 and the anode electrode tab connection mechanism 207 until the winding mechanism 202, and used for removing the anode active layer 1012 particles generated after the anode electrode plate is cleaned and the electrode tab is welded.

In the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 1, in one embodiment, the secondary battery winding formation system 2 further comprises: a plurality of cathode electrode plate dust removal portions 225, disposed on the working platform 201, in communication connection with the central control mechanism 217, located on a convey path of the cathode electrode plate 103 starting from the cathode electrode plate cleaning mechanism 210 and passing through the cathode electrode plate die-cutting mechanism 211 and the cathode electrode tab connection mechanism 213 until the winding mechanism 202, and used for removing the cathode active layer 1032 particles generated after the cathode electrode plate is cleaned and the electrode tab is welded.

A comparison is performed hereafter between the performance of the secondary battery manufactured by the secondary battery winding formation system 2 of the present invention and the performance of the secondary battery manufactured by the prior art.

Embodiment 1 takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm

thickness, 52mm width, and 72mm length) as an example. In the secondary battery 1 manufactured by the secondary battery winding formation system 2 according to the present invention, with reference to Fig. 2-5, the anode electrode plate cleaning mechanism 204 and the cathode electrode plate cleaning mechanism 210 are used to respectively clean out an anode electrode tab receiving groove 1013 and a cathode electrode tab receiving groove 1033 which are 12mm length (in the length direction L) and 8mm width (in the width direction W) at preset positions on the anode electrode plate 101 and the cathode electrode plate 103; the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 are die-cut by the anode electrode plate die-cutting mechanism 205 and the cathode electrode plate die-cutting mechanism 211 to form an anode electrode plate die-cut notch 1014 and a cathode electrode plate die-cut notch 1034 which are 12mm length and 3mm width; the long sides of the anode electrode plate die-cut notch 1014 and the cathode electrode plate die-cut notch are coincident with the corresponding long sides of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033; the anode electrode tab 102 and the cathode electrode tab 104 which are 6mm width are respectively welded in the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033. The first insulating adhesive tape T1 is stuck on the cathode electrode tab receiving groove 1033 having received the cathode electrode tab 104; the second insulating adhesive tape T2 is stuck on the cathode active layer 1032 at a position aligned with the anode electrode tab receiving groove 1013 after the secondary battery 1 is wound and formed; the third insulating adhesive tape T3 is stuck on the cathode active layer 1032 at a position aligned with the anode concave 1015 after the secondary battery 1 is wound and formed; the fourth insulating adhesive tape T4 is stuck on the cathode concave 1035; and the insulating adhesive tapes T1-T4 are 10μm thickness, 15mm length and 24mm width. The insulating adhesive tape is not stuck on the anode electrode plate 101. The secondary battery structure according to one embodiment of the present invention is manufactured as above.

Comparison example 1 also takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example, and uses the conventional independent laser cleaning device, welding device and winding device in the prior art to manufacture a secondary battery. With reference to Fig. 6, except that the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 are not die-cut and removed and that T1-T4 adopt a 35μm thickness insulating adhesive tape, the others are the same as the embodiment 1.

Comparison example 2 also takes the manufacturing of the 335272 type cell (the finished battery is 3.3mm thickness, 52mm width, and 72mm length) as an example, wherein, except thatT1-T4 adopt a 10μm thickness insulating adhesive tape, the others are the same as the comparison example 1.

Twenty pouch cell lithium ion battery samples are respectively selected from the embodiment 1, the comparison example 1 and the comparison example 2 to perform capacity test and thickness measurement; and then the tested pouch cell lithium ion battery samples are dismantled to observe the internal short circuit situation of the cleaning grooves. The results are as shown in table 1.

Table 1: the test results of the embodiment 1 and the comparison examples 1-2

	Average capacity mAh	Average volume energy density Wh/L	Average thickness mm	The number of samples generating internal short circuit
Embodiment 1	3027.5	937	3.28	0
Comparison example 1	3027.3	925	3.32	0
Comparison example 2	3027.4	937	3.28	12

It can be seen from the above table 1 that: in the embodiment 1, the secondary batterys manufactured by the secondary battery winding formation system 2 of the present invention ensure a high average volume energy density while none of the cells generates internal short circuit; in the comparison example 1, similarly, none of the cells generates the internal short circuit problem, however the average volume energy density is obviously reduced because a thick insulating adhesive tape is stuck; and in the comparison example 2, a high average volume energy density is ensured, however a high ratio of cells generate internal short circuit.

Therefore, in the embodiment 1, the electrode plate structure using die-cutting off the burr areas on the side edges of the anode electrode tab receiving groove 1013 and the cathode electrode tab receiving groove 1033 can completely solve the internal short circuit problem caused by the burrs, thus improving the safety use performance of the cell; furthermore, the secondary battery winding formation system 2 can reduce the comprehensive manufacturing cost of the cell.

ABSTRACT OF THE DISCLOSURE

The present invention provides a secondary battery. The secondary battery comprises a first electrode tab and a first electrode plate. The first electrode plate first electrode plate comprises a first current collector, a first active layer, a first electrode tab receiving groove and a first electrode plate notch. The first active layer is disposed on a surface of the first current collector. The first electrode tab receiving groove is configured to receive the first electrode tab, and the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove. The first electrode plate notch is disposed on an edge of the first electrode tab receiving groove.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/908,327	Filing Date 02/28/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT	05/16/2019	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/LISA THOMAS/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	DHNG001.001C1	2611

20995 7590 10/24/2019

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EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
10/24/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

efiling@knobbe.com
jayna.cartee@knobbe.com

Office Action Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 28 February 2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-3,5-6,8-10 and 12 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3,5-6,8-10 and 12 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 28 February 2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 102

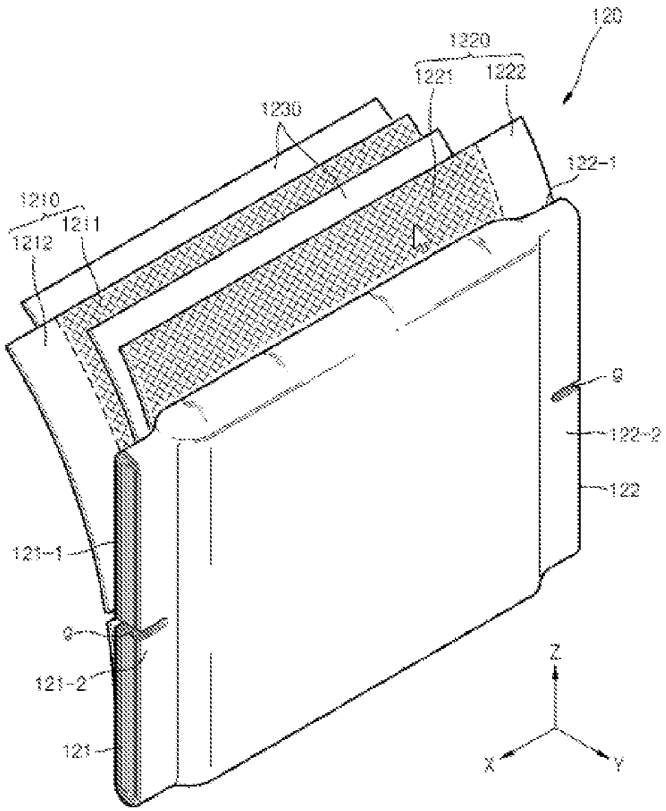
The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.
>
> (a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

Claims 1-3, 5, 6, 8 are rejected under 35 U.S.C. 102(a)(1 or 2) as being anticipated by Woo (US Pub 2013/0252053 newly cited).

In regard to claim 1, Woo teaches a secondary battery (title), comprising: a first and second electrode tab (current collector 131, 132, lead tabs 131b, 132b); a first and second electrode plate (plates 1210, 1220), comprising: a first and second current collector (coated portions 1211, 1221 and uncoated portions 1212, 1222); and a first and second active layer (the coating on the coated portions), disposed on a surface of the first and second current collector, respectively; a first and second electrode tab receiving groove (groove g) configured to receive the first and second electrode tab, respectively, wherein, the first and second electrode tab is electrically connected with the first and second current collector through the first and second electrode tab receiving groove, respectively (paragraph [0063]); a first electrode plate notch (as there is no distinction between a notch and a groove, an additional groove

g in adjacent wound portion of current collector 1212, 1222 is reasonably considered a notch), disposed on the an edge of the first electrode tab receiving groove (see figures 3-5, paragraphs [0063-0082], figure 3 reproduced below).



In regard to claim 2, the prior art teaches a second (cathode/positive) electrode tab, second electrode plate and second current collector with receiving groove identical to the first (anode/negative) electrode construction as applied above (paragraphs [0066-0067] - the prior art uses the opposite convention of the claims, the first components are positive and the second set is the negative components in the prior art and vice/versa in the claims, the Examiner notes that “first” and “second” are arbitrary designations).

In regard to claim 3, the electrode plate 1210 is a positive (i.e. cathode) plate (and the associated components are also cathode components) and the plates 1220 is a negative plate (i.e. an anode with associated anode components) (paragraphs [0066-0067]).

In regard to claim 5, the secondary battery cell battery is a wound-type battery (paragraph [0069], figure 3).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

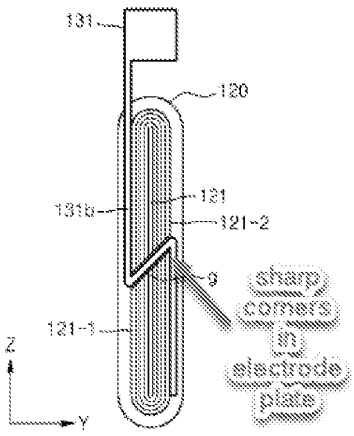
> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 6 is rejected under 35 U.S.C. 103 as being unpatentable over Woo as applied to claim 1 above and further in view of Webb et al. (USP 6,300,002 newly cited).

Woo teaches electrode plate grooves and notches as applied above which may be bent at various angles such as seen in figures 6a and 6b (6A included here) which has sharp corners and the notches and groove of the electrode plate 121 generally have the same length and width.

However, the prior art does not disclose a length of the anode first electrode plate notch in the length direction is 0.9-1.2 times of the a length of the anode first electrode tab receiving groove along a length direction of the first electrode plate: and a width of the anode first electrode plate notch in the width direction

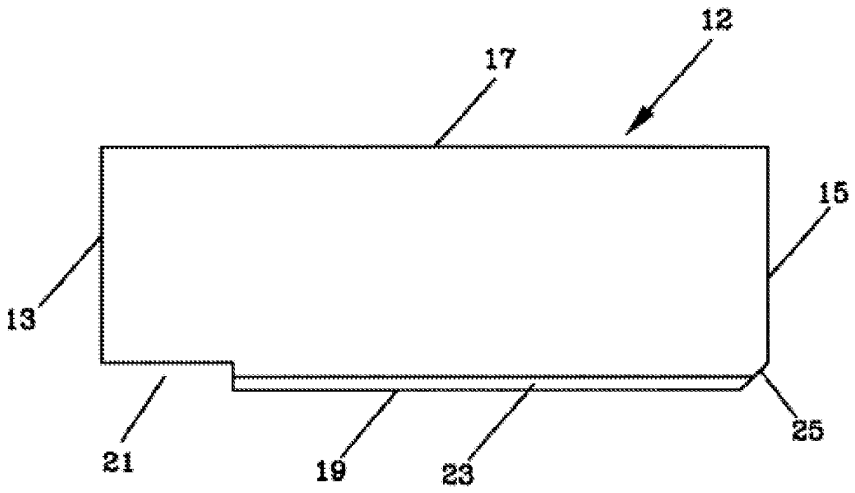
FIG. 6A



is 0.2-0.8 times a width of the anode first electrode tab receiving groove along a width direction of the first electrode plate.

However Webb et al. teach a similar electrode plate 12 which is wound into a cylindrical battery including an anode and cathode with uncoated portions 23 and the desirability to notch edge portions 21, 25 etc. of the electrode plates in order to prevent corners from penetrating other components of the battery and causing short circuits (figure 3 reproduced below, figures and columns 2-4).

FIGURE 3



Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to notch corners of the electrode plate of Woo in various degrees to prevent sharp edges from causing short circuits as taught by Webb et al. In such a combination, a person of ordinary skill in the art would appreciate that the corners of certain edge portions of the groove g of Woo with sharp turns could be made with a different geometry (such as a larger or smaller width) than the rest of groove portions such that a ratio different than 1 is present in a manner which obviates the claimed range absent evidence of criticality (see MPEP 2144.05) as changes to size and shape of the prior art notched groove portions is well with the level of ordinary skill in the art (MPEP 2144.04 Part IV).

Claims 8-10 and 12 are rejected under 35 U.S.C. 103 as being unpatentable over Woo as applied to claim 1 above and further in view of Kim et al. (US Pub 2004/0161662 newly cited).

In regard to claims 8-10 and 12, Woo teaches electrode plates with grooves and notches (which are considered concave portions on both sides, see figure 3) which are connected to a lead tab as applied above, but does not specifically teach insulating adhesive tapes.

However, Kim et al. teach similar wound (jelly roll) type battery unit and winding method (see title) including an anode and positive electrode plate 35 including a positive electrode current collector 41, a positive active material layer 42, a negative electrode plate 26, negative electrode current collector 410, negative electrode tab welded to a negative electrode uncoated area 411 etc. and the desirability to include at least four different insulating tapes 491, 492, 480, 481, 490, 890, 880 on various connections between uncoated portions of the current collector and leads tabs and other the components of the battery (see paragraphs [00400-0080], figures 4-8) which prevents short circuits from forming the battery during winding and covers burrs (paragraphs [0085-0086]) which are presumably single sided tapes as no double sided tapes are disclosed.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to include insulating tapes at various portions of the positive electrode and negative electrode plate windings (including the concave notches and grooves) and lead tabs connections of Woo as such prevents short circuits as taught by Kim et al.

The duplication as well as location and arrangement of those tapes is an obvious modification to the prior art depending on the winding structure and portions which are notched and potentially include burrs (see MPEP 2144.04 Part VI).

Relevant Publications

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Tao et al. (US Pub 2015/0207111, applicant's own work) is considered relevant to the claimed invention. Shiu et al. (US Pub 2017/0092925), while not qualifying as prior art, is considered relevant to the claimed invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached on Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Notice of References Cited	Application/Control No. 15/908,327	Applicant(s)/Patent Under Reexamination Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	Art Unit 1723	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20130252053-A1	09-2013	Woo; Seok-Gyun	H01M2/26	429/94
*	B	US-20040161662-A1	08-2004	Kim, Chang-Seob	H01M2/263	429/94
*	C	US-6300002-B1	10-2001	Webb; Randle K.	H01M4/04	429/94
*	D	US-20170092925-A1	03-2017	Shiu; Brian K.	H01M2/263	1/1
*	E	US-20150207111-A1	07-2015	Tao; Tao	H01M10/0525	429/162
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
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	Q					
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	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC - Searched*		
Symbol	Date	Examiner
H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20	10/18/2019	NPD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East search with inventor/applicant search and text search of CPC classes H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431 (see attached)	10/18/2019	NPD

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	2	cn-203574050-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:17
S2	38	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS.AANM.	USPAT	OR	ON	2019/10/17 13:17
S3	701	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/10/17 13:20
S4	4	(S2 S3) and notch with electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:21
S5	156868	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S6	22720	(H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S7	289	S6 and (electrode collector) with notch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:33
S8	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 13:39
S9	495	S6 and (electrode collector) with (notch groove) same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/10/17 13:41

			DERWENT; IBM_TDB			
S10	423	S6 and (electrode collector) with (notch groove) with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S11	7	S6 and (electrode collector) with (notch groove) near3 edge with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:46
S12	54	S6 and (electrode collector) with (notch groove) near3 edge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:47
S13	57	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" | "20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" | "20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 13:49
S14	1	(13/593213).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:43
S15	5	("20060024572" | "20060063068" | "20070092791" | "20100233521" | "20110200865").PN. OR ("9219267").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 15:44
S16	3	S6 and (electrode collector) with (notch groove) with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2019/10/17 15:48

			IBM_TDB			
S17	3	S6 and notch$4 with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:51
S18	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 15:54
S19	0	(14/596873).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:57
S20	2	S6 and (electrode collector) with (notch groove) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:05
S21	77	S6 and (electrode collector) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:06
S22	15	S6 and (electrode collector) with chamfer$5 same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:08
S23	877	S6 and (electrode collector) same insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S24	40	S6 and (electrode collector) same insulat$5 with tape with (groove notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S25	4	S6 and (electrode collector) same fourth near2 insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:13

EAST Search History (Interference)

< This search history is empty>

10/18/2019 11:32:05 AM
C:\Users\ndaniello\Documents\EAST\Workspaces\15908327.wsp

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	15/908327
	Filing Date	February 28, 2018
	First Named Inventor	Peipei Guo
	Art Unit	1723
(Multiple sheets used when necessary)	Examiner	Cano, Milton I.
SHEET 1 OF 1	Attorney Docket No.	DHNG001.001C1

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	1	CN 105406028 A	03-16-2016	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	2	CN 105990612 A	10-05-2016	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	3	CN 202495523 U	10-17-2012	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	4	CN 203733894 U	07-23-2014	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	5	CN 204905336 U	12-23-2015	NINGDE AMPEREX TECHNOLOGY LIMITED		X
	6	CN 205355186 U	06-29-2016	NINGDE AMPEREX TECHNOLOGY LIMITED		X

28281419

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.P.D/

Examiner Signature	/NICHOLAS P D'ANIELLO/	Date Considered	10/17/2019

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

Bibliographic Data

Application No: 15/908,327

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /NICHOLAS P D'ANIELLO/ Examiner's Signature | Initials

Title: SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
02/28/2018	429	1723	DHNG001.001C1
RULE			

APPLICANTS

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Ping He Ningde, CHINA

Hongxin Fang Ningde, CHINA

Wenqiang Cheng Ningde, CHINA

CONTINUING DATA

This application is a CON of PCT/CN2015/088638 08/31/2015

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

03/23/2018

STATE OR COUNTRY

CHINA

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FOURTEENTH FLOOR
IRVINE, CA 92614
UNITED STATES

FILING FEE RECEIVED

$1,720

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor	:	Peipei Guo
App. No.	:	15/908327
Filed	:	February 28, 2018
For	:	SECONDARY BATTERY
Examiner	:	Cano, Milton I.
Art Unit	:	1723
Conf. No.	:	2611

AMENDMENT AND RESPONSE TO OFFICE ACTION

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The Office Action mailed on October 24, 2019 has been carefully considered. Reconsideration and allowance of the claims, as amended, are respectfully requested.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 5 of this paper.

Electronic Acknowledgement Receipt	
EFS ID:	38333461
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	20995
Filer:	Daniel J. Fischer/Melissa Ramirez
Filer Authorized By:	Daniel J. Fischer
Attorney Docket Number:	DHNG001.006C1
Receipt Date:	17-JAN-2020
Filing Date:	28-FEB-2018
Time Stamp:	17:40:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		DHNG001006C1_OAR.pdf	81693 3376afef256db39cb5f3ac6185ee6c2bba674d3d	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	5	8
	Claims	2	4
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	81693	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Prior to entry of this amendment, Claims 1-3, 5-6, 8-10, 12, 21, and 22 are pending, of which claim 1 is independent.

Claims 1-3, 5-6, 8 are allegedly rejected under 35 U.S.C. §102 (a) (1 or 2) as being anticipated by U.S. Patent Application Publication No. 2013/0252053 ("Woo"). Claim 6, is rejected under 35 U.S.C. §103 as allegedly being unpatentable over Woo and further in view of US 6,300,002 ("Webb"). Claims 8-10 and 12 are rejected under 35 U.S.C. §103 as allegedly being unpatentable over Woo and further in view of U.S. Patent Application Publication No.2004/0161662 ("Kim").

By this amendment, claim 1 has been amended. Support for these amendments can be found at least at paragraph 7 of page 7 and fig. 2 of the application as filed. Claim 3 has been amended. Support for these amendments can be found at least at paragraph 4 of page 7 of the application as filed. Claims 21 and 22 are newly added, and support for these can be found at least at paragraphs [0012], [0013], [0019], and [0025]. Therefore, Applicant believes no new matter is introduced as a result of the amendments. Reconsideration and allowance of the claims in view of the foregoing amendments and in view of the comments to follow are respectfully requested.

Rejections of the claims under 35 U.S.C. §102 (a) (1 or 2)

Claims 1-3, 5-6, 8 are rejected under 35 U.S.C. §102 (a) (1 or 2) as allegedly being anticipated by U.S. Patent Application Publication No. 2013/0252053 ("Woo").

Claims 1-3, 5-6, 8, 21, and 22

Amended claim 1 recites "a first electrode tab receiving groove, provided with the first current collector at a bottom and the first active layer on a periphery." Applicant respectfully submits that this claimed element is not obvious over Woo.

On pages 2 and 3 of the Office Action with respect to the rejection of claim 1, the Office asserts that, with reference to Fig. 3 of Woo (reproduced below), the groove g is equivalent to the first electrode tab receiving groove of Claim 1.

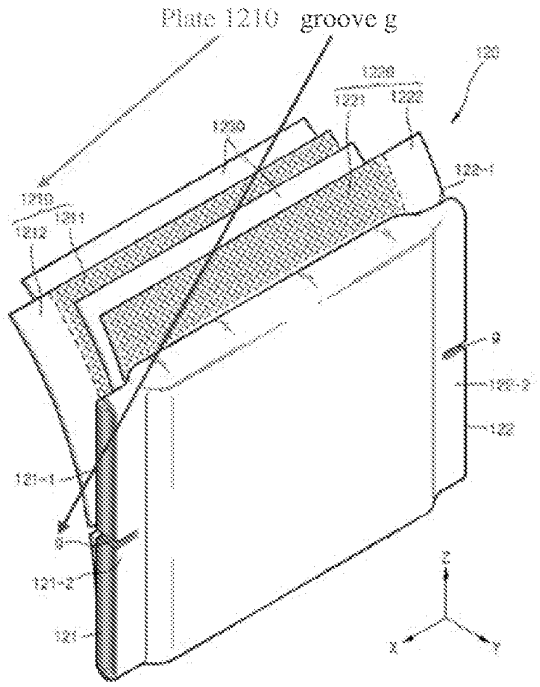


Fig. 3 of Woo

With reference to FIG. 3 of Woo, Woo contrastingly discloses groove g (which the Office Action considers equivalent to the first electrode tab receiving groove of Claim 1) extends through the uncoated portion 1212 (which the Office Action considers equivalent to the first current collector of Claim 1) of plate 1210 (which the Office Action considers equivalent to the first electrode plate of Claim 1).

Therefore, Applicant respectfully submits that the groove g of Woo cannot provide with the uncoated portion 1212 at a bottom.

Besides, the groove g of Woo is provided with the uncoated portion 1212 at a periphery, rather than the coating (which the Office Action considers equivalent to the first active layer of Claim 1) on the coated portions 1211.

For at least these reasons, Applicant respectfully submits that Woo does not teach or disclose each and every element of Claim 1. Accordingly, Applicant respectfully requests the rejection of Claim 1, and its dependents, be withdrawn and the claims indicated as allowable.

Rejections of the claims under 35 U.S.C. §103

Claim 6, is rejected under 35 U.S.C. §103 as being unpatentable over Woo and further in view of US 6,300,002 ("Webb"). Claims 8-10 and 12 are rejected under 35 U.S.C. §103 as being unpatentable over Woo and further in view of U.S. Patent Application Publication No.2004/0161662 ("Kim").

Claims 6, 8-10, and 12 depend from Claim 1, and are therefore likewise allowable over the cited references, not only because they depend from an allowable base claim, but also because each of these claims recites a unique combination of features that are not disclosed, taught, or suggested by the cited references. Accordingly, Applicant respectfully requests the rejection of Claims 6, 8-10, and 12 be withdrawn and the claims indicated as allowable.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: January 17, 2020

By:/Daniel J. Fischer/_____
Dan Fischer
Registration No. 68,043
Registered Practitioner
Customer No. 20995
(212) 849-3000

AMEND

32049273

AMENDMENTS TO THE CLAIMS

1. (**Currently Amended**) A secondary battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector;

a first active layer, disposed on a surface of the first current collector;

a first electrode tab receiving groove, provided with the first current collector at a bottom and the first active layer on a periphery, the first electrode tab receiving groove configured to receive the first electrode tab, wherein, the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove.

2. (**Previously presented**) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector;

a second active layer, disposed on a surface of the second current collector;

a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch, disposed on an edge of the second electrode tab receiving groove.

3. (**Currently Amended**) The secondary battery according to claim 2, wherein,

the first electrode plate is an anode electric plate;

the first current collector is an anode current collector;

the first active layer is an anode active layer;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active layer is a cathode active layer;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove;

the second electrode plate notch is a cathode electrode plate notch.

4. (**Cancelled**)

5. (**Previously presented**) The secondary battery according to claim 3, wherein, the secondary battery is a wound-type battery.

6. (**Previously presented**) The secondary battery according to claim 3, wherein,

a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and

a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (**Cancelled**)

8. (**Previously presented**) The secondary battery according to claim 3, further comprising:

a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and

a second insulating adhesive tape, disposed on the second active layer and facing the first electrode tab receiving groove.

9. (**Previously presented**) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape;

the anode electrode plate comprising an anode concave, wherein, the anode concave and the anode electrode tab receiving groove are relatively deposed on both sides of the anode current collector;

the anode active layer is not deposed on the anode concave, the third insulating adhesive tape is disposed on the anode concave.

10. (**Previously presented**) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode concave, wherein, the cathode concave and the cathode electrode tab receiving groove are relatively deposed on both sides of the cathode current collector;

cathode active layer is not deposed on the cathode concave, the fourth insulating adhesive tape is disposed on the cathode concave.

11. (**Cancelled**)

12. (**Previously presented**) The secondary battery according to claim 10, wherein, each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (**Cancelled**)

21. (**New**) The secondary battery according to claim 1, wherein, the first electrode plate notch extends through the first current collector.

22. (**New**) The secondary battery according to claim 2, wherein, the second electrode plate notch extends through the second current collector.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/908,327	Filing Date 02/28/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT	01/17/2020	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 11	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/KAREN T WASHINGTON/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	DHNG001.006C1	2611

20995 7590 01/31/2020

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
01/31/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

efiling@knobbe.com
jayna.cartee@knobbe.com

Office Action Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 17 January 2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-3,5-6,8-10,12 and 21-22 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3,5-6,8-10,12 and 21-22 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 28 February 2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

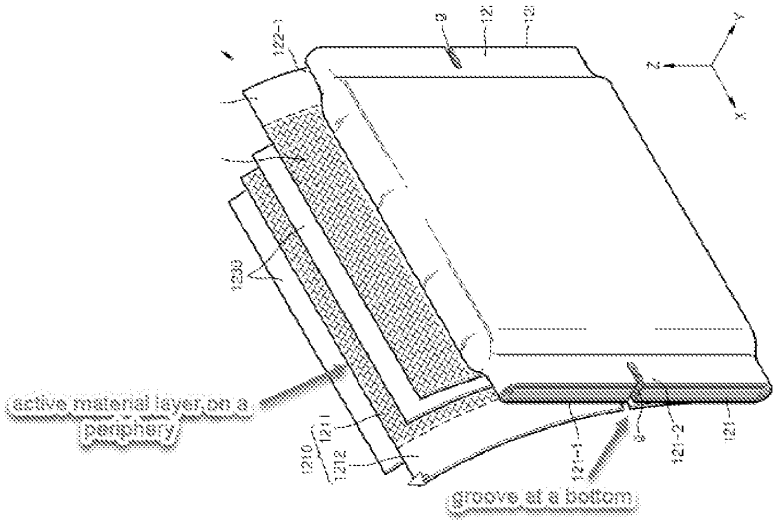
DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

Applicant's arguments filed 17 January 2020 have been fully considered but they are not persuasive. Specifically, applicant argues that the prior art does not disclose the amended limitations. However, as seen in the annotated figures below, the term “a bottom” is not defined in a manner which would prevent the rotated assembly of the prior art from reasonably being considered to have a notch at a bottom (the orientation of the prior art battery is arbitrary and may be selected based on the claimed features), further as seen in the figure the active material extends to “a periphery” as the term has not been given further definition in the claims relative to any of the other components and the active material of the prior art is present along the peripheral edges in the winding direction.



Therefore, the rejection is maintained and is FINAL. All of the references used herein are of record and no PTO-892 is attached.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.
>
> (a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

Claims 1-3, 5, 6, 8, 21 and 22 are rejected under 35 U.S.C. 102(a)(1 or 2) as being anticipated by Woo (US Pub 2013/0252053 of record).

In regard to claim 1, Woo teaches a secondary battery (title), comprising: a first and second electrode tab (current collector 131, 132, lead tabs 131b, 132b); a first and second electrode plate (plates 1210, 1220), comprising: a first and second current collector (coated portions 1211, 1221 and uncoated portions 1212, 1222); and a first and second active layer (the coating on the coated portions), disposed on a surface of the first and second current collector, respectively; a first and second electrode tab receiving groove (groove g) provided with the first current collector 1212 at a bottom and the first active layer 1211 on a periphery (see annotated figure 3 above), the first electrode tab receiving groove configured to receive the first and second electrode tab, respectively, wherein, the first and second electrode tab is electrically connected with the first and second current collector through the first and second electrode tab receiving groove, respectively (paragraph [0063]); a first electrode plate notch (as there is no distinction between a notch and a groove, an additional groove g in adjacent wound portion of current collector 1212, 1222 is reasonably considered a notch), disposed on the an edge of the first electrode tab receiving groove (see figures 3-5, paragraphs [0063-0082], figure 3 reproduced above).

In regard to claim 2, the prior art teaches a second (cathode/positive) electrode tab, second electrode plate and second current collector with receiving groove identical to the first (anode/negative) electrode construction as applied above (paragraphs [0066-0067] - the prior art uses the opposite convention of the claims, the first components are positive and the second set is the negative components in the prior art and vice/versa in the claims, the Examiner notes that "first" and "second" are arbitrary designations).

In regard to claim 3, the electrode plate 1210 is a positive (i.e. cathode) plate (and the associated components are also cathode components) and the plates 1220 is a negative plate (i.e. an anode with associated anode components) (paragraphs [0066-0067]).

In regard to claim 5, the secondary battery cell battery is a wound-type battery (paragraph [0069], figure 3).

In regard to claim 21 and 22, the first electrode plate notch g extends through the first current collector 1220 and the second electrode plate notch g extends through the second current collector 1210 (figure 3 above).

Claim Rejections - 35 USC § 103

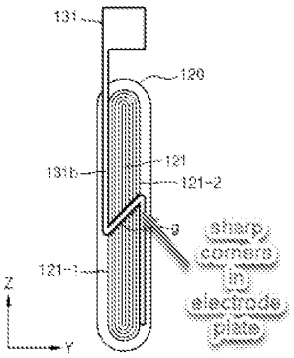
The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 6 is rejected under 35 U.S.C. 103 as being unpatentable over Woo as applied to claim 1 above and further in view of Webb et al. (USP 6,300,002 of record).

Woo teaches electrode plate grooves and notches as applied above which may be bent at various angles such as seen in figures 6a and 6b (6A included here) which has sharp corners and the notches and groove of the electrode plate 121 generally have the same length and width.

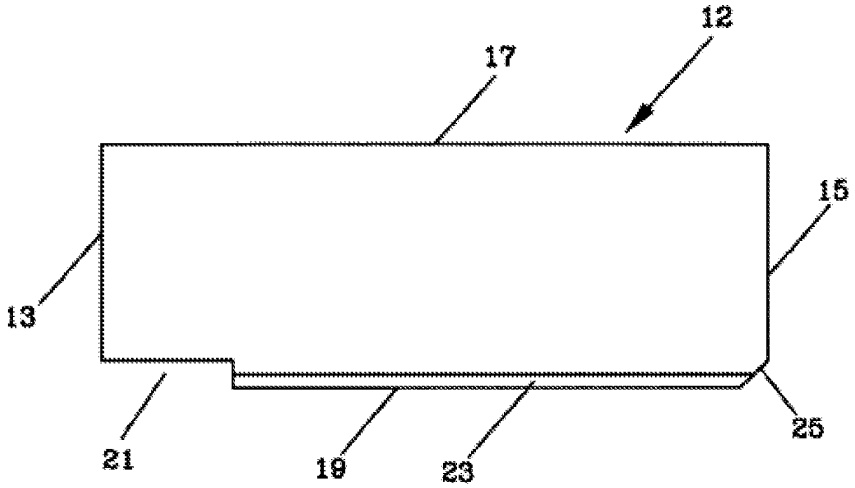
FIG. 6A



However, the prior art does not disclose a length of the anode first electrode plate notch in the length direction is 0.9-1.2 times of the a length of the anode first electrode tab receiving groove along a length direction of the first electrode plate: and a width of the anode first electrode plate notch in the width direction is 0.2-0.8 times a width of the anode first electrode tab receiving groove along a width direction of the first electrode plate.

However Webb et al. teach a similar electrode plate 12 which is wound into a cylindrical battery including an anode and cathode with uncoated portions 23 and the desirability to notch edge portions 21, 25 etc. of the electrode plates in order to prevent corners from penetrating other components of the battery and causing short circuits (figure 3 reproduced below, figures and columns 2-4).

FIGURE 3



Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to notch corners of the electrode plate of Woo in various degrees to prevent sharp edges from causing short circuits as taught by Webb et al. In such a combination, a person of ordinary skill in the art would appreciate that the corners of certain edge portions of the groove g of Woo with sharp turns could be made with a different geometry (such as a larger or smaller width) than the rest of groove portions such that a ratio different than 1 is present in a manner which obviates the claimed range absent evidence of criticality (see MPEP 2144.05) as changes to size and shape of the prior art notched groove portions is well with the level of ordinary skill in the art (MPEP 2144.04 Part IV).

Claims 8-10 and 12 are rejected under 35 U.S.C. 103 as being unpatentable over Woo as applied to claim 1 above and further in view of Kim et al. (US Pub 2004/0161662 of record).

In regard to claims 8-10 and 12, Woo teaches electrode plates with grooves and notches (which are considered concave portions on both sides, see figure 3) which are connected to a lead tab as applied above, but does not specifically teach insulating adhesive tapes.

However, Kim et al. teach similar wound (jelly roll) type battery unit and winding method (see title) including an anode and positive electrode plate 35 including a positive electrode current collector 41, a positive active material layer 42, a negative electrode plate 26, negative electrode current collector 410, negative electrode tab welded to a negative electrode uncoated area 411 etc. and the desirability to include at least four different insulating tapes 491, 492, 480, 481, 490, 890, 880 on various connections between uncoated portions of the current collector and leads tabs and other the components of the battery (see paragraphs [00400-0080], figures 4-8) which prevents short circuits from forming the battery during winding and covers burrs (paragraphs [0085-0086]) which are presumably single sided tapes as no double sided tapes are disclosed.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to include insulating tapes at various portions of the positive electrode and negative electrode plate windings (including the concave notches and grooves) and lead tabs connections of Woo as such prevents short circuits as taught by Kim et al.

The duplication as well as location and arrangement of those tapes is an obvious modification to the prior art depending on the winding structure and portions which are notched and potentially include burrs (see MPEP 2144.04 Part VI).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached on Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC - Searched*		
Symbol	Date	Examiner
H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20	10/18/2019	NPD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East search with inventor/applicant search and text search of CPC classes H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431 (see attached)	10/18/2019	NPD
update search	01/27/2020	NPD

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	206	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc. and notch with bottom	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/27 16:01
S1	2	cn-203574050-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:17
S2	38	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2019/10/17 13:17
S3	701	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/10/17 13:20
S4	4	(S2 S3) and notch with electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:21
S5	156868	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S6	22720	(H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S7	289	S6 and (electrode collector) with notch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:33

S8	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 13:39
S9	495	S6 and (electrode collector) with (notch groove) same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S10	423	S6 and (electrode collector) with (notch groove) with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S11	7	S6 and (electrode collector) with (notch groove) near3 edge with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:46
S12	54	S6 and (electrode collector) with (notch groove) near3 edge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:47
S13	57	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" | "20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" | "20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 13:49
S14	1	(13/593213).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:43
S15	5	("20060024572" | "20060063068" | "20070092791" | "20100233521" | "20110200865").PN. OR	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 15:44

		("9219267").URPN.				
S16	3	S6 and (electrode collector) with (notch groove) with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:48
S17	3	S6 and notch$4 with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:51
S18	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 15:54
S19	0	(14/596873).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:57
S20	2	S6 and (electrode collector) with (notch groove) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:05
S21	77	S6 and (electrode collector) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:06
S22	15	S6 and (electrode collector) with chamfer$5 same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:08
S23	877	S6 and (electrode collector) same insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S24	40	S6 and (electrode collector) same insulat$5 with tape with (groove notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S25	4	S6 and (electrode collector) same fourth near2 insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2019/10/17 16:13

			IBM_TDB			

EAST Search History (Interference)

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1/ 27/ 2020 4:01:37 PM
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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/908,327	Filing Date 02/28/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT	04/02/2020	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/PARTHENIA D MERRILL/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	15908327	Filing Date	2018-02-28	Docket Number (if applicable)	DHNG001.006C1	Art Unit	1723
First Named Inventor	Peipei Guo			Examiner Name	Nicholas P. D'Aniello		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 111410

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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Signature of Registered U.S. Patent Practitioner			
Signature	/Daniel J. Fischer/	Date (YYYY-MM-DD)	2020-04-02
Name	Daniel J. Fischer	Registration Number	68043

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal	
Application Number:	15908327
Filing Date:	28-Feb-2018
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Filer:	Daniel J. Fischer/Lynn Marmolijo
Attorney Docket Number:	DHNG001.006C1
Filed as Large Entity	

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1300	1300
		Total in USD ($)		**1300**

Electronic Acknowledgement Receipt	
EFS ID:	39042676
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	20995
Filer:	Daniel J. Fischer/Wendi Manzanares
Filer Authorized By:	Daniel J. Fischer
Attorney Docket Number:	DHNG001.006C1
Receipt Date:	02-APR-2020
Filing Date:	28-FEB-2018
Time Stamp:	14:18:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1300
RAM confirmation Number	E202042E18454632
Deposit Account	111410
Authorized User	Wendi Manzanares
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		amendment.pdf	265780 46ba6842120006af2b19bbfa138891b30228e02d	yes	8

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	5
Applicant Arguments/Remarks Made in an Amendment	6	8

Warnings:

Information:

2	Request for Continued Examination (RCE)	RCE_FINAL.PDF	1349937 d27bb8e18ed393fb411477a0a410d5ce06ec3eb7	no	3

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30851 0005c7c3d21b59782660acf32d52d2d6819df7e9	no	2

Warnings:

Information:

Total Files Size (in bytes):	1646568

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor	:	Peipei Guo
App. No.	:	15/908327
Filed	:	February 28, 2018
For	:	SECONDARY BATTERY
Examiner	:	D'Aniello, Nicholas P.
Art Unit	:	1723
Conf. No.	:	2611

RESPONSE TO FINAL OFFICE ACTION DATED JANUARY 31, 2020

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The Office Action mailed on January 31, 2020 has been carefully considered. Reconsideration and allowance of the claims, as amended, are respectfully requested.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

AMENDMENTS TO THE CLAIMS

1. (**Currently Amended**) A secondary-battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector;

a first active layer, disposed on a surface of the first current collector;

a first electrode tab receiving groove, provided with the first current collector at a bottom and the first active layer on a periphery, the first electrode tab receiving groove ~~configured to receive~~ receiving the first electrode tab, wherein, the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and

the first electrode tab receiving groove is formed by the first current collector and at least two first active layer walls.

2. (**Previously presented**) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector;

a second active layer, disposed on a surface of the second current collector;

a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch, disposed on an edge of the second electrode tab receiving groove.

3. (**Currently Amended**) The secondary battery according to claim 2, wherein,

the first electrode plate is an anode electrode~~ic~~ plate;

the first current collector is an anode current collector;

the first active layer is an anode active layer;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active layer is a cathode active layer;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove;

the second electrode plate notch is a cathode electrode plate notch.

4. (Cancelled)

5. (**Previously presented**) The secondary battery according to claim 3, wherein, the secondary battery is a wound-type battery.

6. (**Previously presented**) The secondary battery according to claim 3, wherein,

a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and

a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (Cancelled)

8. (**Previously presented**) The secondary battery according to claim 3, further comprising:

a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and

a second insulating adhesive tape, disposed on the second active layer and facing the first electrode tab receiving groove.

9. (**Previously presented**) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape;

the anode electrode plate comprising an anode concave, wherein, the anode concave and the anode electrode tab receiving groove are relatively deposed on both sides of the anode current collector;

the anode active layer is not deposed on the anode concave, the third insulating adhesive tape is disposed on the anode concave.

10. (**Previously presented**) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode concave, wherein, the cathode concave and the cathode electrode tab receiving groove are relatively deposed on both sides of the cathode current collector;

cathode active layer is not deposed on the cathode concave, the fourth insulating adhesive tape is disposed on the cathode concave.

11. (Cancelled)

12. (**Previously presented**) The secondary battery according to claim 10, wherein, each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (Cancelled)

21. (**Currently Amended**) The secondary battery according to claim 1, wherein, the first electrode tab receiving groove is defined in the first active layer and extends to the surface

of the first current collector, and the first electrode plate notch extends through the first current collector from the surface of the first current collector.

22. (**Currently Amended**) The secondary battery according to claim 2, wherein, the second electrode tab receiving groove is defined in the second active layer and extends to the surface of the second current collector, and the second electrode plate notch extends through the second current collector from the surface of the second current collector.

23. (**New**) The secondary battery according to claim 1, wherein, a whole of the first electrode tab is parallel with the surface of the first current collector.

REMARKS

Prior to entry of this amendment, Claims 1-3, 5-6, 8-10, 12, 21, and 22 are pending, of which Claim 1 is independent.

By this amendment, Claims 1, 21 and 22 have been amended. Support for these amendments can be found at least at fig. 2 of the application as filed. Claim 3 has been amended. Support for this amendment can be found at least at paragraph 4 of page 7 of the application as filed. Claim 23 has been added. Support for this new claim can be found at paragraph 4 of page 8. Therefore, Applicant believes no new matter is introduced as a result of the amendments. Reconsideration and allowance of the claims in view of the foregoing amendments and in view of the comments to follow are respectfully requested.

Rejections of the claims under 35 U.S.C. §102 (a) (1 or 2)

Claims 1-3, 5-6, 8, 21 and 22 are rejected under 35 U.S.C. §102 (a) (1 or 2) as being allegedly anticipated by U.S Patent Application Publication No. 2013/0252053 ("Woo").

Amended independent Claim 1 recites, *inter alia*: "a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and the first electrode tab receiving groove is formed by the first current collector and at least two first active layer walls." Applicant respectfully submits that this claimed element is not anticipated by Woo.

Woo discloses "a first uncoated portion formed on a side of the first active material portion" and "[t]he first lead tab 131b which is bent twice to pass through the groove g is welded to the first uncoated portion 121. For example, welding may be performed in a state in which a portion of the first lead tab 131b contacts a portion of the first surface 121-1 of the first uncoated portion 121 and another portion of the first lead tab 131b contacts a portion of the second surface 121-2 of the first uncoated portion 121." Woo, [0015], [0075]. This shows there is only one first active material wall on the periphery of the first uncoated portion 121. That is to say the uncoated portion 121 of Woo is not equal to the "first electrode tab receiving groove" of the present application.

With reference to FIG. 3, reproduced below, and specification [0082] of Woo, Woo discloses "[t]he groove g of the first uncoated portion 121 which has been described with reference to FIGS. 5A and 5B," so the groove of Woo is not equal to "the first electrode plate

notch" of the present application. Therefore, Woo does not disclose or teach each and every element of Claim 1.

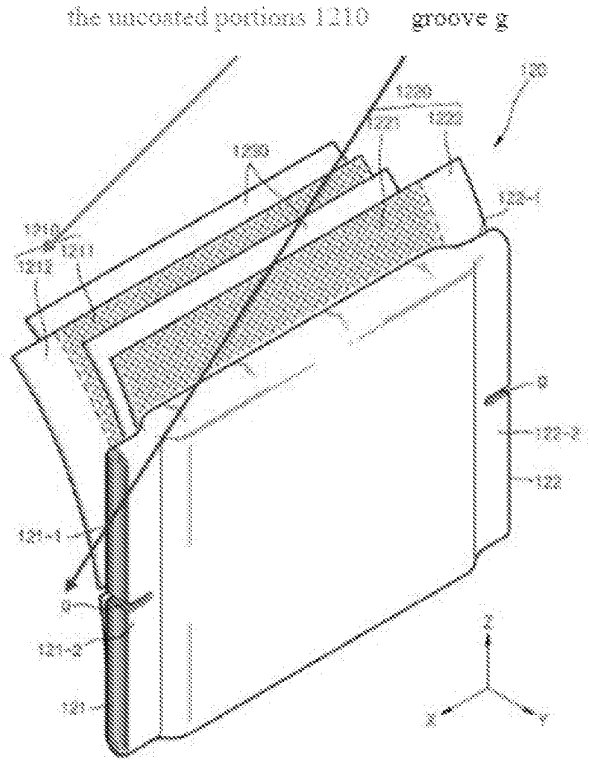


Fig. 3 of Woo

Besides, the above-mentioned distinguishing technical features are not common knowledge or commonly used technical terms in the art. Based on the above-mentioned distinguishing technical features, the technical problem to be solved in amended Claim 1 is to remove the burrs formed on the current collector. None of Woo, Webb and Kim discloses such a technical problem. For example, the technical problem to be solved in the relationship between the groove g and the lead tab 131b disclosed in Woo is how to accommodate the tab.

For at least these reasons, Applicant respectfully submits that amended Claim 1 is patentable over Woo.

Claims 2-3, 5-6, 8, 21-22, and 23 depend from Claim 1. Accordingly, Applicant respectfully requests allowance of these claims for at least the above reasons and also for their additional features.

Rejections of the claims under 35 U.S.C. §103

Claim 6, is rejected under 35 U.S.C §103(a) as allegedly being unpatentable over Woo and further in view of US 6,300,002 ("Webb et al"). Claims 8-10 and 12 are rejected under 35 U.S.C §103(a) as allegedly being unpatentable over Woo and further in view of U.S Patent Application Publication No.2004/0161662 ("Kim").

Claims 6, 8-10 and 12 depend from Claim 1. Applicant submits that neither Webb nor Kim teach or disclose the elements described above as missing from Woo. Applicant respectfully requests allowance of these claims for at least the above reasons and also for their additional features. Accordingly, Applicant respectfully requests allowance of Claims 6, 8-10, and 12.

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: April 2, 2020

By:/Daniel J. Fischer/
Dan Fischer
Registration No. 68,043
Registered Practitioner
Customer No. 20995
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UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	DHNG001.006C1	2611

20995 7590 10/19/2020

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IRVINE, CA 92614

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
10/19/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

efiling@knobbe.com
jayna.cartee@knobbe.com

Office Action Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 2 April 2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-3,5-6,8-10,12 and 21-23 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3,5-6,8-10,12 and 21-23 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 28 February 2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2 April 2020 has been entered.

Response to Arguments

Applicant's arguments with respect to claim 1 have been considered but are moot because the new ground of rejection does not rely on any reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

Claims 1-3, 5, 6 and 21-23 are rejected under 35 U.S.C. 103 as being unpatentable over Tao et al. (CN 203733894 cited in IDS, using US Pub 2015/0207111 as an English equivalent, newly cited) in view of Shiu et al. (US Pub 2016/0013455 newly cited).

In regard to claim 1, Tao et al. teach a secondary-battery (title), comprising: a first electrode tab (leads 13, 23); a first electrode plate (plates 1, 2), comprising: a first current collector (collectors 11,21) ; a first active layer (films 12, 22), disposed on a surface of the first current collector; a first electrode tab receiving groove (recess 14, 24), provided with the first current collector at a bottom and the first active layer 12, 22 on a periphery, the first electrode tab receiving groove 14, 24 receiving the first electrode tab 13, 23, wherein, the first electrode tab 13, 23 is electrically connected with the first current collector 11, 21 through the first electrode tab receiving groove 14, 24; and the first electrode tab receiving groove 14, 24 is formed by the first current collector and at least two first active layer walls (see figures 1-5, paragraphs [0028-0035]).

Independent claim 1 differs in calling for a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove. However, Shiu et al. teach a similar secondary battery (title), comprising: a first and second electrode tab (conductive tabs 110-112); a first and second electrode plate (102-106), comprising: a first and second current collector (122); and a first and second active layer (such as active material 211) disposed on a surface of the first and second current collector and the desirability to provide an electrode tab receiving section with an electrode plate notch (114-115) to facilitate bonding of the electrode layers to the battery terminals in a space efficient manner (see figure 2, paragraphs [0033-0042]) because such saves room in the battery and allows for increased energy density of the cell (paragraph [0006-0007]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to include electrode plate notches, disposed on an edge of the tab receiving grooves in the device of Tao et al. as such increases space efficiency in the cell as taught by Shiu et al.

In regard to claims 2 and 3, the prior art (both references) teach anode and cathode electrodes of the same structure which are interchangeably labeled as first or second electrodes and their respective components (each including tabs, plates, collectors, active material etc.).

In regard to claim 5, Tao et al. teach the secondary battery cell battery is a wound-type battery (figure 5).

In regard to claim 6, in such a combination, a person of ordinary skill in the art would appreciate that the recess in electrode (grooves 14 of Tao et al.) may have different geometry (depending on the size of the electrode tabs. Shiu et al. teach making enough space for the electrode tabs so that the tabs do not protrude to increase space efficiency (paragraphs [0042-0044]) in a manner which obviates the claimed range absent evidence of criticality (see MPEP 2144.05) as changes to size and shape of the prior art notched groove portions is well with the level of ordinary skill in the art (MPEP 2144.04 Part IV).

In regard to claim 21 and 22, Tao et al. teach the first electrode tab receiving groove 14 is defined in the first active layer 22 and extends to the surface of the first current collector 21 (see figure 2), and Shiu et al. teach the first electrode plate notch extends through the first current collector from the surface of the first current collector (figure 2).

In regard to claim 23, Tao et al. teach a whole of the first electrode tab 13 is parallel with the surface of the first current collector 11 (figures).

Claims 8-10 and 12 are rejected under 35 U.S.C. 103 as being unpatentable over Tao and Shiu as applied to claim 1 above and further in view of Kim et al. (US Pub 2004/0161662 of record).

In regard to claims 8-10 and 12, Tao and Shiu teach electrode plates with grooves and notches (which are considered concave portions on both sides) which are connected to a lead tab as applied above. Tao et al. teach the inclusion of insulating glue portions 15, 16 (paragraph [0057]) but does not specifically teach insulating adhesive tapes.

However, Kim et al. teach similar wound (jelly roll) type battery unit and winding method (see title) including an anode and positive electrode plate 35 including a positive electrode current collector 41, a positive active material layer 42, a negative electrode plate 26, negative electrode current collector

410, negative electrode tab welded to a negative electrode uncoated area 411 etc. and the desirability to include at least four different insulating tapes 491, 492, 480, 481, 490, 890, 880 on various connections between uncoated portions of the current collector and leads tabs and other the components of the battery (see paragraphs [00400-0080], figures 4-8) which prevents short circuits from forming the battery during winding and covers burrs (paragraphs [0085-0086]) which are presumably single sided tapes as no double sided tapes are disclosed.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to include insulating tapes at various portions of the positive electrode and negative electrode plate windings (including the concave notches and grooves) and lead tabs connections of Tao et al. as such prevents short circuits as taught by Kim et al.

The duplication as well as location and arrangement of those tapes is an obvious modification to the prior art depending on the winding structure and portions which are notched and potentially include burrs (see MPEP 2144.04 Part VI).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Shiu et al. (US Pub 2017/0092925 newly cited) teach a similar wound assembly with notches which shows the interchangeability between stacked and wound assemblies.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached on Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Notice of References Cited	Application/Control No. 15/908,327	Applicant(s)/Patent Under Reexamination Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	Art Unit 1723	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150207111-A1	07-2015	Tao; Tao	H01M4/139	429/162
*	B	US-20160013455-A1	01-2016	Shiu; Brian K.	H01M2/266	361/679.26
*	C	US-20170092925-A1	03-2017	Shiu; Brian K.	H01M10/0431	1/1
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC - Searched*		
Symbol	Date	Examiner
H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20	10/18/2019	NPD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East search with inventor/applicant search and text search of CPC classes H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431 (see attached)	10/18/2019	NPD
update search	01/27/2020	NPD
update with Global Dossier for CN counterpart prosecution	08/27/2020	NPD

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	0	(14/799345).APP.	USPAT; USOCR	OR	ON	2020/08/31 13:25
S1	2	cn-203574050-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:17
S2	38	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2019/10/17 13:17
S3	701	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/10/17 13:20
S4	4	(S2 S3) and notch with electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:21
S5	156,868	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S6	22,720	(H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S7	289	S6 and (electrode collector) with notch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/10/17 13:33

			DERWENT; IBM_TDB			
S8	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 13:39
S9	495	S6 and (electrode collector) with (notch groove) same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S10	423	S6 and (electrode collector) with (notch groove) with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S11	7	S6 and (electrode collector) with (notch groove) near3 edge with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:46
S12	54	S6 and (electrode collector) with (notch groove) near3 edge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:47
S13	57	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" | "20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" |	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 13:49

		"20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.				
S14	1	(13/593213).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:43
S15	5	("20060024572" | "20060063068" | "20070092791" | "20100233521" | "20110200865").PN. OR ("9219267").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 15:44
S16	3	S6 and (electrode collector) with (notch groove) with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:48
S17	3	S6 and notch$4 with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:51
S18	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 15:54
S19	0	(14/596873).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:57
S20	2	S6 and (electrode collector) with (notch groove) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:05
S21	77	S6 and (electrode collector) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:06
S22	15	S6 and (electrode collector) with chamfer$5 same (tab terminal)	US-PGPUB; USPAT;	OR	ON	2019/10/17 16:08

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S23	877	S6 and (electrode collector) same insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S24	40	S6 and (electrode collector) same insulat$5 with tape with (groove notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S25	4	S6 and (electrode collector) same fourth near2 insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:13
S26	206	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc. and notch with bottom	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/27 16:01
S27	2	cn-203733894-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/08/26 16:03
S28	2	cn-202423456-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/08/26 16:03
S29	2	"20150207111".pn.	US-PGPUB; USPAT; USOCR;	OR	ON	2020/08/27 10:29

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S30	58	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" | "20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" | "20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/08/31 11:47

EAST Search History (Interference)

<This search history is empty>

8/31/2020 2:02:41 PM
C:\Users\ndaniello\Documents\EAST\Workspaces\15908327.wsp

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE
THE UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint the practitioners of Morgan, Lewis & Bockius LLP, Customer Number **24341** as attorneys or agents to represent the undersigned and to transact all business before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications and patents assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 C.F.R. § 3.73(c), said appointment to be to the exclusion of the inventor(s) and their attorney(s) in accordance with the provisions of 37 C.F.R. § 3.71, provided that, if any one of these attorneys ceases being affiliated with the law firm of Morgan, Lewis & Bockius LLP as partner, counsel, or employee, then the appointment of that attorney and all powers derived therefrom shall terminate on the date such attorney ceases being so affiliated.

Assignee Name and Address:

Ningde Amperex Technology Limited
No. 1, Xingang Road, Zhangwan Town
Jiaocheng Zone, Ningde City
Fujian Province, P. R. China 352100

SIGNATURE of Assignee of Record

The undersigned whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	Houyong Li		
Name	Houyong LI	Date	Feb. 24, 2014
Title	IP Manager	Telephone	+86-0593-258-2597

A copy of this form, together with a statement under 37 C.F.R. § 3.73(c) (Form PTO/SB96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 C.F.R. § 3.73(c) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee and must identify the application in which this Power of Attorney is to be filed.

DB2/ 24723704.1

Electronically filed November 11, 2020

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei GUO, et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit	1723
Filed:	February 28, 2018	Examiner:	D'ANIELLO, Nicholas P.
For:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF	Attorney Docket No.:	024607-02-5055-US

STATEMENT UNDER 37 C.F.R. § 3.73(c)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Ningde Amperex Technology Limited, a Corporation, states that it is the assignee of the entire right, title and interest in the patent application/patent identified above by virtue of an assignment from the inventor(s) inventor(s) of the patent application/patent identified above.

The assignment was recorded in the United States Patent and Trademark Office on November 9, 2020 at Reel 054317, Frame 0891, or for which a copy thereof is attached.

The undersigned is authorized to act on behalf of the assignee.

Date: November 11, 2020

/Yalei Sun/ 57,765
Yalei Sun (Reg. No.)

MORGAN, LEWIS & BOCKIUS LLP
1400 Page Mill Road
Palo Alto, CA 94304
(650) 843-4000

Electronic Acknowledgement Receipt	
EFS ID:	41094295
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	20995
Filer:	Yalei Sun/Cheryl Rogers
Filer Authorized By:	Yalei Sun
Attorney Docket Number:	DHNG001.006C1
Receipt Date:	11-NOV-2020
Filing Date:	28-FEB-2018
Time Stamp:	13:08:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		024607-02-5055-US_Assignee_Statement.pdf	138048 e05e682f22425bb1faeeee7039955d9be1752834	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Power of Attorney	2	2
	Assignee showing of ownership per 37 CFR 3.73	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	138048	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/908,327	02/28/2018	Peipei Guo	DHNG001.006C1

CONFIRMATION NO. 2611

24341
Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

POA ACCEPTANCE LETTER

OC000000121314225

Date Mailed: 11/13/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/11/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/dtdinh/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

24341 7590 02/17/2021

Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
02/17/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

padocketingdepartment@morganlewis.com
vskliba@morganlewis.com

PTOL-90A (Rev. 04/07)

Applicant-Initiated Interview Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.		
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 2

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
NICHOLAS P D'ANIELLO	Primary Examiner	Telephonic
Yalei Sun	Attorney	
Ai Leen Koh	Attorney	

Date of Interview: 11 February 2021

Issues Discussed:

Proposed Amendment(s)

Applicant's proposed amendments and agenda (see attached) were discussed. Further clarifying the proposed language to include that "the first electrode plate includes a first active layer on the first side of the current collector and a second active layer on the second side of the current collector" which includes the matching recess "opposite of the first electrode tab receiving groove" were discussed as there are in fact two distinct layers of the active material (1012 and 1012 or 1032 and 1032 in figures 2 and 3, respectively). Such amendments would appear to overcome the rejection based on Tao et al. of record because the only a single electrode material layer with a single groove is discussed. The Examiner noted that while the addition of a second electrode layer on the opposite side of the current collector is known in the art, the specific location of the matching recess is not disclosed by the prior art of record. Further search and consideration of such an amendment would be required as such was never previously claimed.

☑ Attachment

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general

indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

For email to: nicholas.daniello@uspto.gov
FOR DISCUSSION PURPOSES ONLY

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

PROPOSED INTERVIEW AGENDA

Proposed Interview Logistics

Date: February 11, 2021 (Thursday)

Time: 1:30 PM ET (10:30 AM PT)

Method: By phone

(Applicants' representative to call Examiner D'aniello at 571-270-3635)

Proposed Attendees: Primary Examiner Nicholas D'aniello

Yalei Sun (57,765 / 650-843-7558)

Ai Leen Koh (77,267 / 650-843-7823)

Proposed Interview Agenda

1. Discuss proposed amendments to claim 1 and the 103 rejection.

IN THE CLAIMS:

1. (Proposed Amendment) A secondary battery ~~secondary battery~~, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active layer, disposed on a first surface and a second surface of the first current collector, wherein the second surface is opposite the first surface;

a first electrode tab receiving groove, provided with the first surface of the first current collector at a bottom and the first active layer on a periphery, the first electrode tab receiving groove receiving the first electrode tab, wherein, the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first matching recess paired with the first electrode tab receiving groove, provided with the second surface of the first current collector at a bottom and the first active layer on a periphery;

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and

the first electrode tab receiving groove is formed by the first current collector and at least two first active layer walls.

Remarks:

Support for the proposed amendments can be found in at least FIGS. 2 and 3, and paragraphs [0135] to [0137] of the published application. No new matter has been added.

Electronically filed February 18, 2021

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Sir:

The enclosed Amendment is in response to the Office Action dated October 19, 2020 for the above identified patent application.

Petition for Extension of Time under 37 CFR 1.136. It is respectfully requested that the time for responding to the Office Action dated October 19, 2020 be extended for a period of one (1) month(s) from January 19, 2021 to February 19, 2021.

The Commissioner is hereby authorized to charge any required fee(s) to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 024607-02-5055-US).

Electronic Patent Application Fee Transmittal					
Application Number:	15908327				
Filing Date:	28-Feb-2018				
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF				
First Named Inventor/Applicant Name:	Peipei Guo				
Filer:	Yalei Sun/Cheryl Rogers				
Attorney Docket Number:	024607-02-5055-US				
Filed as Large Entity					
Filing Fees for Utility under 35 USC 111(a)					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	220	220
Miscellaneous:				
		Total in USD ($)		**220**

Electronic Acknowledgement Receipt	
EFS ID:	41960641
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	24341
Filer:	Yalei Sun
Filer Authorized By:	
Attorney Docket Number:	024607-02-5055-US
Receipt Date:	18-FEB-2021
Filing Date:	28-FEB-2018
Time Stamp:	18:59:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$220
RAM confirmation Number	E20212HI59424721
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		024607-02-5055-US_Amendment.pdf	621232 3f47f8702afca317fcec53def6f86d72d380f611	yes	10

Multipart Description/PDF files in .zip description

Document Description	Start	End
Applicant Arguments/Remarks Made in an Amendment	6	10
Claims	2	5
Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	31049 8c5f0aae2548892ac4e76677e74c0704d1b6261f	no	2

Warnings:

Information:

Total Files Size (in bytes):	652281

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

This amendment responds to the office action mailed October 19, 2020. In the office action, the Examiner:

- rejected claims 1-3, 5, 6 and 21-23 under 35 U.S.C. 103 as being unpatentable over Tao et al. (CN 203733894 cited in IDS, using U.S. Patent Publication No. 2015/0207111 as an English equivalent), in view of Shiu et al. (U.S. Patent Publication No. 2016/0013455); and
- rejected claims 8-10 and 12 under 35 U.S.C. 103 as being unpatentable over Tao and Shiu as applied to claim 1 above, and further in view of Kim et al. (U.S. Patent Publication No. 2004/0161662).

SUBSTANCE OF INTERVIEW

The Applicant thanks Primary Examiner D'aniello for the opportunity to discuss the application during a telephone interview on February 11, 2021 with Yalei Sun (undersigned attorney) and Ai Leen Koh (working under the supervision of Yalei Sun). During the interview, the Applicant and the Examiner discussed proposed amendments to claim 1. The Examiner provided suggestions to further clarify claim 1, which have been adopted by the Applicant in this Response. No specific agreement was reached.

REMARKS CONCERNING CLAIMS

Claim 1 has been amended to incorporate the claim limitations of claim 5. The claim amendments are further supported by at least FIGS. 2 and 3, and paragraphs [0135] to [0137] of the published application. No new matter has been added.

Claim 5 has been canceled.

Claims 2, 3, 6, 8-10, 12, and 21-23 have been amended to be consistent with the independent claim and to correct for informalities. No new matter has been added.

With respect to all amendments, Applicant has not dedicated or abandoned any unclaimed subject matter. Moreover, Applicant has not acquiesced to any characterizations of the invention, nor any rejections or objections of the claims, made by the Examiner. Moreover, the Applicant hereby rescinds any prior disclaimer of claim scope, to the extent they exist, made during the prosecution of this application or made during the prosecution of any patent or other related patents/applications, and advises the Examiner that any such

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previous disclaimers and the cited references that they were made to avoid may need to be revisited.

After entry of this amendment, the pending claims are: claims 1-3, 6, 8-10, 12, and 21-23.

REMARKS CONCERNING REJECTIONS UNDER 35 U.S.C. 103

I. REJECTION OF CLAIMS 1-3, 5, 6 AND 21-23 UNDER 35 U.S.C. 103 AS BEING UNPATENTABLE OVER TAO, IN VIEW OF SHIU

Claim 5 has been canceled and so its rejection is moot.

As amended, claim 1 recites:

> A secondary battery, comprising:
>
> a first electrode tab;
>
> a first electrode plate, comprising:
>
> a first current collector; and
>
> **a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface**;
>
> a first electrode tab receiving groove, defined by a portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;
>
> **a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess**;
>
> a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and
>
> the first electrode tab receiving groove is formed by the first current collector and at least two first active ~~layer~~ substance walls;
>
> **wherein the secondary battery is a wound-type secondary battery**.

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(Emphasis added)

A. The cited references do not disclose a first active substance that is disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface.

Claim 1, as amended, recites that the first electrode plate comprises a "first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface." But this claim feature of a current collector covered with active substance on both sides is not disclosed by the cited references.

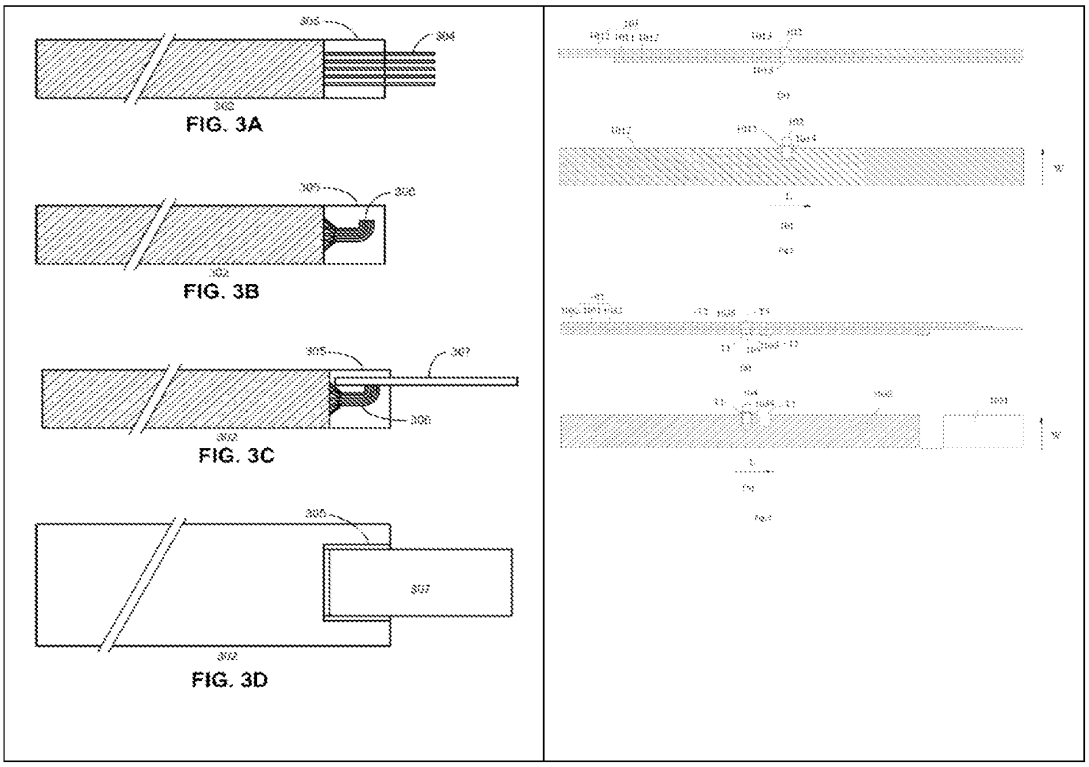
B. The cited references do not disclose a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess.

Claim 1, as amended, recites "a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess." This limitation is not disclosed by the cited references.

C. The teachings of Shiu are not compatible with claim 1 as amended.

Claim 1 as amended requires that "the secondary battery is a wound-type secondary battery." In contrast, Shiu teaches "a stacked-cell battery comprising a stack of layers, including alternating anode and cathode layers coated with active material with intervening separator layers." *See*, *e.g.*, Shiu at Abstract. Stated another way, Shiu teaches a battery that is manufactured using a stacking process whereas the pending claims are directed to a battery that is manufactured using a winding process. These two different structured batteries have very different mechanisms of electrode tab structures as depicted in FIGS. 3A-3D of Shiu and FIGS. 2(a)-2(b) and 3(a)-3(b), both reproduced below. As a result, one skilled in the art would not be able to learn from Shiu for addressing the technical problem unique to the wound-type battery. Therefore, the teachings of Shiu are not compatible with claim 1 as amended.

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Thus, for at least the above reasons, there is no prima facie case of obviousness for claim 1 and its associated dependent claims 2, 3, 6, and 21-23 over the cited combination of Tao and Shiu.

Applicant respectfully requests that these rejections be withdrawn.

II. REJECTION OF CLAIMS 8-10 AND 12 UNDER 35 U.S.C. 103 AS BEING UNPATENTABLE OVER TAO AND SHIU AS APPLIED TO CLAIM 1 ABOVE, AND FURTHER IN VIEW OF KIM

Claims 8-10 and 12 depend from patentable claim 1, so they ae patentable over Tao and Shiu. Furthermore, Kim is not cited for, and does not teach, the limitations that are missing from Tao and Shiu. Thus, there is no prima facie case of obviousness for claim 1 and its associated dependent claims 8-10 and 12 over the cited combination of Tao, Shiu, and Kim.

Applicant respectfully requests that these rejections be withdrawn.

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CONCLUDING REMARKS

By responding in the foregoing remarks only to particular positions asserted by the examiner, the Applicant does not necessarily acquiesce in other positions that have not been explicitly addressed. In addition, the Applicant's arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

In light of the above amendments and remarks, the Applicant respectfully requests that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney at (650) 843-7558, if a telephone call could help resolve any remaining items.

Respectfully submitted,

Date: February 18, 2021

/Yalei Sun/ 57,765

Yalei Sun (Reg. No.)
MORGAN, LEWIS & BOCKIUS LLP
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Palo Alto, CA 94304
Phone: (650) 843-7558
E-mail: yalei.sun@morganlewis.com

Amendments to the Claims

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A secondary battery ~~secondary battery~~, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active substance ~~layer~~, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface;

a first electrode tab receiving groove, ~~provided with~~ defined by a portion of the first surface of the first current collector ~~at a bottom~~ and the first active substance ~~layer~~ on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein[[,]] the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess;

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and

the first electrode tab receiving groove is formed by the first current collector and at least two first active ~~layer~~ substance walls;

wherein the secondary battery is a wound-type secondary battery.

2. (Currently Amended) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector; and

a second active substance ~~layer~~, disposed on a surface of the second current collector;

———a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

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———a second electrode plate notch, disposed on an edge of the second electrode tab receiving groove.

3. (Currently Amended) The secondary battery according to claim 2, wherein:[[,]]
the first electrode plate is an anode electrode plate;
the first current collector is an anode current collector;
the first active substance ~~layer~~ is an anode active substance ~~layer~~;
the first electrode tab is an anode electrode tab;
the first electrode tab receiving groove is an anode electrode tab receiving groove;
the first recess is an anode recess;
the first electrode plate notch is an anode electrode plate notch;
the second electrode plate is a cathode electrode plate;
the second current collector is a cathode current collector;
the second active substance ~~layer~~ is a cathode active substance ~~layer~~;
the second electrode tab is a cathode electrode tab;
the second electrode tab receiving groove is a cathode electrode tab receiving groove; and
the second electrode plate notch is a cathode electrode plate notch.

4. (Cancelled)

5. (Cancelled)

6. (Currently Amended) The secondary battery according to claim 3, wherein:[[,]]
a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and
a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (Cancelled)

8. (Currently Amended) The secondary battery according to claim 3, further comprising:
a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and
a second insulating adhesive tape, disposed on the second active substance ~~layer~~ and facing the first electrode tab receiving groove.

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9. (Currently Amended) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape, disposed on the anode recess.[[;]]

~~the anode electrode plate comprising an anode concave, wherein, the anode concave and the anode electrode tab receiving groove are relatively deposed on both sides of the anode current collector;~~

~~the anode active layer is not deposed on the anode concave, the third insulating adhesive tape is disposed on the anode concave.~~

10. (Currently Amended) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode recess ~~concave~~, wherein[[,]] the cathode recess ~~concave~~ and the cathode electrode tab receiving groove are disposed ~~deposed~~ on opposite ~~both~~ sides of the cathode current collector; and

~~cathode active layer is not deposed on the cathode concave,~~ the fourth insulating adhesive tape is disposed on the cathode recess ~~concave~~.

11. (Cancelled)

12. (Currently Amended) The secondary battery according to claim 10, wherein:[[,]]

each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape, and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (Cancelled)

21. (Currently Amended) The secondary battery according to claim 1, wherein:[[,]]

the first electrode tab receiving groove is defined [[in]] by the first active substance ~~layer~~ and extends to the first surface of the first current collector;[[,]] and

the first electrode plate notch extends through the first current collector from the first surface of the first current collector.

22. (Currently Amended) The secondary battery according to claim 2, wherein:[[,]]

the second electrode tab receiving groove is defined in the second active substance ~~layer~~ and extends to the surface of the second current collector;[[,]] and

the second electrode plate notch extends through the second current collector from the surface of the second current collector.

23. (Currently Amended) The secondary battery according to claim 1, wherein[[,]] a whole of the first electrode tab is parallel with the first surface of the first current collector.

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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/908,327	Filing Date 02/28/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT	02/18/2021	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 11	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/TERESA J JACKSON WOODRUFF/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

24341 7590 03/09/2021

Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
03/09/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

padocketingdepartment@morganlewis.com
vskliba@morganlewis.com

PTOL-90A (Rev. 04/07)

Office Action Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 18 February 2021.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-3,6,8-10,12 and 21-23 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3,6,8-10,12 and 21-23 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 28 February 2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

Applicant's arguments with respect to claim 1 have been considered but are moot because the new ground of rejection contains a new prior art reference (Stern et al.) not previously cited which obviates the amendments and the teaching or matter is not specifically challenged in the argument.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

Claims 1-3, 6 and 21-23 are rejected under 35 U.S.C. 103 as being unpatentable over Stern et al. (WO2012/072222 using US Pub 2013/0302674 as an English equivalent, both newly cited).

In regard to claim 1, Stern et al. teach a secondary-battery (lithium ion battery - paragraph [0035]) which may be a wound-type battery (paragraph [0008]), comprising:

a first electrode tab (connection lugs 50);

a first electrode plate (anode 10 or cathode 20), comprising:

a first current collector (collector substrate 60) ;

a first active substance (coating films 70), disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite the first surface (see paragraph [0018] - coating film preferably formed on both sides of the collector substrate);

a first electrode tab receiving groove (arrestor regions 40), defined by a portion of the first surface of the first current collector and the first active substance 70 on a periphery of the electrode tab receiving groove 40, the first electrode tab receiving groove 40 receiving the first electrode tab 50, wherein the first electrode tab 50 is electrically connected with the first current collector 60 through the first electrode tab receiving groove 40 (paragraph [0019], figure 6 and 9);

a first recess (additional arrestor region 40) that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess (see figure 3 annotated below);

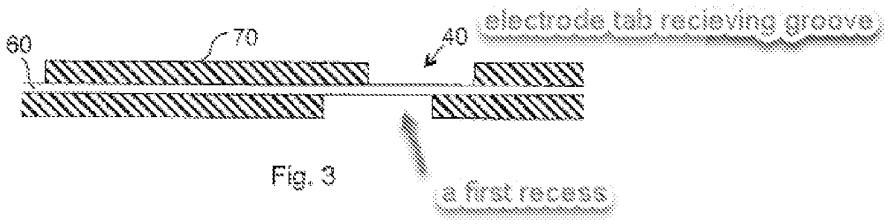


Fig. 3

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and the first electrode tab receiving groove is formed by the first current collector and at least two first active layer substance walls (see figure 9C below which was inadvertently omitted from the US PGPub but can be seen in the WO document and issued US Patent 10,062,897, paragraph [0020, 0044] - portion of collector substrate is also removed).

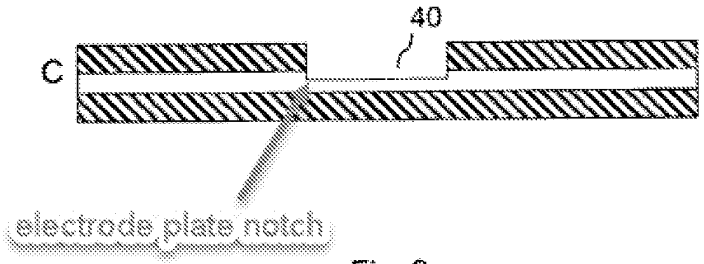


Fig. 9

Therefore, while the prior art does not disclose all of the claimed features in a single embodiment, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to form a wound battery assembly with the claimed electrode plate notches, disposed on an edge of the tab receiving grooves and recessed portion opposite thereof in the device of Stern et al. as all of the claimed features are described by the reference in a manner which could be combined together to obviate the claimed secondary battery.

In regard to claims 2 and 3, the prior art teach anode and cathode electrodes of the same structure which are interchangeably labeled as first or second electrodes and their respective components (each including tabs, plates, collectors, active material etc. - paragraph [0008]).

In regard to claim 6, a person of ordinary skill in the art would appreciate that the recess in electrode (arrestor regions of Stern et al.) may have different geometry (depending on the size of the electrode tabs which may be any size and shape (paragraphs [0019, 0044]) in a manner which obviates the claimed range absent evidence of criticality (see MPEP 2144.05) as changes to size and shape of the prior art notched groove portions is well with the level of ordinary skill in the art (MPEP 2144.04 Part IV).

In regard to claim 21 and 22, Stern et al. teach the first electrode tab receiving groove 40 is defined in the first active substance 17 and extends to the surface of the first current collector 60 (see figure 3), and the first electrode plate notch extends through the first current collector from the surface of the first current collector (figure 9, notch through entire cross section).

In regard to claim 23, Stern et al. teach a whole of the first electrode tab 50 is parallel with the surface of the first current collector 60 (figure 6).

Claims 8-10 and 12 are rejected under 35 U.S.C. 103 as being unpatentable over Stern et al. as applied to claim 1 above and further in view of Kim et al. (US Pub 2004/0161662 of record).

In regard to claims 8-10 and 12, Stern et al. teach electrode plates with grooves and notches (which are considered concave portions on both sides) which are connected to a lead tabs (connection lugs 50) as applied above but do not disclose insulating tapes on the connection portions. However, Kim et al. teach similar wound (jelly roll) type battery unit and winding method (see title) including an anode and positive electrode plate 35 including a positive electrode current collector 41, a positive active material layer 42, a negative electrode plate 26, negative electrode current collector 410, negative electrode tab welded to a negative electrode uncoated area 411 etc. and the desirability to include at least four different insulating tapes 491, 492, 480, 481, 490, 890, 880 on various connections between uncoated portions of the current collector and leads tabs and other the components of the battery (see paragraphs [00400-0080], figures 4-8) which prevents short circuits from forming the battery during winding and covers burrs (paragraphs [0085-0086]) which are presumably single sided tapes as no double sided tapes are disclosed.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to include insulating tapes at various portions of the positive electrode and negative electrode plate windings (including the concave notches and grooves) and lead tabs connections of Stern et al. as such prevents short circuits as taught by Kim et al.

The duplication as well as location and arrangement of those tapes is an obvious modification to the prior art depending on the winding structure and portions which are notched and potentially include burrs (see MPEP 2144.04 Part VI).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached on Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Notice of References Cited	Application/Control No. 15/908,327	Applicant(s)/Patent Under Reexamination Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	Art Unit 1723	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20130302674-A1	11-2013	Stern; Rainer	H01M10/0585	429/211
*	B	US-10062897-B2	08-2018	Stern; Rainer	H01M50/54	1/1
	C					
	D					
	E					
	F					
	G					
	H					
	I					
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	K					
	L					
	M					

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	WO-2012072222-A1	06-2012	WO	KASPER MICHAEL	H01M4/0402
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC - Searched*		
Symbol	Date	Examiner
H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20	10/18/2019	NPD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East search with inventor/applicant search and text search of CPC classes H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431 (see attached)	10/18/2019	NPD
update search	01/27/2020	NPD
update with Global Dossier for CN counterpart prosecution	08/27/2020	NPD
update for recess on opposite side	03/04/2021	NPD

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L8	10	("20030228517" | "20050208354" | "20060035152" | "20070139001" | "20100028767" | "5766798" | "6151338" | "6162264" | "6187473" | "8679677").PN. OR ("10062897").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2021/03/04 08:41
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S2	38	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2019/10/17 13:17
S3	701	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/10/17 13:20
S4	4	(S2 S3) and notch with electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:21
S5	156,868	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S6	22,720	(H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/10/17 13:32

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S8	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 13:39
S9	495	S6 and (electrode collector) with (notch groove) same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S10	423	S6 and (electrode collector) with (notch groove) with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S11	7	S6 and (electrode collector) with (notch groove) near3 edge with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:46
S12	54	S6 and (electrode collector) with (notch groove) near3 edge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:47
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S17	3	S6 and notch$4 with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:51
S18	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 15:54
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S21	77	S6 and (electrode collector) with chamfer$5	US-PGPUB; USPAT;	OR	ON	2019/10/17 16:06

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S25	4	S6 and (electrode collector) same fourth near2 insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:13
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S27	2	cn-203733894-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/08/26 16:03
S28	2	cn-202423456-$.did.	US-PGPUB; USPAT; USOCR;	OR	ON	2020/08/26 16:03

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S32	1	(14/991686).APP.	USPAT; USOCR	OR	ON	2021/02/11 14:06
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EAST Search History (Interference)

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(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
7. Juni 2012 (07.06.2012)

WIPO | PCT

(10) Internationale Veröffentlichungsnummer
WO 2012/072222 A1

(51) Internationale Patentklassifikation:
H01M 2/26 (2006.01) *H01M 10/0585* (2010.01)
H01M 10/04 (2006.01) *H01M 4/70* (2006.01)
H01M 4/04 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2011/005946

(22) Internationales Anmeldedatum:
25. November 2011 (25.11.2011)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2010 062 143.9
29. November 2010 (29.11.2010) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **ZENTRUM FUER SONNENENERGIE- UND WASSERSTOFF-FORSCHUNG BADEN-WUERTTEMBERG, GEMEINNÜTZIGE STIFTUNG** [DE/DE]; Industriestrasße 6, 70565 Stuttgart (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **STERN, Rainer** [DE/DE]; Frauenstraße 22, 89073 Ulm (DE). **KASPER, Michael** [DE/DE]; Mühlweg 4, 89257 Illertissen (DE).

(74) Anwalt: **RIEMANN, Joerg**; Ter Meer Steinmeister & Partner GbR, Mauerkircherstraße 45, 81679 München (DE).

(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

[Fortsetzung auf der nächsten Seite]

(54) **Title**: BATTERY ELECTRODE AND A METIIOD FOR PRODUCING SAME

(54) **Bezeichnung** : BATTERIEELEKTRODE UND VERFAIIREN ZUM IIERSTELLEN DERSELBEN

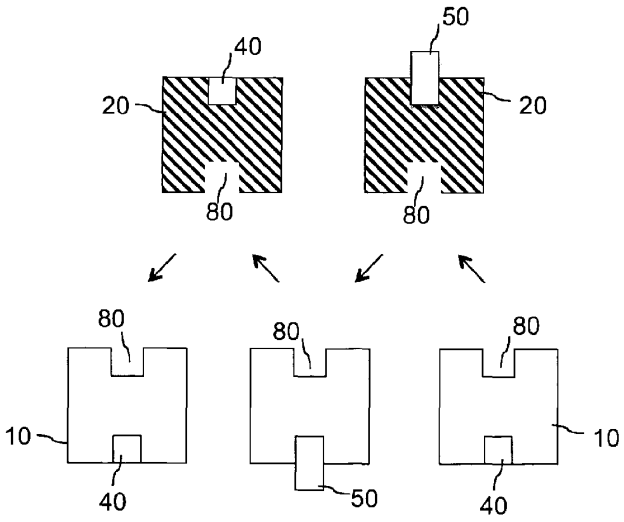


Fig. 6

(57) **Abstract**: The invention relates to a compact design for a battery with an increased energy density/volume ratio, for which production costs are low. A battery electrode and a method for producing same are therefore disclosed, wherein an arrester region is arranged on a collector substrate such that it is predominantly surrounded by a coating film.

(57) **Zusammenfassung**: Um eine kompakte Gestaltung einer Batterie mit erhöhtem Energiedichte/Volumen- Verhältnis bei geringen Herstellungskosten zu ermöglichen, wird eine Batterieelektrode und ein Verfahren zum Herstellen derselben angegeben, wobei ein Ableiterbereich auf einem Kollektorsubstrat so angeordnet ist, dass er überwiegend von einem Beschichtungsfilm umgeben ist.

WO 2012/072222 A1

(84) **Bestimmungsstaaten** *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eingehen (Regel 48 Absatz 2 Buchstabe h)*

Batterieelektrode und Verfahren zum Herstellen derselben

Technisches Gebiet

Die Erfindung betrifft eine Batterieelektrode und ein Verfahren zum Herstellen derselben.

Hintergrund der Erfindung

Im Allgemeinen bezeichnet eine Batterie sowohl nicht-wiederaufladbare Primärzellen als auch wiederaufladbare Sekundärzellen (auch Akku genannt). Batterien werden anhand der zugrundeliegenden chemischen Redoxreaktion, der eingesetzten Materialien, der elektrischen Werte (z.B. Spannung oder Kapazität) oder der geometrischen oder konstruktiven Bauform eingeteilt. Beispielsweise gibt es Alkali-Mangan-Batterien, Zink-Kohle-Batterien oder Lithiumbatterien. Entsprechend ihrem inneren Aufbau werden bei Batterien des Weiteren Wickelzellen und Stapelbatterien unterschieden. Bei einer Wickelzelle werden die übereinander angeordneten Elektroden- und Separatorschichten spiralförmig aufgewickelt und beispielsweise in eine Rundbatterie mit zylindrischem Gehäuse eingebaut. Bei einer Stapelbatterie hingegen werden mehrere Elektroden- und Separatorschichten abwechselnd übereinander gestapelt.

In Fig. 1 ist beispielhaft eine Stapelbatterie gezeigt. Wie in Fig. 1 gezeigt, ist in der Batterie abwechselnd eine Anode 10 und eine Kathode 20 angeordnet, wobei jeweils zwischen der Anode 10 und der Kathode 20 ein Separator 30 angeordnet ist, um die beiden Elektroden räumlich und elektrisch zu trennen. Der Separator 30 muss jedoch für Ionen durchlässig sein, die die Umwandlung der gespeicherten chemischen Energie in elektrische Energie bewirken. Meistens werden für Separatoren 30 mikroporöse Kunststoffe oder Vliese aus Glasfaser oder Polyethylen verwendet. Die Anoden 10 sind in ihren Ableiterbereichen 40 miteinander verbunden ebenso wie die Kathoden 20, sodass alle gleichnamigen Elektroden in einer Batterie zusammengeschaltet sind. In den Ableiterbereichen 40 ist jeweils eine Anschlussfahne 50 (siehe Fig. 2B) für die Kathoden 20 und die Anoden 10 befestigt, die mit einem entsprechenden äußeren Spannungspol der Batterie verbunden wird.

Fig. 2A zeigt eine Draufsicht auf eine Kathode 20 mit einem Ableiterbereich 40. In den Ableiterbereichen 40 der übereinander angeordneten Kathoden 20 werden die Kathoden 20 miteinander verbunden. Wie in Fig. 2B gezeigt, wird die Anschlussfahne 50 an den miteinander verbundenen Ableiterbereichen 40 befestigt, die nach dem Zusammensetzen der Batterie mit dem Minus-Pol der Batterie in Kontakt steht.

Üblicherweise werden Batterieelektroden als Bulk- oder Rollenmaterial vorgefertigt, aus dem bei der Herstellung einer Batterie eine gewünschte Elektrodenform ausgeschnitten wird. Wie in Fig. 3 gezeigt, umfasst das Elektrodenmaterial ein Kollektorsubstrat 60, das mit einem Beschichtungsfilm 70 versehen ist. Dabei weist das Elektrodenmaterial ein oder mehrere unbeschichtete Ableiterbereiche 40 auf, die später im zusammengesetzten Zustand erforderlich sind, um Spannung bzw. Strom nach Außen abzuführen. An den Ableiterbereichen 40 werden mehrere gleichnamige Elektroden miteinander verbunden und eine metallische Anschlussfahne 50 befestigt. Wenn das Kollektorsubstrat 60 beidseitig beschichtet ist, sind deshalb auch auf beiden Seiten Ableiterbereiche 40 ausgebildet. Hierbei müssen die Ableiterbereiche nicht unbedingt gegenüberliegend ausgebildet sein, sondern können gegeneinander versetzt sein, wie in Fig. 3 gezeigt.

In Figuren 4A und 4B sind Verfahren zum Herstellen eines Elektrodenmaterials mittels eines Schlitzdüsensystems 300 gezeigt. Auf dem bandförmigen Kollektorsubstrat 60 wird ein tintenartiger Beschichtungsfilm 70 aufgetragen. Dies kann entweder durch diskontinuierliche, intermittierende Beschichtung, wobei wie in Fig. 4A gezeigt durch regelmäßiges Unterbrechen der Beschichtung ein unbeschichteter Ableiterbereich 40 ausgebildet wird, oder durch kontinuierliche Beschichtung erfolgen, wie in Fig. 4B gezeigt. Allerdings ist das Ausbilden von komplexeren Ableiterbereichen mit diesen Verfahren sehr aufwändig. Deshalb werden gelegentlich Maskierungsschritte eingesetzt. Alternativ können Ableiterbereiche 40 durch Bürsten oder ähnliche Verfahren auf einem Kollektorsubstrat 60 freigelegt werden.

Nach der Beschichtung wird das Elektrodenmaterial kalandriert, um den Beschichtungsfilm zu verdichten und Hohlräume zu beseitigen, die beim Trocknen des Beschichtungsfilms 70 entstehen. Das fertige Elektrodenmaterial kann dann aufgerollt und bis zur Weiterverarbeitung gelagert werden. Für das Herstellen einer Batterie wird aus dem Elektro-

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denmaterial eine gewünschte Form ausgeschnitten oder ausgestanzt, die je nach Batterietyp oder Batterieform unterschiedlich ist. Beim Ausschneiden der Batterieelektrode ist zudem zu beachten, dass ein Ableiterbereich 40 vorhanden sein muss. Ein Beispiel für eine rechteckige Elektrodenform mit Ableiterbereich 40 ist in Fig. 2A gezeigt.

In Fig. 5 ist ein Ablaufdiagramm gezeigt, anhand dessen der Herstellungsprozess einer Batterie, beispielsweise einer Wickelzelle oder einer Stapelbatterie, veranschaulicht wird. Zuerst wird das Kollektorsubstrat 60 mit dem Beschichtungsfilm 70 beispielsweise in einem intermittierenden Verfahren beschichtet (S10), wobei durch Unterbrechung oder Aussetzen beim Auftragen der tintenartigen Beschichtung mehrere unbeschichtete Ableiterbereiche 40 ausgebildet werden. Anschließend wird das Elektrodenmaterial kalandriert (S20). Aus dem Elektrodenmaterial kann dann eine gewünschte Elektrodenform ausgeschnitten oder ausgestanzt werden (S30), wobei die ausgestanzte Form einen Ableiterbereich 40 aufweisen muss. Diese Schritte erfolgen sowohl beim Herstellen der Anode 10 als auch beim Herstellen der Kathode 20. Als nächstes werden die ausgeschnittenen Elektroden so übereinander angeordnet (S40), dass abwechselnd eine Anode 10 und eine Kathode 20 mit einem Separator 30 dazwischen aufeinanderfolgen (siehe Fig. 1). Hierbei werden die Ableiterbereiche 40 der Kathoden 20 und die Ableiterbereiche 40 der Anoden 10 jeweils übereinander angeordnet und miteinander verbunden. Anschließend wird eine Anschlussfahne 50 daran befestigt (S50). Die Anzahl der übereinander angeordneten Anoden 10 und Kathoden 20 kann dabei je nach Art und Eigenschaft der Batterie variieren. Nach Fertigstellen der Elektrodenanordnung wird die Elektrodenanordnung in ein Gehäuse eingesetzt und die Anschlussfahnen 50 werden mit den äußeren Spannungspolen des Gehäuses verbunden (S60). Bei einer Wickelzelle wird die Elektrodenanordnung ferner spiralförmig aufgewickelt und so in das Gehäuse eingesetzt. Nach Einfüllen des Elektrolyts (S70) wird die Zelle dann verschlossen (S80) und abschließend formiert (S90).

Bei den herkömmlichen Verfahren zum Herstellen von Batterieelektroden bestehen allerdings folgende Probleme. So ist das Herstellen von unbeschichteten Ableiterbereichen durch Maskierungsschritte oder Abbürsten der Beschichtung sehr aufwändig und teuer. Bei dem alternativen Herstellungsverfahren durch intermittierende oder kontinuierliche Beschichtung mit Hilfe eines Schlitzdüsensystems hingegen sind die möglichen Formen und Anordnungen der Ableiterbereiche auf dem Elektrodenmaterial stark eingeschränkt. Ange-

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sichts der vielfältigen Einsatzgebiete von Batterien insbesondere in Design-Produkten wie beispielsweise in Mobiltelefonen, Laptops oder Autos wird allerdings eine Flexibilität bei der Gestaltung der Batterieelektroden immer stärker gefordert. Hierbei stellt der Trend zu kleineren Geräten eine besondere Herausforderung an die Batterieherstellung dar. Zum einen müssen daher Batterien mit kleineren Abmessungen entwickelt werden, zum anderen sind häufig komplexe Formen gefordert, um den Innenraum eines Geräts möglichst effizient zu nutzen. Darüber hinaus ist es bei einem intermittierenden Beschichtungsverfahren schwierig, regelmäßige und saubere Randbereiche zwischen Beschichtungsbereich und Ableiterbereich herzustellen.

Darüber hinaus ist es mit den herkömmlichen Verfahren schwierig und teuer, eine Formenvielfalt der Elektroden zu realisieren. Aus Kostengründen wird üblicherweise ein Rollenmaterial als Elektrodenmaterial verwendet, bei dem mögliche Positionen des unbeschichteten Ableiterbereichs 40 bezüglich des Beschichtungsfilms 70 fest definiert sind. Dadurch ist allerdings die Designfreiheit für die Elektrodenform stark eingeschränkt, weil jede Elektrode einen Ableiterbereich 40 aufweisen muss. Außerdem entsteht beim Ausschneiden der gewünschten Elektrodenform mitsamt des Ableiterbereichs 40 viel überschüssiges Elektrodenmaterial, das verworfen werden muss. Wenn beispielsweise kleine Elektroden so ausgeschnitten werden, dass sie einen Ableiterbereich 40 enthalten, können bei einem großen Abstand zwischen aufeinanderfolgenden Ableiterbereichen 40 Bereiche des dazwischen liegenden beschichteten Substrats nicht mehr verwendet werden. Dadurch wird der Materialverbrauch erhöht und das Herstellungsverfahren verteuert. Des Weiteren muss für jede gewünschte Elektrodenform eine eigene Stanzform zum Ausstanzen der gewünschten Form angeschafft werden. Aufgrund der hohen Anforderungen an eine Schneidgüte sind diese Stanzformen jedoch sehr teuer.

In den herkömmlichen Herstellungsverfahren wird der Ableiterbereich 40 von einem beschichteten Elektrodenbereich vorstehend ausgebildet, um daran die Anschlussfahne 50 zu befestigen und gleichnamige Elektroden miteinander zu verbinden. Dies führt jedoch zu ungenutztem Raum in der Batterie, der nicht durch aktives Elektrodenmaterial gefüllt ist. Dadurch wird die Größe der Batterie unnötig erhöht bzw. eine äußere Form der Batterie festgelegt.

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Des Weiteren können die Ableiterbereiche 40 in den herkömmlichen Herstellungsverfahren oder auch während des Lagerns leicht verunreinigt werden. Insbesondere bei einem Kalandrierprozess können Verunreinigungen auf die Ableiterbereiche 40 gelangen. Dies verschlechtert die Qualität eines elektrischen Kontakts zwischen gleichnamigen Elektroden untereinander und zwischen den Elektroden und einer dazugehörigen Anschlussfahne 50. Da beim Herstellen des Elektrodenmaterials zudem die Ableiterbereiche 40 vor dem Kalandrierprozess ausgebildet werden, ist das Kalandrieren aufgrund der ungleichmäßig dicken Struktur erschwert. Außerdem kann der durch herkömmliche Verfahren ausgebildete Ableiterbereich 40 schlecht definiert sein, wobei besonders ein Randbereich des Ableiterbereichs 40 ungenau und ungleichmäßig ausgebildet sein kann.

Zusammenfassung der Erfindung

Daher ist es Aufgabe der vorliegenden Erfindung, eine Batterieelektrode und ein Herstellungsverfahren für selbige anzugeben, wobei eine volumetrische Energiedichte einer Batterie durch kompakte Gestaltung der Batterieelektrode bei geringen Herstellungskosten erhöht werden kann.

Die Aufgabe wird durch die Merkmale der unabhängigen Ansprüche gelöst.

Die Erfindung basiert auf dem Gedanken, einen als Ableiterbereich fungierenden unbeschichteten Bereich auf einem Kollektorsubstrat einer Batterieelektrode so anzuordnen, dass er in einen beschichteten Bereich des Kollektorsubstrats hineinragt oder innerhalb des beschichteten Bereichs angeordnet ist. Wenn der unbeschichtete Ableiterbereich in den beschichteten Bereich hineinragt, ist eine gesamte Umfangslänge des beschichteten Bereichs größer als bei einer Batterieelektroden mit vorstehendem Ableiterbereich. Zugleich ist ein außen liegender Rand des unbeschichteten Bereichs, d.h. ein an eine Kante der Batterieelektrode angrenzender Rand, minimiert. Auf diese Weise kann ein ungenützter Raum in einer Batterie, der durch einen von der Batterieelektrode vorstehenden Ableiterbereich verursacht wird, vermieden und eine Energiedichte bei gleichbleibendem Batterievolumen erhöht werden.

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Gemäß einem Aspekt der vorliegenden Erfindung wird eine Batterieelektrode angegeben, die ein Kollektorsubstrat, einen auf dem Kollektorsubstrat ausgebildeten Beschichtungsfilm und einen Ableiterbereich umfasst, wobei der Ableiterbereich zu einem Großteil vom Beschichtungsfilm umgeben ist. Der Ableiterbereich kann einen Umfangsbereich aufweisen, der mit einem äußeren Rand der Batterieelektrode zusammenfällt, wobei der Ableiterbereich allerdings überwiegend an den aktiven vom Beschichtungsfilm bedeckten Bereich der Batterieelektrode angrenzt, d.h. der Ableiterbereich ist wenigstens in seinem halben Außenumfang vom Beschichtungsfilm umgeben. Alternativ kann der Ableiterbereich jedoch auch vollständig im beschichteten Bereich des Kollektorsubstrats liegen, sodass der Ableiterbereich an seinem gesamten Umfang an den Beschichtungsfilm angrenzt. Auf diese Weise kann beim Zusammensetzen der Batterie ein inaktiver Bereich bzw. Totvolumen reduziert werden, sodass bei gleicher Batteriegröße eine Kapazität und eine volumetrische Energiedichte erhöht wird.

In einem Ausführungsbeispiel ist der Ableiterbereich auf der Batterieelektrode in einer beliebigen Form ausgebildet, beispielsweise im Wesentlichen kreisförmig, ringförmig, rechteckig oder dreieckig. Wenn sowohl der Ableiterbereich als auch die Batterieelektrode eine rechteckige Form aufweisen, kann der Ableiterbereich in einer Ecke der Batterieelektrode angeordnet sein, so dass zwei Seiten des Ableiterbereichs an den Beschichtungsfilm angrenzen. Alternativ kann der Ableiterbereich nur mit einer Seite an den äußeren Rand der Batterieelektrode angrenzen, so dass drei Seiten des Ableiterbereichs von dem beschichteten Bereich der Batterieelektrode umgeben sind.

Vorzugsweise ist der Beschichtungsfilm auf beiden Seiten des Kollektorsubstrats ausgebildet, um eine aktive Fläche der Batterieelektrode zu erhöhen. In diesem Fall kann jeweils mindestens ein Ableiterbereich auf beiden Seiten des Kollektorsubstrats ausgebildet sein. Wenn Ableiterbereiche auf beiden Seiten des Kollektorsubstrats ausgebildet sind, liegen sich jeweils zwei Ableiterbereiche vorzugsweise gegenüber, so dass gleichnamige Batterieelektroden am Ableiterbereich beispielsweise durch einen Schweißkontakt leicht miteinander verbunden werden können. Alternativ können die Ableiterbereiche gegeneinander versetzt auf beiden Seiten des Kollektorsubstrats angeordnet sein.

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In einem bevorzugten Ausführungsbeispiel wird der Ableiterbereich durch Laserablation des Beschichtungsfilms hergestellt, sodass das darunterliegende Kollektorsubstrat freigelegt wird. Auf diese Weise kann der Beschichtungsfilm großflächig oder im Wesentlichen vollständig und kontinuierlich auf dem Kollektorsubstrat hergestellt werden, ohne einen Ableiterbereich aussparen zu müssen. Zudem kann der Beschichtungsfilm auf einer oder auf beiden Seiten des Kollektorsubstrats großflächig ausgebildet sein, so dass das beschichtete Substrat eine gleichmäßige Dicke aufweist. Wegen der gleichmäßigen Dicke des beschichteten Kollektorsubstrats ist darüber hinaus ein Kalandrierprozess vereinfacht und kann mit besserer Qualität durchgeführt werden. Darüber hinaus kann das Ausbilden des Ableiterbereichs dann unmittelbar vor Kontaktieren des Ableiterbereichs erfolgen, so dass eine frische und saubere Oberfläche für die Kontaktierung zur Verfügung steht. Daher kann das Auftreten von Verunreinigungen vermieden werden, die eine ernsthafte Gefahr für eine fertige Batterie darstellen und Dendritenbildung mit daraus resultierendem Kurzschluss verursachen können, wie beispielsweise beim Bürsten entstehende Schleifpartikel oder Beschichtungsreste. Durch die Verwendung eines Lasers zum Freilegen der Ableiterbereiche können die Ableiterbereiche außerdem in beliebiger Form und an jeder beliebigen Stelle mit sauberen und gleichmäßigen Kanten auf dem beschichteten Kollektorsubstrat hergestellt werden. Dadurch besteht absolute Designfreiheit und die Möglichkeit, flächenoptimierte Ableiterstrukturen herzustellen. Die äußere Form der Batterieelektrode kann ebenfalls mit einem Laser ausgeschnitten werden. Dies erspart ein weiteres Werkzeug bzw. einen weiteren Arbeitsschritt und insbesondere teure Stanzformen. Dadurch wird es möglich, beliebige Elektrodenformen schon bei geringen Stückzahlen kostengünstig herzustellen. Somit können mit einem einzigen Laser zwei verschiedene Arbeitsschritte mit erheblicher Zeitersparnis durchgeführt werden, wodurch auch ein Umsetzen des zu bearbeitenden Elektrodenmaterials oder des Werkzeugs entfällt.

Des Weiteren kann mindestens eine Aussparung in der Batterieelektrode ausgebildet sein. Vorzugsweise entspricht die Aussparung einer Elektrode einem auf einer gegennamigen Elektrode ausgebildeten Ableiterbereich, damit die übereinander angeordneten Ableiterbereiche der gleichnamigen Elektroden bei einer alternierenden Elektrodenanordnung durch die anderen Elektroden hindurch miteinander verbunden werden können. Dies kann beispielsweise vorteilhaft sein, wenn der Ableiterbereich einer Elektrode in einen beschichteten Elektrodenbereich hineinragt oder von diesem vollständig umgeben ist. Wenn die Bat-

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terieelektrode mittels Laserschneiden ausgeschnitten wird, kann das Ausschneiden der mindestens einen Aussparung ebenfalls mit Hilfe des Lasers erfolgen, um einen Verfahrensablauf zu optimieren.

Für den Materialabtrag mittels Laserablation bzw. für das Laserschneiden kann jedes geeignete Lasersystem verwendet werden, z.B. Schneid- oder Gravurlasersysteme. Aufgrund der hohen Kantenqualität und Schnittpräzision bezüglich Schnittführung und Eindringtiefe können Ableiterbereiche von hoher Qualität hergestellt werden. Durch die Verwendung von ultrakurzen Laserpulsen kann darüber hinaus der Energieeintrag reduziert werden, sodass eine thermische Belastung des Elektrodenmaterials gering gehalten wird. Da geeignete Lasersysteme vergleichbar teuer wie Schlitzdüsensysteme sind, entstehen keine hohen Anschaffungskosten.

In einem weiteren Aspekt der vorliegenden Erfindung wird eine Batterie angegeben, die mindestens eine Batterieelektrode nach einem der obigen Ausführungsbeispiele enthält. Da die Batterieelektrode durch Ausbilden eines Ableiterbereichs, der überwiegend von einem Beschichtungsfilm umgeben ist, kompakter gestaltet werden kann und somit einen geringeren Platzbedarf aufweist, kann eine volumetrische Energiedichte der Batterie erhöht werden.

In einem weiteren Aspekt der vorliegenden Erfindung wird ein Verfahren zum Herstellen einer Batterieelektrode angegeben, wobei auf einem Kollektorsubstrat ein Beschichtungsfilm aufgetragen wird. In einem Ableiterbereich wird anschließend der Beschichtungsfilm so entfernt, dass ein Umfang des Ableiterbereichs überwiegend bzw. wenigstens zur Hälfte vom Beschichtungsfilm umgeben ist. Da der Ableiterbereich durch Abtragen des Beschichtungsfilms ausgebildet wird, kann das im Wesentlichen vollständig beschichtete Kollektorsubstrat als Elektrodenmaterial ohne besondere Vorkehrungen gelagert werden und die Ausbildung des Ableiterbereichs erst unmittelbar vor einer Kontaktierung des Ableiterbereichs erfolgen. Auf diese Weise werden Verunreinigungen und chemische Veränderungen der Oberfläche vermieden und ein Kontaktwiderstand im Ableiterbereich reduziert. Des Weiteren kann bei diesem Verfahren der Beschichtungsfilm auf einer gesamten Oberfläche des Kollektorsubstrats großflächig und/oder nahezu vollständig ausgebildet werden. Möglicherweise wird der Beschichtungsfilm auch auf beiden Seiten des Kollek-

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torsubstrats ausgebildet. Vorteilhafterweise werden kontinuierliche Beschichtungstechnologien, wie beispielsweise Doctor-blade, Comma-bar und Kiss-Coating verwendet, so dass die Herstellungskosten reduziert werden können. Darüber hinaus weist das beschichtete Kollektorsubstrat eine gleichmäßige Dicke auf, wodurch ein Kalandrierprozess vereinfacht und verbessert wird.

In einem bevorzugten Ausführungsbeispiel wird der Beschichtungsfilm im Ableiterbereich mit einem Laser entfernt. Dabei kann in einem bevorzugten Ausführungsbeispiel gleichzeitig eine dünne Schicht des Kollektorsubstrats im Ableiterbereich abgetragen werden, um eine Oberflächenbeschaffenheit im Ableiterbereich zu verbessern. Durch Verwendung der Laserablation zum Ausbilden des Ableiterbereichs wird eine Designfreiheit in der Gestaltung der Batterieelektrode und des Ableiterbereichs erhöht und individuelle Anfertigungen ermöglicht.

Kurze Beschreibung der Figuren

In den Figuren zeigen

Fig. 1 eine schematische Schnittansicht einer Elektrodenanordnung in einer herkömmlichen Batterie;

Figuren 2A und 2B eine Draufsicht auf eine herkömmliche Batterieelektrode;

Fig. 3 zeigt eine Schnittansicht eines herkömmlichen Elektrodenmaterials;

Figuren 4A und 4B Verfahren zum Herstellen eines herkömmlichen Elektrodenmaterials;

Fig. 5 ein Ablaufdiagramm eines herkömmlichen Herstellungsverfahrens einer Batterie;

Fig. 6 Batterieelektroden gemäß einem ersten Ausführungsbeispiel der vorliegenden Erfindung;

Fig. 7 Batterieelektroden gemäß einem weiteren Ausführungsbeispiel der vorliegenden Erfindung;

Fig. 8 Batterieelektroden gemäß einem anderen Ausführungsbeispiel der vorliegenden Erfindung;

Fig. 9A-9C Schnittansichten durch ein Elektrodenmaterial während eines Herstellungsprozesses gemäß der vorliegenden Erfindung; und

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Fig. 10 ein Ablaufdiagramm eines Herstellungsverfahrens gemäß einem Ausführungsbeispiel der vorliegenden Erfindung.

Ausführliche Beschreibung der Erfindung

Im Folgenden wird die Erfindung anhand des Beispiels der Lithium-Ionen-Batterie beschrieben, die sich durch eine hohe Energiedichte und thermische Stabilität auszeichnet. Die vorliegende Erfindung soll jedoch nicht auf Lithium-Ionen-Batterien beschränkt sein, sondern kann auf jede beliebige Batterie angewendet werden.

Bei einer Lithium-Ionen-Batterie besteht ein Kollektorsubstrat 60 einer Anode 10 beispielsweise aus Kupfer, das mit einem Beschichtungsfilm 70 aus Graphit, Bindemittel, Ruß und Lösungsmittel beschichtet ist. Gemäß der vorliegenden Erfindung wird der Beschichtungsfilm 70 in einem Ableiterbereich 40 entfernt, sodass das Kollektorsubstrat 60 im Ableiterbereich 40 freigelegt ist. Am Ableiterbereich 40 der Anode 10 kann eine Anschlussfahne 50 bspw. aus Nickel befestigt werden. Bei der Kathode 20 besteht ein Kollektorsubstrat 60 beispielsweise aus Aluminium und ist mit einem Beschichtungsfilm 70 aus einem zu einer Redoxreaktion beitragenden Aktivmaterial, Bindemittel, Ruß, Graphit und Lösungsmittel beschichtet. Die Anschlussfahne der Kathode besteht vorzugsweise ebenfalls aus Aluminium.

In Fig. 6 sind Batterieelektroden gemäß der vorliegenden Erfindung gezeigt, bei denen ein Ableiterbereich 40 an seinem Umfang überwiegend an den Beschichtungsfilm 70 auf dem Kollektorsubstrat 60 angrenzt. Sowohl die Anoden 10 als auch die Kathoden weisen einen innen liegenden Ableiterbereich 40 und eine Aussparung 80 auf. Die Aussparung 80 ist an einer Stelle ausgebildet, die dem Ableiterbereich 40 der jeweiligen gegennamigen Elektrode im zusammengesetzten Zustand entspricht. Die Aussparungen 80 der Anoden 10 sind folglich so angeordnet, dass sie im zusammengesetzten Zustand der Elektroden über bzw. unter den Ableiterbereichen 40 der Kathoden 10 liegen. Die Pfeile in Fig. 6 deuten eine Elektrodenanordnung im zusammengesetzten Zustand an, wobei jeweils abwechselnd eine Anode 10 und eine Kathode 20 übereinander angeordnet werden. Hierbei ist zwischen den Anoden 10 und Kathoden 20 ein Separator 30 angeordnet (nicht gezeigt), der aus mikroporösen Folien oder Vliesstoffen bestehen kann. In den Ableiterbereichen 40 können vor dem

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Zusammensetzen der Elektroden Anschlussfahnen 50 jeweils an mindestens einer der Anoden 10 und an mindestens einer der Kathoden 20 befestigt werden. Vorzugsweise werden die Anschlussfahnen 50 jedoch nach dem Zusammensetzen der Elektroden beispielsweise durch Ultraschallschweißen an den Ableiterbereichen 40 befestigt. Da bei diesem Ausführungsbeispiel ein Ableiterbereich 40 einer Elektrode einer Aussparung 80 einer gegennamigen Elektrode gegenüberliegt, können hierbei gleichzeitig jeweils die Anoden 10 bzw. die Kathoden 20 an ihren Ableiterbereichen 40 elektrisch miteinander verbunden werden.

Es ist auch möglich, nur die Kathoden oder nur die Anoden mit einem innen liegenden oder hineinragenden Ableiterbereich auszubilden, wobei die andere der zwei Elektroden nach dem herkömmlichen Verfahren mit vorstehendem Ableiterbereich hergestellt wird.

In Fig. 7 ist ein weiteres Ausführungsbeispiel für Batterieelektroden gemäß der vorliegenden Erfindung gezeigt. Die in Fig. 7 dargestellten Anoden 10 weisen eine runde Aussparung 80 in ihrer Mitte auf, während die Kathoden 20 in ihrer Mitte einen entsprechenden Ableiterbereich 40 aufweisen. Der Ableiterbereich 40 der Anoden 10 ist an ihrem Umfangsrand ausgebildet, so dass die Kathoden 20 an dieser Stelle eine Aussparung 80 aufweisen. Wie zuvor beschrieben, werden die Ableiterbereiche 40 der gleichnamigen Elektroden miteinander verbunden und Anschlussfahnen 50 werden jeweils in den Ableiterbereichen 40 der Anoden 10 und der Kathoden 20 befestigt.

In Fig. 8 ist ein weiteres Beispiel für Batterieelektroden gemäß der vorliegenden Erfindung gezeigt. In diesem Ausführungsbeispiel sind die Ableiterbereiche 40 vollständig vom Beschichtungsfilm 70 umgeben. Hier weist die Anode 10 zwei Ableiterbereiche 40a und 40b auf und die Kathode 20 zwei entsprechende Aussparungen 80a und 80b. In diesem Fall ist an jedem der beiden Ableiterbereiche 40a und 40b der Anode 10 jeweils eine Anschlussfahne 50 angebracht. Das Ausbilden von mehreren Ableiterbereichen 40 auf einer Elektrode kann zu einer verbesserten Spannungsableitung führen und einen Widerstand reduzieren.

Im Folgenden wird ein beispielhaftes Verfahren zur Herstellung der Batterieelektroden erläutert. Gemäß der vorliegenden Erfindung wird zunächst, wie in Fig. 9A gezeigt, ein Kollektorsubstrat 60 großflächig und beidseitig mit einem Beschichtungsfilm 70 beschich-

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tet. Das Kollektorsubstrat 60 kann allerdings auch nur auf einer Oberfläche großflächig oder im Wesentlichen vollständig beschichtet sein. Der Beschichtungsfilm 70 wird in einem flüssigen Zustand auf das Kollektorsubstrat 60 aufgetragen. Hierbei können einfache, kontinuierliche Beschichtungstechnologien, wie beispielsweise Doctor-blade, Comma-bar oder Kiss-Coating eingesetzt werden. Anschließend wird der Beschichtungsfilm 70 getrocknet oder ausgehärtet, wobei eine Dicke des Beschichtungsfilms 70 im trockenen Zustand beispielsweise in etwa 25µm beträgt. Nach dem Trocknen oder Aushärten des Beschichtungsfilms 70 wird das beschichtete Kollektorsubstrat 60 kalandriert, um den Beschichtungsfilm 70 zu verdichten. Aufgrund der gleichmäßigen Dicke des Kollektorsubstrats 60 ist der Kalandrierprozess vereinfacht und kann effizienter durchgeführt werden, sodass die Qualität des Elektrodenmaterials verbessert ist. Darüber hinaus ist das beschichtete Kollektorsubstrat 60 als Rollenmaterial lagerbar und steht als Elektrodenmaterial für die spätere Weiterverarbeitung zur Verfügung.

Wie in Fig. 9B gezeigt, wird anschließend mindestens ein Ableiterbereich 40 auf dem beschichteten Kollektorsubstrat 60 ausgebildet, indem im Ableiterbereich 40 der Beschichtungsfilm 70 durch Laserablation entfernt und das darunterliegende Kollektorsubstrat 60 freigelegt wird. Dies ist allerdings nur ein Beispiel für einen Herstellungsprozess eines Ableiterbereichs 40. Alternativ kann der Ableiterbereich 40 auch durch Bürsten, Lithographie und andere Verfahren hergestellt werden. Bei einer Laserablation wird Material von der Oberfläche durch Beschuss mit Laserstrahlung abgetragen. Hierfür wird beispielsweise gepulste Laserstrahlung mit hoher Leistungsdichte verwendet. Da die Wärmeleitung nur einen sehr langsamen Energietransport in das Volumen ermöglicht, wird die eingestrahlte Energie auf eine sehr dünne Schicht an der Oberfläche konzentriert. Dadurch wird die Oberfläche stark erhitzt und es kommt zum schlagartigen Verdampfen oder Schmelzen des Materials. Um eine ausreichende Absorption des Laserlichts zu gewährleisten, wird eine Wellenlänge der Laserstrahlung in Abhängigkeit des abzutragenden Materials gewählt. Vorzugsweise wird ein Gravur- oder Schneidlasersystem verwendet, beispielsweise mit einem Ytterbium-Faserlaser bei einer Wellenlänge von 1070 nm. Es können allerdings auch andere Gas-, Festkörper- oder Faserlaser eingesetzt werden. Während der Laser-Verarbeitungsprozesse kann außerdem ein Prozessgas oder Blasgas auf die Oberfläche geleitet werden, um das abgetragene Material aus der Schnittfuge zu treiben oder unerwünschte chemische Reaktionen an der Oberfläche zu verhindern. Vorzugsweise ist das

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Prozessgas kalt, um das Elektrodenmaterial während der Laserbearbeitung zu kühlen. Durch das Verdampfen oder Schmelzen des Materials werden keine schädlichen Verunreinigungen erzeugt.

Da die Ableiterbereiche 40 durch Laserablation hergestellt werden, können beliebige Ableiterbereichformen und -anordnungen ausgebildet werden. Insbesondere können die Ableiterbereiche 40 so auf der Elektrodenfläche angeordnet werden, dass sie nicht von der Batterieelektrode vorstehen. Dadurch kann ein Energiedichte/Volumen-Verhältnis erhöht und die Größe einer Batterie bei gleichen elektrischen Eigenschaften verringert werden. Das Ausbilden des Ableiterbereichs 40 erfolgt vorzugsweise unmittelbar vor dem Verbinden von gleichnamigen Elektroden oder dem Anbringen einer Anschlussfahne 50 in den Ableiterbereichen 40. Beispielsweise können übereinanderliegende gleichnamige Elektroden durch einen Schweißkontakt in den Ableiterbereichen 40 miteinander verbunden werden. Hierbei kann gleichzeitig eine Anschlussfahne 50 an einem der Ableiterbereiche 40 befestigt werden. Da die Ableiterbereiche 40 erst kurz vor der Weiterverarbeitung des Elektrodenmaterials ausgebildet werden, steht für die Kontaktierung der gleichnamigen Elektroden untereinander bzw. für das Anbringen der Anschlussfahne 50 eine frische saubere Oberfläche zur Verfügung. Dadurch können Passivierungsschichten wie beispielsweise oxidierte Oberflächen und andere Verunreinigungen im Ableiterbereich 40 vermieden werden.

Möglicherweise wird nicht nur der Beschichtungsfilm 70 im Ableiterbereich 40 mittels Laser entfernt, sondern wie in Fig. 9C gezeigt, auch eine dünne Schicht des Kollektorsubstrats 60. Durch die Verwendung von Lasersystemen mit hoher Schnittpräzision kann die Eindringtiefe des Lasers exakt gesteuert werden, sodass die Tiefe des Materialabtrags beliebig gewählt werden kann. Daher kann ein Kollektorsubstrat 60 im Ableiterbereich 40 gezielt verdünnt werden. Außerdem kann dadurch die Oberflächenbeschaffenheit für eine elektrische Kontaktierung verbessert werden.

Fig. 10 ist ein Ablaufdiagramm eines Herstellungsprozesses einer Batterie gemäß der vorliegenden Erfindung. Zuerst wird auf einem Kollektorsubstrat 60, das aus einem ungefähr 8-20 μm dicken Metallband besteht, ein tintenartiger Beschichtungsfilm 70 großflächig oder nahezu vollständig aufgetragen (S100). Nach dem Trocknen oder Aushärten des Be-

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schichtungsfilms 70, der im trockenen Zustand ungefähr 25 µm dick ist, wird das gleichmäßig beschichtete Kollektorsubstrat 60 kalandriert (S200), um beim Trocknen entstandene Hohlräume und Unregelmäßigkeiten aus dem Beschichtungsfilm 70 zu entfernen. Das kalandrierte und beschichtete Kollektorsubstrat 60 kann nun als Rollenmaterial bis zur Weiterverarbeitung gelagert werden. Zur Fertigstellung der Batterieelektrode wird der Beschichtungsfilm 70 in einem vorgegebenen Ableiterbereich 40 auf dem beschichteten Kollektorsubstrat 60 durch Laserablation entfernt (S300). Möglicherweise wird zusätzlich eine dünne Schicht des Kollektorsubstrats 60 im Ableiterbereich 40 abgetragen, um eine Oberflächenqualität für elektrische Kontaktierung zu verbessern. Im nächsten Schritt S400 wird dann die Elektrode und gegebenenfalls die Aussparungen 80 in einer gewünschten Form aus dem beschichteten Kollektorsubstrat 60 ausgeschnitten. Vorzugsweise wird die Elektrode bzw. die Aussparung 80 mit Laser ausgeschnitten, alternativ kann aber auch eine Stanzvorrichtung verwendet werden. Die Reihenfolge der Schritte S400 und S300 kann auch vertauscht werden. Danach werden Anoden 10 und Kathoden 20 abwechselnd übereinander so angeordnet, dass sich jeweils die Ableiterbereiche 40 von gleichnamigen Elektroden gegenüberliegen, wobei zwischen den Ableiterbereichen 40 der Anoden 10 die Aussparungen 80 der Kathoden 20 und umgekehrt angeordnet sind. Anschließend werden jeweils die Ableiterbereiche 40 von gleichnamigen Elektroden beispielsweise durch Ultraschallschweißen miteinander verbunden, wobei jeweils eine Anschlussfahne 50 daran befestigt wird (S500). Altnernativ kann die Anschlussfahne 50 auch vor dem Zusammensetzen der Elektroden jeweils an einer der Kathoden 20 bzw. Anoden 10 angebracht werden.

Die weiteren Schritte entsprechen denen des herkömmlichen Verfahrens zum Herstellen einer Batterie. Die Elektrodenanordnung wird in einen Behälter eingesetzt und die Anschlussfahnen 50 werden mit den äußeren Spannungspolen der Batterie verbunden (S60). Anschließend wird ein Elektrolyt eingefüllt (S70) und die Zelle verschlossen (S80). Abschließend wird eine Formierung (S90) durchgeführt.

Gemäß der vorliegenden Erfindung können die Ableiterbereiche so ausgebildet werden, dass sie nicht von einem Außenumfang der Batterieelektrode vorstehen, sondern in einen beschichteten Bereich der Batterieelektrode hineinragen. Dadurch kann bei gleicher Batteriegröße eine höhere Kapazität und Energiedichte erreicht werden.

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Patentansprüche:

1. Batterieelektrode, umfassend:

ein Kollektorsubstrat (60);

einen Beschichtungsfilm (70) auf dem Kollektorsubstrat (60); und

mindestens einen Ableiterbereich (40) auf dem Kollektorsubstrat (60) , der in einen beschichteten Bereich des Kollektorsubstrats (60) hineinragt oder innerhalb des beschichteten Bereichs angeordnet ist.

2. Batterieelektrode nach Anspruch 1, wobei ein Umfang des Ableiterbereichs (40) mindestens zu einer Hälfte an den Beschichtungsfilm (70) angrenzt.

3. Batterieelektrode nach Anspruch 1 oder 2, wobei der Ableiterbereich (40) eine im Wesentlichen rechteckige, dreieckige, kreisförmige oder ringförmige Form oder einen Ausschnitt davon aufweist.

4. Batterieelektrode nach einem der obigen Ansprüche, wobei der Ableiterbereich (40) an seinem Umfang vollständig vom Beschichtungsfilm (70) umgeben ist.

5. Batterieelektrode nach einem der obigen Ansprüche, wobei der Beschichtungsfilm (70) und/oder jeweils mindestens ein Ableiterbereich (40) auf beiden Seiten des Kollektorsubstrats (60) ausgebildet ist.

6. Batterieelektrode nach einem der obigen Ansprüche, wobei der Ableiterbereich (40) durch Laserablation des Beschichtungsfilms (70) hergestellt ist.

7. Batterieelektrode nach einem der obigen Ansprüche, wobei die Batterieelektrode und/oder eine Aussparung (80) durch Laserschneiden ausgeschnitten ist.

8. Batterie, die mindestens eine Batterieelektrode nach einem der obigen Ansprüche enthält.

9. Verfahren zum Herstellen einer Batterieelektrode, umfassend:

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Ausbilden eines Beschichtungsfilms (70) auf einem Kollektorsubstrat (60);

Ausbilden eines Ableiterbereichs (40) durch Abtragen des Beschichtungsfilms (70) im Ableiterbereich (40), wobei der Ableiterbereich (40) in einen beschichteten Bereich des Kollektorsubstrats (60) hineinragt oder innerhalb des beschichteten Bereichs angeordnet ist.

10. Verfahren nach Anspruch 9, wobei ein Umfang des Ableiterbereichs (40) mindestens zu einer Hälfte vom Beschichtungsfilm (70) umgeben ist.

11. Verfahren nach Anspruch 9 oder 10, wobei der Beschichtungsfilm (70) auf einer gesamten Oberfläche und/oder auf beiden Seiten des Kollektorsubstrats (60) und/oder kontinuierlich ausgebildet wird.

12. Verfahren nach einem der Ansprüche 9 bis 11, wobei der Beschichtungsfilm (70) im Ableiterbereich (40) mittels Laserablation entfernt wird.

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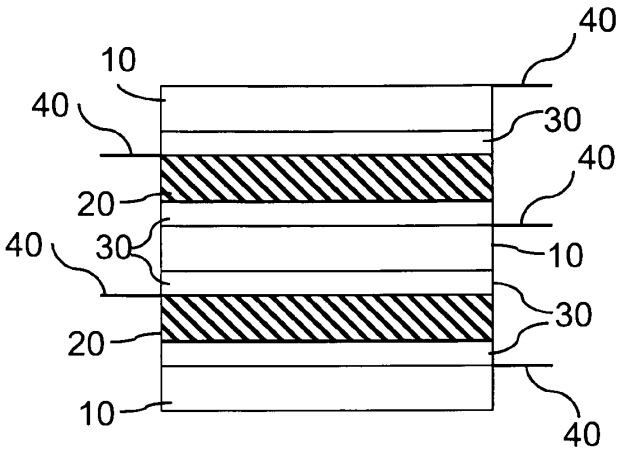


Fig. 1

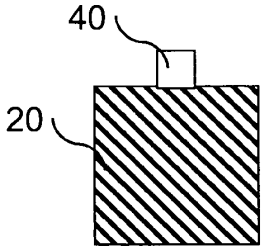


Fig. 2A

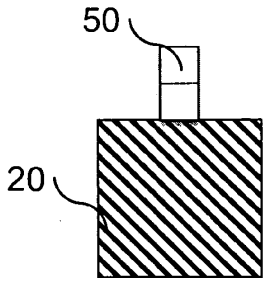


Fig. 2B

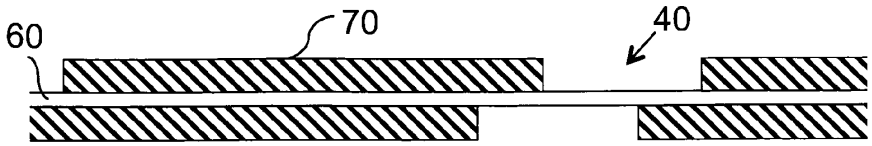


Fig. 3

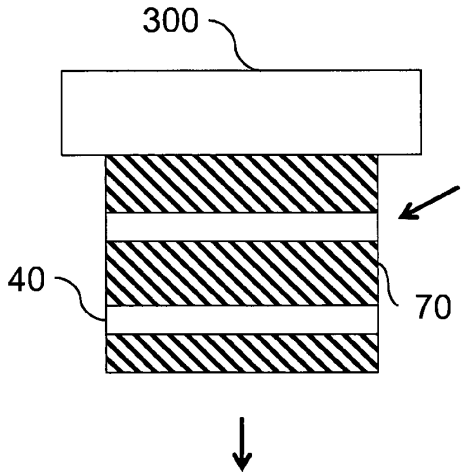


Fig. 4A

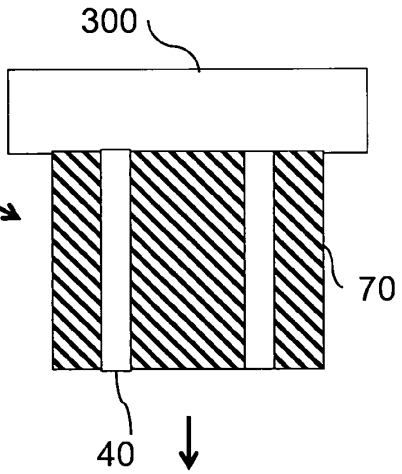


Fig. 4B

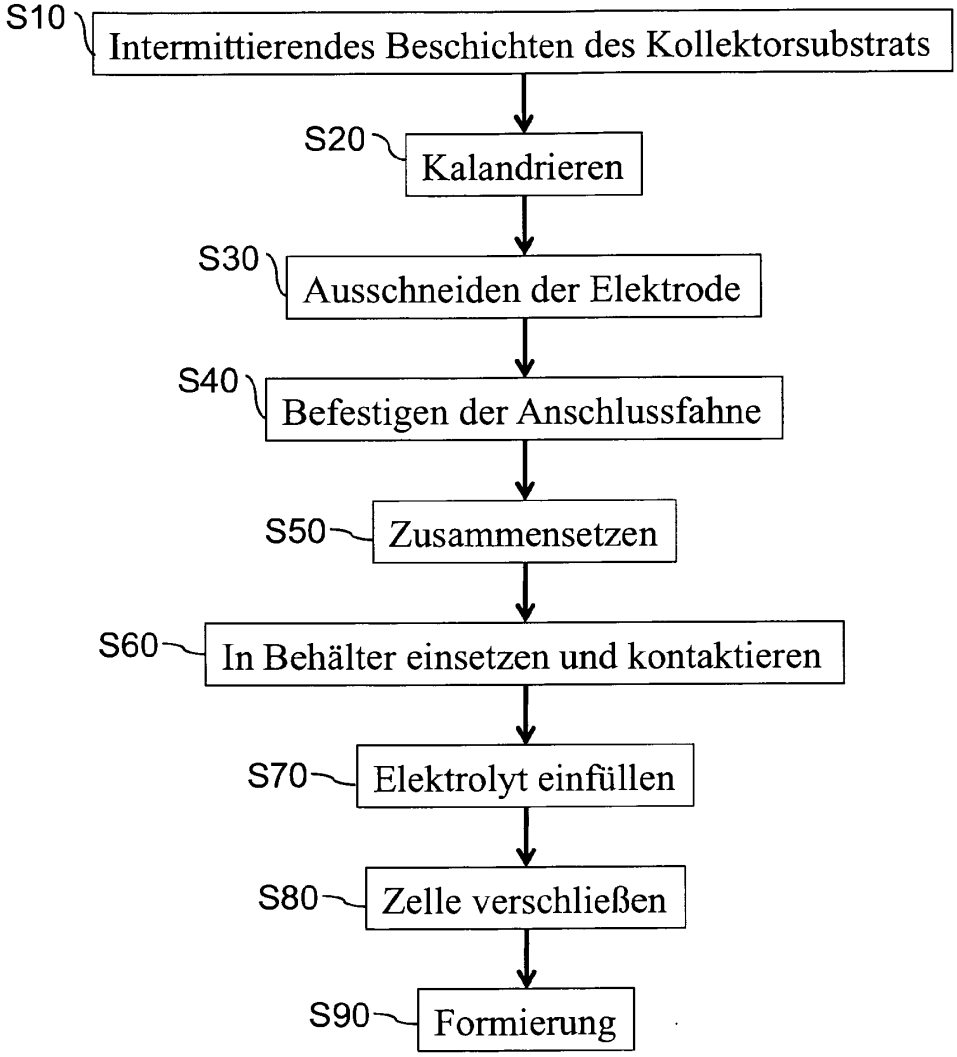

S10
Intermittierendes Beschichten des Kollektorsubstrats
S20
Kalandrieren
S30
Ausschneiden der Elektrode
S40
Befestigen der Anschlussfahne
S50
Zusammensetzen
S60
In Behälter einsetzen und kontaktieren
S70
Elektrolyt einfüllen
S80
Zelle verschließen
S90
Formierung

Fig. 5

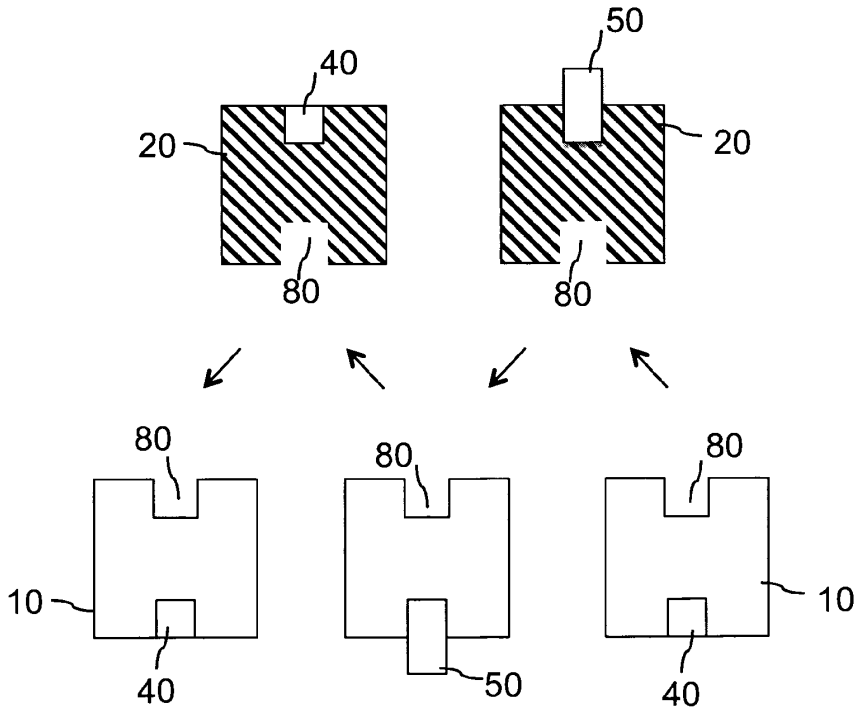


Fig. 6

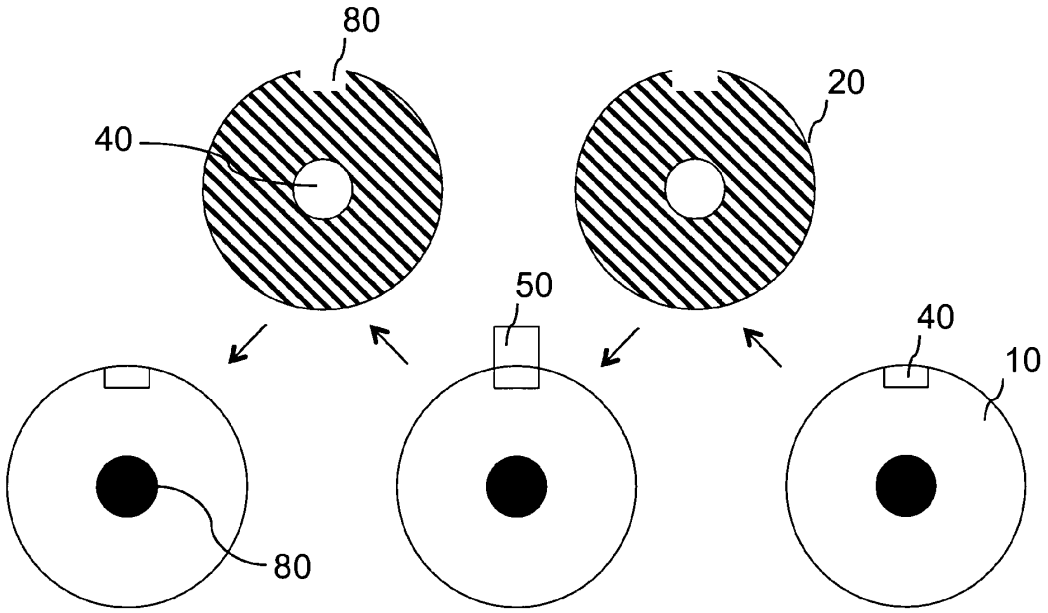


Fig. 7

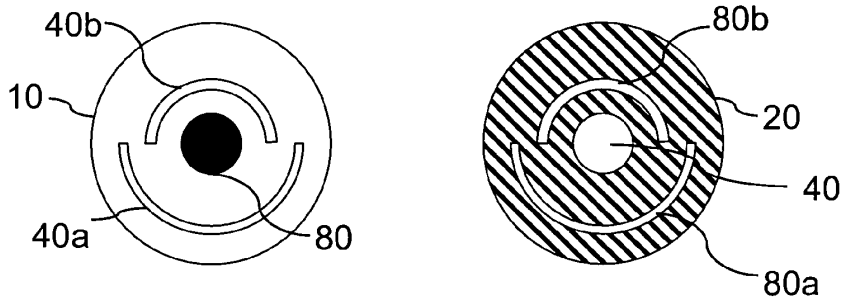


Fig. 8

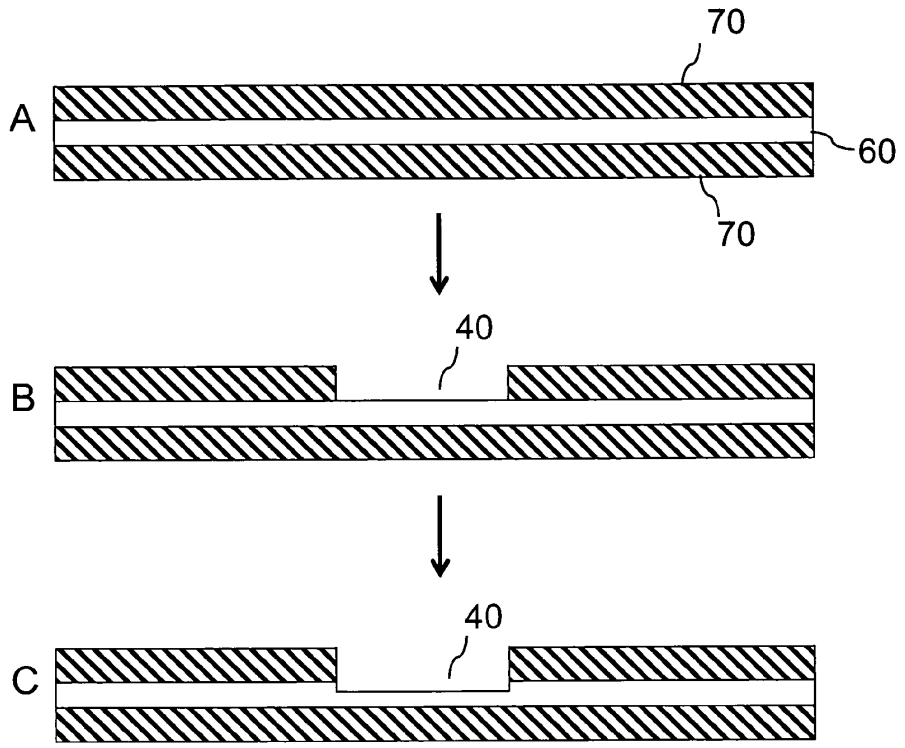


Fig. 9

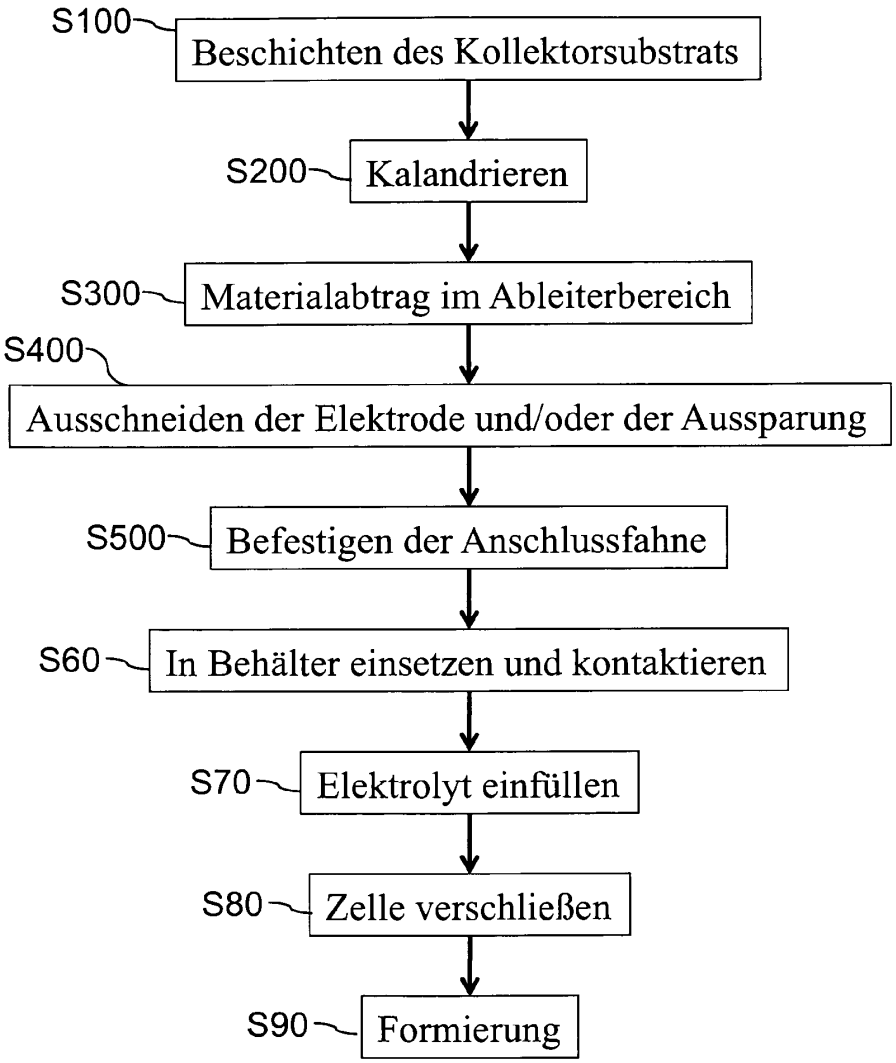

S100
Beschichten des Kollektorsubstrats
S200
Kalandrieren
S300
Materialabtrag im Ableiterbereich
S400
Ausschneiden der Elektrode und/oder der Aussparung
S500
Befestigen der Anschlussfahne
S60
In Behälter einsetzen und kontaktieren
S70
Elektrolyt einfüllen
S80
Zelle verschließen
S90
Formierung

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/005946

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01M2/26 H01M10/04 H01M4/04 H01M10/0585 H01M4/70
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2011/060982 A1 (EVONIK LITARION GMBH [DE]; MODLINGER ARMIN [DE]; MECKLENBURG ANDRE [DE) 26 May 2011 (2011-05-26) figures 4-6 page 9, lines 12-16 claim 1	1,2,8
X	EP 1 596 459 A1 (MATSUSHITA ELECTRIC IND CO LTD [JP]) 16 November 2005 (2005-11-16) paragraph [0140] - paragraph [0142] figures 5,8,9	1-12
A	DE 10 2008 041713 A1 (GAIA AKKUMULATORENWERKE GMBH [DE]) 4 March 2010 (2010-03-04) claim 10	7

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 April 2012	19/04/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Reich, Claus

Form PCT/ISA/210 (second sheet) (April 2005)

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 2005/036689 A2 (FRAUNHOFER GES FORSCHUNG [DE]; HAHN ROBERT [DE] TEN FORSCHUNG EV FRAUN) 21 April 2005 (2005-04-21) claim 28	1-12
A	EP 1 359 633 A1 (VARTA MICROBATTERY GMBH [DE]) 5 November 2003 (2003-11-05) paragraph [0025]	1-12
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A	EP 1 403 943 A2 (GREATBATCH W LTD [US] GREATBATCH W TECHNOLOGIES [US]) 31 March 2004 (2004-03-31) abstract; figure 2	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/005946

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP2011/005946

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
INV. H01M2/26 H01M10/04 H01M4/04 H01M10/0585 H01M4/70
ADD.

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
H01M

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X,P	WO 2011/060982 A1 (EVONIK LITARION GMBH [DE]; MODLINGER ARMIN [DE]; MECKLENBURG ANDRE [DE) 26. Mai 2011 (2011-05-26) Abbildungen 4-6 Seite 9, Zeilen 12-16 Anspruch 1	1,2,8
X	EP 1 596 459 A1 (MATSUSHITA ELECTRIC IND CO LTD [JP]) 16. November 2005 (2005-11-16) Absatz [0140] - Absatz [0142] Abbildungen 5,8,9	1-12
A	DE 10 2008 041713 A1 (GAIA AKKUMULATORENWERKE GMBH [DE]) 4. März 2010 (2010-03-04) Anspruch 10	7

-/--

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen [X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
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"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden
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"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
12. April 2012	19/04/2012

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Reich, Claus

Formblatt PCT/ISA/210 (Blatt 2) (April 2005)

CosMX Exhibit 1003, Page 393 of 676

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP2011/005946

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	EP 0 766 327 A1 (VARTA BATTERIE [DE]) 2. April 1997 (1997-04-02) Anspruch 13	7
A	WO 2005/036689 A2 (FRAUNHOFER GES FORSCHUNG [DE]; HAHN ROBERT [DE] TEN FORSCHUNG EV FRAUN) 21. April 2005 (2005-04-21) Anspruch 28	1-12
A	EP 1 359 633 A1 (VARTA MICROBATTERY GMBH [DE]) 5. November 2003 (2003-11-05) Absatz [0025]	1-12
A	DE 103 41 355 A1 (DILO TRADING AG ZUG [CH]) 7. April 2005 (2005-04-07) Absätze [0024] - [0032] Abbildungen 5,6	1-12
A	EP 1 403 943 A2 (GREATBATCH W LTD [US] GREATBATCH W TECHNOLOGIES [US]) 31. März 2004 (2004-03-31) Zusammenfassung; Abbildung 2	1-12

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/EP2011/005946

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
WO 2011060982 A1	26-05-2011	DE 102009046815 A1	21-07-2011
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PUB-NO: WO2012072222A1

DOCUMENT-IDENTIFIER: WO 2012072222 A1

TITLE: BATTERY ELECTRODE AND A METHOD FOR PRODUCING SAME

PUBN-DATE: June 7, 2012

PATENT-FAMILY-ID: 45044525

INVENTOR-INFORMATION:

NAME	COUNTRY
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STERN RAINER	DE

APPLICANT:

NAME	COUNTRY
KASPER MICHAEL	DE
STERN RAINER	DE
ZSW	DE

APPL-NO: EP 2011005946 W

APPL-DATE: November 25, 2011

PRIORITY-DATA:

PRIORITY-NO	PRIORITY-APPL-DATE
DE 102010062143 A	20101129

CPC-CURRENT:

TYPE	CPC	DATE
CPCI	H01M4/0402	20130101
CPCI	H01M10/0585	20130101
CPCI	H01M4/0404	20130101
CPCI	H01M50/531	20210101
CPCI	H01M4/70	20130101
CPCI	H01M10/04	20130101
CPCI	H01M50/54	20210101
CPCA	Y02E60/10	20130101
CPCA	Y02E60/50	20130101

CPCA H01M10/052 20130101

INT-CL-CURRENT:

TYPE	IPC	DATE
IPCP	H01M2/26	20060101
IPCS	H01M10/0585	20100101
IPCS	H01M10/04	20060101
IPCS	H01M4/70	20060101
IPCS	H01M4/04	20060101

REF-CITED:

PHASE-COUNTRY/NUMBER/KIND/DATE-NPL-INFO

None
EP 1403943 A2 20040331
DE 10341355 A1 20050407
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ABSTRACT:

The invention relates to a compact design for a battery with an increased energy density/volume ratio, for which production costs are low. A battery electrode and a method for producing same are therefore disclosed, wherein an arrester region is arranged on a collector substrate such that it is predominantly surrounded by a coating film.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/908,327	Filing Date 02/28/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)			
FOR	NUMBER FILED	NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	05/10/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 11	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/PAMELA V THERATT/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

Address to:
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Commissioner of Patents
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Alexandria, VA 22313-1450

Electronically filed	May 10, 2021
Application Number	15/908,327
Confirmation Number	2611
Filing Date	February 28, 2018
First Named Inventor	Peipei Guo, et al.
Art Unit	1723
Examiner Name	D'Aniello, Nicholas P.
Attorney Docket No.	024607-02-5055-US

This is a Request for Continued Examination (RCE) under 37 C.F.R. § 1.114 of the above-identified application. Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application.

1. Submission required under 37 C.F.R. § 1.114

NOTE: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

a. ☐ Previously submitted. If a final Office Action is outstanding, any amendments filed after the final Office Action may be considered as a submission.
   i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed _____
   ii. ☐ Other _____

b. ☒ Enclosed
   i. ☒ Amendment/Reply
   ii. ☐ Affidavit(s)/Declaration(s)
   iii. ☐ Information Disclosure Statement (IDS)
   iv. ☐ Other _____

2. Miscellaneous

a. ☐ Suspension of action on the above-identified application is requested under 37 C.F.R. § 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 C.F.R. § 1.17(i) required)

b. ☐ Other _____

3. Fees — The RCE fee under 37 C.F.R. § 1.17(e) is required by 37 C.F.R. § 1.114 when the RCE is filed.

a. ☒ Payment has been made via Financial Manager, however, the Director is hereby authorized to charge any required fees to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 024607-02-5055-US).
   i. ☐ (1st request) RCE fee required under 37 C.F.R. § 1.17(e)(1), ☐ $1360 (large entity); ☐ $680 (small entity)
   ii. ☒ (2nd or subsequent request) RCE fee required under 37 C.F.R. § 1.17(e)(2), ☒ $2000 (large entity); ☐ $1000 (small entity)
   iii. ☐ Extension of time fee required under 37 C.F.R. §§ 1.136 and 1.17, to be $ for a month(s) extension, the request for which is being made herewith
   iv. ☐ Other _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print/Type)	Yalei Sun	*Registration No. (Attorney/Agent)*	57,765
Signature	/Yalei Sun/	*Date*	May 10, 2021

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, or by facsimile transmitted to fax no. 1-703- to the U.S. Patent and Trademark Office on the date indicated below.

Name (Print/Type)		*Registration No. (Attorney/Agent)*	
Signature		*Date*	

C:\Users\mp074366\Desktop\Cheryl Documents\Patent Forms - Samples\2020 New Forms\Request for

Electronic Patent Application Fee Transmittal	
Application Number:	15908327
Filing Date:	28-Feb-2018
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Filer:	Yalei Sun/Cheryl Rogers
Attorney Docket Number:	024607-02-5055-US
Filed as Large Entity	

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2ND AND SUBSEQUENT REQUEST	1820	1	2000	2000
		Total in USD ($)		**2000**

Electronic Acknowledgement Receipt	
EFS ID:	42681817
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	24341
Filer:	Yalei Sun
Filer Authorized By:	
Attorney Docket Number:	024607-02-5055-US
Receipt Date:	10-MAY-2021
Filing Date:	28-FEB-2018
Time Stamp:	19:26:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$2000
RAM confirmation Number	E202150J26504415
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		024607-02-5055-US_RCE_Amendmentv2.pdf	2159623 730c28f6462654cdb7b96196f49e65bad6aae1a4	yes	12

Multipart Description/PDF files in .zip description

Document Description	Start	End
Applicant Arguments/Remarks Made in an Amendment	7	12
Claims	3	6
Response After Final Action	2	2
Request for Continued Examination (RCE)	1	1

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30664 138dc59553d5cf9710bb6c70938e5e9f3a87c1c5	no	2

Warnings:

Information:

Total Files Size (in bytes):	2190287

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

This amendment responds to the final office action mailed March 9, 2021. In the final office action, the Examiner:

- rejected claims 1-3, 6 and 21-23 under 35 U.S.C. 103 as being unpatentable over Stern et al. (WO 2012/072222), using U.S. Patent Publication No. 2013/0302674 as an English equivalent; and
- rejected claims 8-10 and 12 under 35 U.S.C. 103 as being unpatentable over Stern as applied to claim 1 above, and further in view of Kim et al. (U.S. Patent Publication No. 2004/0161662).

REMARKS CONCERNING CLAIMS

Claim 1 has been amended. Support for the amendments can be found in at least Figures 5(a) and 5(b) of the published application. No new matter has been added.

With respect to all amendments, Applicant has not dedicated or abandoned any unclaimed subject matter. Moreover, Applicant has not acquiesced to any characterizations of the invention, nor any rejections or objections of the claims, made by the Examiner. Moreover, the Applicant hereby rescinds any prior disclaimer of claim scope, to the extent they exist, made during the prosecution of this application or made during the prosecution of any patent or other related patents/applications, and advises the Examiner that any such previous disclaimers and the cited references that they were made to avoid may need to be revisited.

After entry of this amendment, the pending claims are: claims 1-3, 6, 8-10, 12, and 21-23.

REMARKS CONCERNING REJECTIONS UNDER 35 U.S.C. 103

I. **REJECTION OF CLAIMS 1-3, 6 AND 21-23 UNDER 35 U.S.C. 103 AS BEING UNPATENTABLE OVER STERN**

As amended herein, claim 1 recites

> a first electrode plate notch [Element 1014 or 1034 in FIG. 5(a) and 5(b)], disposed on an edge of the first electrode tab receiving groove [Element 1013 or 1033 in FIG. 5(a) and 5(b)], wherein:

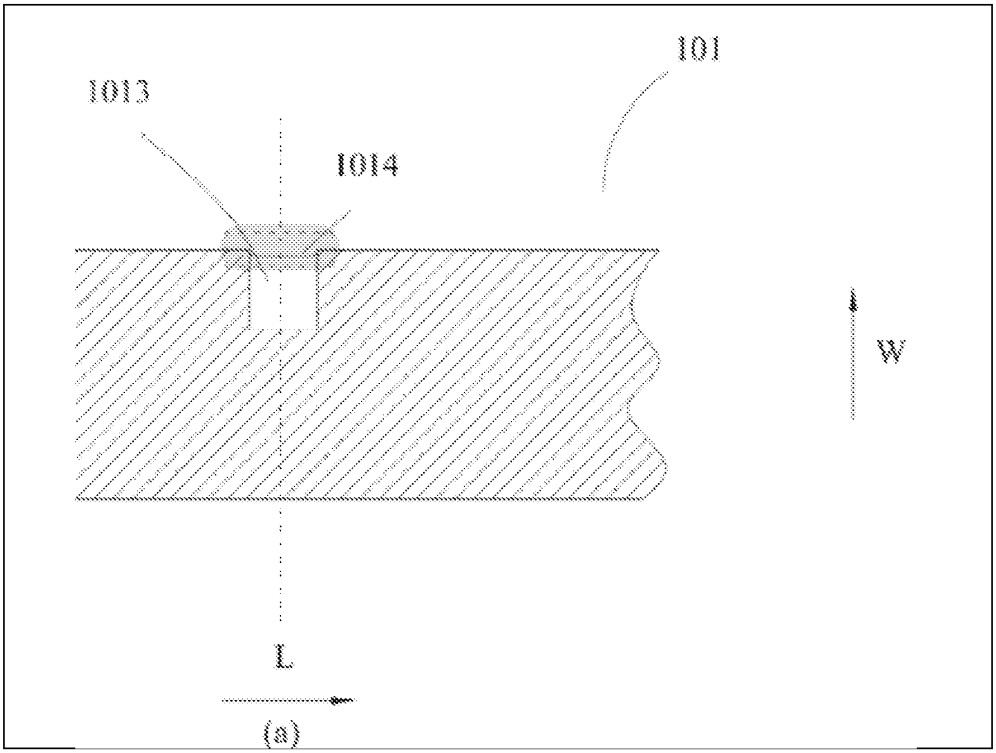
CosMX Exhibit 1003, Page 405 of 676

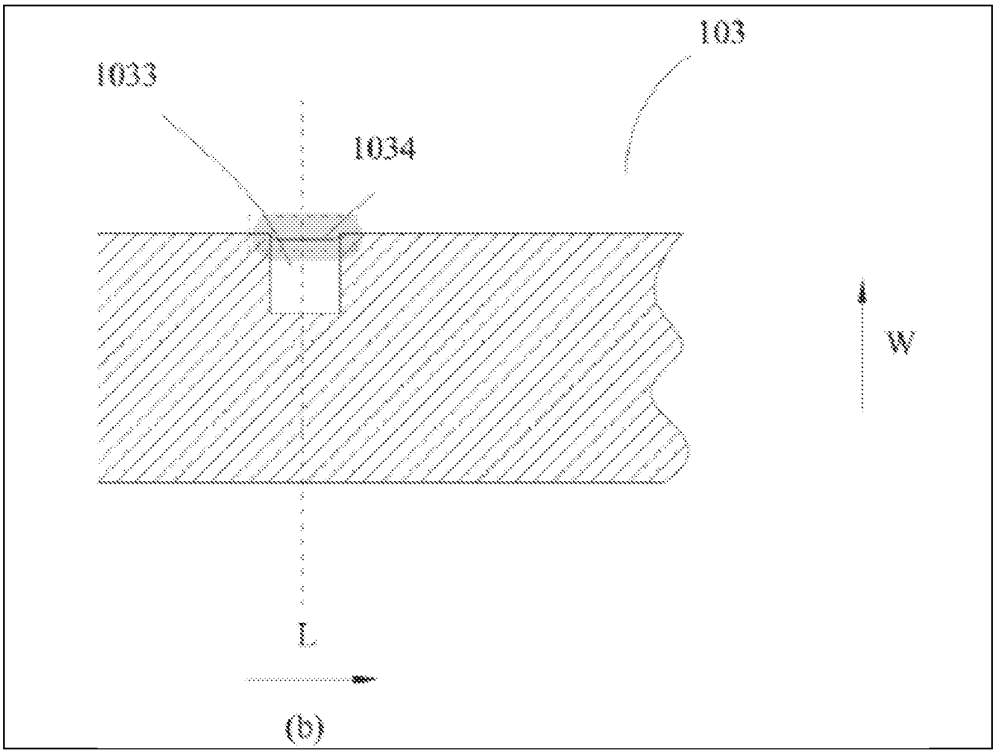
the first electrode plate notch has a depth in a width direction [direction W in FIG. 5(a) and 5(b)] of the first electrode plate; and

the first electrode plate notch has a width in a length direction [direction L in FIG. 5(a) and 5(b)] of the first electrode plate [Element 101 or 103 in FIG. 5(a) and 5(b)].

(Emphasis added)

Support for the above claim limitation can be found in FIGS. 5(a) and 5(b) of the published application, which illustrate **plan views** of the anode electrode plate and anode electrode plate, portions of which reproduced below with the anode electrode plate notch 1014 and the cathode electrode plate notch 1034 being highlighted. The notations in square brackets in the above claim limitation denote the corresponding element numbers in the figures.





Published application at FIG. 5(a) and 5(b)

The Office Action at page 3 maps the claimed **"first electrode tab receiving groove" to "arrestor regions 40" of Stern.** The Office Action also cites Stern at FIG. 9C for allegedly disclosing the first electrode plate notch. The entirety of FIG. 9 of Stern is reproduced below. **Notably, "FIGS. 9A-9C show cross-sectional views** through an electrode material during a **production process …"** Stern at 6:46-48.

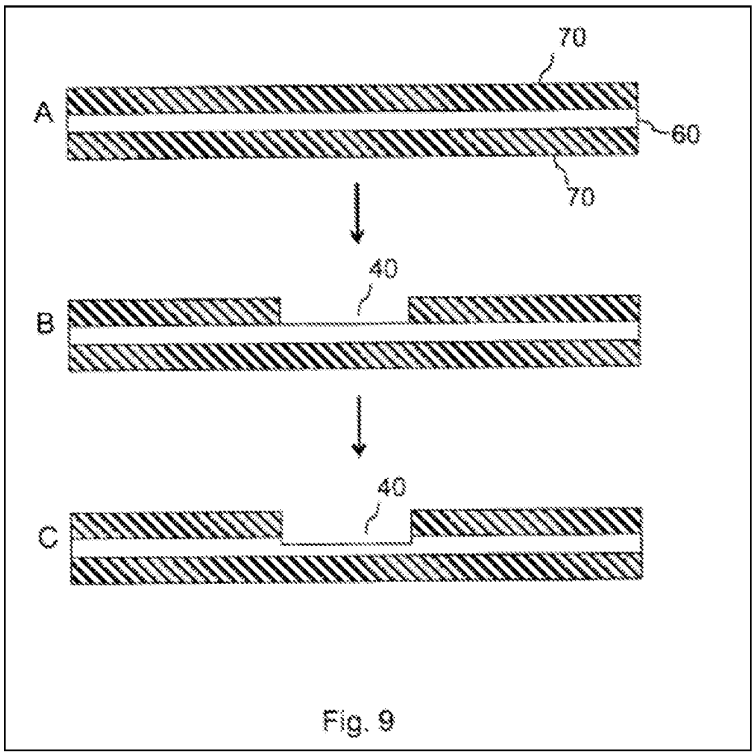


Fig. 9

Stern at FIG. 9.

The portions of Stern corresponding to FIG. 9C recite:

> It is possible for not only the coating film 70 in the arrester region 40, but also, as shown in FIG. 9C, a thin layer of the collector substrate 60, to be removed by means of laser. By virtue of the use of laser systems with a high level of cutting precision, the penetration depth of the laser can be exactly controlled, with the result that the depth of the material removal can be selected as desired. Therefore, a collector substrate 60 in the arrester region 40 can be thinned down in a targeted manner. In addition, the surface condition for making electrical contact can be improved as a result.

Stern at 8:66 – 9:8 (Emphasis added)

First, in contrast to "a first electrode plate notch [that is] disposed on an edge of the first electrode tab receiving g**roove" as recited in claim 1, Stern discloses "**a collector substrate 60 in the arrester region 40 can be thinned down in a **targeted manner." However,** the cited portion of Stern does not disclose or s**uggest formation of a "notch" that is disposed on "an edge of the first electrode** tab receiving groove [arrester re**gion 40]" as recited in claim** 1.

Second, claim 1 as amended recites that the first electrode plate notch "has a depth in a width direction of the first electrode plate." Assuming, *arguendo*, that the collector substrate 60 in Stern corresponds to the first electrode plate, FIGS. 9A and 9C of Stern at best show that the thinned down arrester region has a depth in a thickness direction of the collector substrate 60.

Thus, for at least the above reasons, claim 1 and its associated dependent claims 2, 3, 6, and 21-23 are patentable over Stern.

II. REJECTION OF CLAIMS 8-10 AND 12 UNDER 35 U.S.C. 103 AS BEING UNPATENTABLE OVER STERN AS APPLIED TO CLAIM 1 ABOVE, AND FURTHER IN VIEW OF KIM

Claims 8-10 and 12 depend from claim 1, and thus include all the limitations of claim 1 as amended. As discussed above, Stern does not disclose each and every limitation of claim 1 as amended. Furthermore, Kim is not cited for, and does not disclose, the limitations that are missing from Stern. Thus, there is no prima facie case of obviousness for claim 1 and its associated dependent claims 8-10 and 12, over the cited combination of Stern and Kim.

Applicant respectfully requests that these rejections be withdrawn.

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CONCLUDING REMARKS

By responding in the foregoing remarks only to particular positions asserted by the examiner, the Applicant does not necessarily acquiesce in other positions that have not been explicitly addressed. In addition, the Applicant's arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

In light of the above amendments and remarks, the Applicant respectfully requests that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney at (650) 843-7558, if a telephone call could help resolve any remaining items.

Respectfully submitted,

Date: May 10, 2021

/Yalei Sun/ 57,765

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CosMX Exhibit 1003, Page 410 of 676

Amendments to the Claims

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A secondary battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface;

a first electrode tab receiving groove, defined by a portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess;

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove, wherein:

the first electrode plate notch has a depth in a width direction of the first electrode plate; and

the first electrode plate notch has a width in a length direction of the first electrode plate; and

the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls;

wherein the secondary battery is a wound-type secondary battery.

2. (Previously Presented) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector; and

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a second active substance, disposed on a surface of the second current collector;

a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch, disposed on an edge of the second electrode tab receiving groove.

3. (Previously Presented) The secondary battery according to claim 2, wherein:

the first electrode plate is an anode electrode plate;

the first current collector is an anode current collector;

the first active substance is an anode active substance;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first recess is an anode recess;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active substance is a cathode active substance;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove; and

the second electrode plate notch is a cathode electrode plate notch.

4. (Cancelled)

5. (Cancelled)

6. (Previously Presented) The secondary battery according to claim 3, wherein:

a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and

a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (Cancelled)

8. (Previously Presented) The secondary battery according to claim 3, further comprising:

a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and

a second insulating adhesive tape, disposed on the second active substance and facing the first electrode tab receiving groove.

9. (Previously Presented) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape, disposed on the anode recess.

10. (Previously Presented) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode recess, wherein the cathode recess and the cathode electrode tab receiving groove are disposed on opposite sides of the cathode current collector; and

the fourth insulating adhesive tape is disposed on the cathode recess.

11. (Cancelled)

12. (Previously Presented) The secondary battery according to claim 10, wherein:

each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape, and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (Cancelled)

21. (Previously Presented) The secondary battery according to claim 1, wherein:

the first electrode tab receiving groove is defined by the first active substance and extends to the first surface of the first current collector; and

the first electrode plate notch extends through the first current collector from the first surface of the first current collector.

22. (Previously Presented) The secondary battery according to claim 2, wherein:

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the second electrode tab receiving groove is defined in the second active substance and extends to the surface of the second current collector; and

the second electrode plate notch extends through the second current collector from the surface of the second current collector.

23. (Previously Presented) The secondary battery according to claim 1, wherein a whole of the first electrode tab is parallel with the first surface of the first current collector.

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Electronically filed May 10, 2021

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo, et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION FILED WITH A REQUEST FOR CONTINUED EXAMINATION (RCE)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Sir:

The enclosed Amendment is in response to the Final Office Action dated March 9, 2021 for the above identified patent application.

The Commissioner is hereby authorized to charge any required fee(s) to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 024607-02-5055-US).

INFORMATION DISCLOSURE STATEMENT BY APPLICANT Substitute for Form 1449-PTO				*Electronically filed May 10, 2021*	
				Application Number	*15/908,327*
				Filing Date	*February 28, 2018*
				First Named Inventor	*Peipei GUO*
				Art Unit	*1723*
				Examiner Name	*D'Aniello, Nicholas P*
Sheet	1	of	2	Attorney Docket Number	*024607-02-5055-US*

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number Number - Kind Code	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2011/0020694 A1	10-27-2011	Khakhalev et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document Country Code – Number - Kind Code *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
		CN101783402A	07-21-2010	AMPEREX TECHNOLOGY LTD		
		CN102315477A	11JAN2012	SHENZHEN YAKANG PREC MACHINERY CO LTD		
		CN103579666A	02-12-2014	WIDO NEW ENERGY CO LTD		
		CN1805183A	07-19-2006	SHENZHEN HAOPENG TECHNOLOGY CO [CN]		
		CN201336332Y	10-28-2009	SHENZHEN BETTERPOWER BATTERY C [CN]		
		CN 202373667U	08-08-2012	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD		
		CN202423456U	09-05-2012	YIYANG KELIYUAN BATTERY CO LTD		
		CN202839841U	03-27-2013	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD		
		CN203574050U	04-30-2014	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD		
		CN204538109U	08-05-2015	SHIDA BATTERY TECHNOLOGY CO LTD		
		CN204946995U	06JAN2016	NINGDE AMPEREX TECHNOLOGY LTD		
		JP2000323135A	11-24-2000	TOSHIBA BATTERY		

Examiner Signature		Date Considered	

DB2/ 40844923.1

INFORMATION DISCLOSURE STATEMENT BY APPLICANT Substitute for Form 1449-PTO				*Electronically filed May 10, 2021*	
				Application Number	*15/908,327*
				Filing Date	*February 28, 2018*
				First Named Inventor	*Peipei GUO*
				Art Unit	*1723*
				Examiner Name	*D'Aniello, Nicholas P*
Sheet	2	of	2	Attorney Docket Number	*024607-02-5055-US*

NON PATENT LITERATURE DOCUMENTS		
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published
		Ningde Amperex Technology Limited, International Search Report and Written Opinion, PCT/CN2015/088638, 27MAY2016, 17 pgs.
		Chinese Office Action, CN201580082766.1, 27MAY2020, 7 pgs.
		Chinese Office Action, CN201580082766.1, 08JAN2021, 7 pgs.

Examiner Signature		Date Considered	

DB2/ 40844923.1

Electronically filed May 10, 2021

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei GUO et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'Aniello, Nicholas P.
For:	Secondary Battery Cell And Winding Formation System Thereof	Attorney Docket No.:	024607-02-5055-US

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the duty of disclosure provisions of 37 C.F.R. §1.56, there is hereby provided certain information which the Examiner may consider material to the examination of the subject U.S. patent application. It is requested that the Examiner make this information of record if it is deemed material to the examination of the application.

1. Enclosures accompanying this Information Disclosure Statement are:

1a. ☒ A list of all patents, publications, applications, or other information submitted for consideration by the office.

1b. A legible copy of:

☒ Each foreign patent;

☐ Each publication or that portion which caused it to be listed on the PTO-1449;

☐ For each cited pending U.S. application, the application specification including the claims, and any drawing of the application, or portion of the application which caused it to be listed on the PTO-1449 including any claims directed to that portion;

☒ all other information or portion which caused it to be listed on the PTO-1449.

1c. ☒ An English language copy of search report(s) from a counterpart foreign application or PCT International Search Report.

1d. ☐ Explanations of relevancy (ATTACHMENT 1(d), hereto) or English language abstracts of the non-English language publications.

2. ☒ This Information Disclosure Statement is filed under 37 C.F.R. §1.97(b):

☐ Within three months of the filing date of a national application other than a continued prosecution application under §1.53(d);

☐ Within three months of the date of entry of the national stage as set forth in §1.491 in an international application;

☐ Before the mailing of the first Office action on the merits;

☒ Before the mailing of a first Office action after the filing of a request for continued examination under §1.114.

3. ☐ This Information Disclosure Statement is filed under 37 C.F.R. §1.97(c) after the period specified in 37 C.F.R. §1.97(b), but before the mailing date of any of a final action under 37 C.F.R. §1.113, a notice of allowance under 37 C.F.R. §1.311 or an action that otherwise closes prosecution in the application.

(Check either Item 3a, 3b, 3c or 3d)

3a. ☐ The Certification Statement in Item 5 below is applicable. Accordingly, no fee is required.

3b. ☐ The $260 (large entity) fee set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c) is to be charged to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no.).

3c. ☐ The $130 (small entity) fee set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c) is to be charged to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no.).

3d. ☐ The $65 (micro entity) fee set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c) is to be charged to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no.).

(Items 3b or 3c to be checked if any reference known for more than 3 months)

4. ☐ This Information Disclosure Statement is filed under 37 C.F.R. §1.97(d) after the period specified in 37 C.F.R. §1.97(c), but on or before the date of payment of the issue fee.

(Check Item 4a, and 4b, 4c or 4d)

4a. ☐ The Certification Statement in Item 5 below is applicable.

4b. ☐ The $260 (large entity) fee set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c) is to be charged to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no.).

4c. ☐ The $130 (small entity) fee set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c) is to be charged to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no.).

4d. ☐ The $65 (micro entity) fee set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c) is to be charged to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no.).

5. ☐ Certification Statement (applicable if Item 3a or Item 4a is checked)

(Check either Item 5a, 5b, 5c or 5d)

5a. ☐ In accordance with 37 C.F.R. §1.97(e)(1), it is certified that each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement.

5b. ☐ In accordance with 37 C.F.R. §1.97(e)(2), it is certified that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing of this information disclosure statement.

5c. ☐ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and the communication was not **received** by any individual designated in 37 C.F.R. §1.56(c) more than thirty days prior to the filing of this information disclosure statement.

5d. ☐ Pursuant to 37 C.F.R. §1.704(d), each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and the communication was not **received** by any individual designated in 37 C.F.R. §1.56(c) more than thirty days prior to the filing of this information disclosure statement.

6. ☒ Copies of each cited U.S. patent and each U.S. patent application publication are not enclosed pursuant to the USPTO OG Notice dated 05 August 2003 waiving the requirement under 37 C.F.R. 1.98(a)(2)(i) for U.S. patent applications filed after June 30, 2003.

7. ☐ This application is a continuation application under 37 C.F.R. §1.53(b) or (d).

(Check appropriate Items 7a, 7b and/or 7c)

7a. ☐ A Petition to Withdraw from issue under 37 C.F.R. §1.313(b)(5) is concurrently filed herewith.

7b. ☐ Copies of publications listed on Form PTO-1449 from prior application Serial No. , filed on , of which this application claims priority under 35 U.S.C. §120, are not being submitted pursuant to 37 C.F.R. §1.98(d).

7c. ☐ Copies of the publications listed on the attached Form PTO-1449 that were not previously cited in prior application Serial No. , filed on , are provided herewith.

8. ☐ This is a Supplemental Information Disclosure Statement. (Check Item 8a)

8a. ☐ This Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(f) supplements the Information Disclosure Statement filed on . A bona fide attempt was made to comply with 37 C.F.R. §1.98, but inadvertent omissions were made. These omissions have been corrected herein. Accordingly, additional time is requested so that this Supplemental Information Disclosure Statement can be considered as if properly filed on .

9. ☐ In accordance with 37 C.F.R. §1.98, a concise explanation of what is presently understood to be the relevance of each non-English language publication is:

(Check Item 9a, 9b, or 9c)

9a. ☐ satisfied because all non-English language publications were cited on the enclosed English language copy of the PCT International Search Report or the search report from a counterpart foreign application indicating the degree of relevance found by the foreign office.

9b. ☐ set forth in the application.

9c. ☐ enclosed as an attachment hereto.

10. ☒ The Commissioner is authorized to charge any additional fee required or credit any overpayment for this Information Disclosure Statement and/or Petition to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 024607-02-5055-US).

11. ☒ No admission is made that the information cited in this Statement is, or is considered to be, material to patentability nor a representation that a search has been made (other than a search report of a foreign counterpart application or PCT International Search Report if submitted herewith). 37 C.F.R. §§1.97(g) and (h).

Respectfully submitted,

Date: May 10, 2021

/Yalei Sun/ 57,765

Yalei Sun (Reg. No.)
MORGAN, LEWIS & BOCKIUS LLP
1400 Page Mill Road
Palo Alto, CA 94304
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Electronic Acknowledgement Receipt	
EFS ID:	42686247
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	24341
Filer:	Yalei Sun/Edith Fuentes
Filer Authorized By:	Yalei Sun
Attorney Docket Number:	024607-02-5055-US
Receipt Date:	10-MAY-2021
Filing Date:	28-FEB-2018
Time Stamp:	21:54:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Foreign Reference	CN101783402A.pdf	527537 a4d9663f73e24bea01086af7990a0d1a88ca7dcb	no	9
Warnings:					

Information:					
2	Foreign Reference	CN102315477A.pdf	1198293 54744717fb842317ec30e700e820c214e47b32ec	no	24
Warnings:					
Information:					
3	Foreign Reference	CN103579666A.pdf	823908 5846d4000c4c4c19942589e7b0aaff1aa38bb498	no	11
Warnings:					
Information:					
4	Foreign Reference	CN1805183A.pdf	521637 97fb06d96826e73f3cdbdf47470e03a6c8281bcc	no	9
Warnings:					
Information:					
5	Foreign Reference	CN201336332Y.pdf	309781 9e02b59d4553c95406eabdb4679f6ac7a324acd3	no	7
Warnings:					
Information:					
6	Foreign Reference	CN202373667U.pdf	730504 f50f24efdff30798a071666855f2fff40e2f6beb	no	8
Warnings:					
Information:					
7	Foreign Reference	CN202423456U.pdf	357612 b26b81d4e4ec5732faff4cfc710e9a86d015a28a	no	7
Warnings:					
Information:					
8	Foreign Reference	CN202839841U.pdf	799882 7e40390fbe115191913dacedc14aaae2e65523d4	no	9
Warnings:					
Information:					

9	Foreign Reference	CN203574050U.pdf	1204047 b711a1e4e0e8ff0be63050b3774fb46d43099236	no	16
Warnings:					
Information:					
10	Foreign Reference	CN204538109U.pdf	322828 6f810897ea9e25a4a0d6f3ce09436d23b059de02	no	8
Warnings:					
Information:					
11	Foreign Reference	CN204946995U.pdf	1871024 6832ecd9762553e3e9cdb7c3fe5c8ce40261f611	no	26
Warnings:					
Information:					
12	Foreign Reference	JP2000323135A.pdf	338913 0486b3f02761090e2a94c1caf7e3c6535687ae51	no	5
Warnings:					
Information:					
13	Other Reference-Patent/App/Search documents	NingdeAmperex_International-Search-Rpt-Written-Opinion-PCTCN2015088638_27MAY2016.pdf	981441 e71435d2d2b581b5a93bd77408f856614d9a7e63	no	17
Warnings:					
Information:					
14	Non Patent Literature	Chinese-Office-Action-CN201580082766-1_27MAY2020.pdf	316648 d32f1867cecbaa1175ec1077bdb7d01be02da897	no	7
Warnings:					
Information:					
15	Non Patent Literature	Chinese-Office-Action-CN201580082766-1_08JAN2021.pdf	317597 14fdaae5b85ae386bcc8726781e4a2814c6c4b32	no	7
Warnings:					
Information:					

16		024607-02-5055US_IDS.pdf	165338 39f14b81ce87c8d84c664461f940ffc7771ac608	yes	6

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Information Disclosure Statement (IDS) Form (SB08)	5	6
Transmittal Letter	1	4

Warnings:	
Information:	
Total Files Size (in bytes):	10786990

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Espacenet

Bibliographic data: CN101783402 (A) — 2010-07-21

Burr removing method for cathode plate of lithium ion battery

Inventor(s): WEIFENG CHEN; WEI CHEN; JIALI GUO; LIYAN ZHU ± (CHEN WEIFENG, ; CHEN WEI, ; GUO JIALI, ; ZHU LIYAN)

Applicant(s): AMPEREX TECHNOLOGY LTD ± (AMPEREX TECHNOLOGY LTD)

Classification: **- international:** ***H01M4/04; H01M4/64***
- cooperative: Y02E60/10 (EP)

Application number: CN20091036707 20090116

Priority number (s): CN20091036707 20090116

Abstract of CN101783402 (A)

The invention discloses a burr removing method for a cathode plate of a lithium ion battery. The method removes burrs at the cut edge of a cathode current collector through the chemical reaction of alkali substance and aluminum. The method removes the cut burrs of the cathode current collector by a chemical treatment method under the conditions that the edge shape of the cathode plate is not affected and a cathode membrane coat is kept complete; and an isolating membrane between the cathode plate and an anode plate is pierced, and the cathode current collector is not contacted with the anode membrane to form short circuit, so the safety of the lithium ion battery is effectively ensured.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 101783402 A
(43)申请公布日 2010.07.21

(21)申请号 200910036707.7

(22)申请日 2009.01.16

(71)申请人 东莞新能源科技有限公司
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代理人 刘延喜 王基才

(51)Int.Cl.
H01M 4/04(2006.01)
H01M 4/64(2006.01)

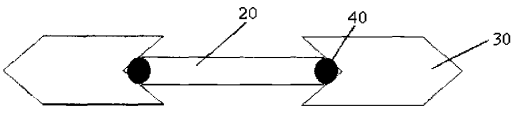
权利要求书 1 页 说明书 4 页 附图 2 页

(54)发明名称

锂离子电池阴极片的去毛刺方法

(57)摘要

本发明公开了一种锂离子电池阴极片的去毛刺方法，其通过碱性物质与铝的化学反应除去阴极集流体切割边缘的毛刺。本发明通过化学处理的方法，在不影响阴极片边缘形状且保持阴极膜片涂层完整的情况下，将阴极集流体的切割毛刺去除，因此阴、阳极片之间的隔离膜不会被刺破，阴极集流体不会与阳极膜片接触短路，从而有效保证锂离子电池的安全。



CN 101783402 A

1. 一种锂离子电池阴极片的去毛刺方法，其特征在于：通过碱性物质与铝的化学反应除去阴极集流体切割边缘的毛刺。

2. 根据权利要求 1 所述的锂离子电池阴极片的去毛刺方法，其特征在于：所述碱性物质为氢氧化钠、氢氧化锂或硅酸钠。

3. 根据权利要求 2 所述的锂离子电池阴极片的去毛刺方法，其特征在于：所述碱性物质是以碱性处理液的形式与作为阴极集流体的铝箔发生化学反应的。

4. 根据权利要求 3 所述的锂离子电池阴极片的去毛刺方法，其特征在于：所述碱性处理液的浓度为 0.2 ～ 5mol/L。

5. 根据权利要求 1 至 4 中任意一项所述的锂离子电池阴极片的去毛刺方法，其特征在于：所述碱性物质在去除毛刺的同时，还将阴极集流体的切割边缘蚀刻进一定的深度 D，蚀刻深度 D 满足以下条件：$0 << D < 200um$。

6. 根据权利要求 5 所述的锂离子电池阴极片的去毛刺方法，其特征在于：去毛刺时，所述阴极集流体只有 1 ～ 5mm 的切割边缘与碱性处理液接触。

7. 根据权利要求 6 所述的锂离子电池阴极片的去毛刺方法，其特征在于：所述阴极片去毛刺步骤是在阴极片切割完毕后仅针对阴极片进行，或是在阴、阳极片和隔离膜叠加或卷绕成电池单体后针对电池单体进行。

8. 根据权利要求 7 所述的锂离子电池阴极片的去毛刺方法，其特征在于：在卷绕前对单独的阴极片进行去毛刺步骤时，阴极片的切割边缘和碱性处理液的接触宽度为 2 ～ 5mm，处理时间不超过 5 分钟。

9. 根据权利要求 7 所述的锂离子电池阴极片的去毛刺方法，其特征在于：在卷绕后对电池单体进行去毛刺步骤时，电池单体的端部浸入碱性溶液的深度为 1 ～ 3mm，处理时间为 1 ～ 5 分钟，之后用清洗液清洗电池单体的浸入端部。

10. 根据权利要求 9 所述的锂离子电池阴极片的去毛刺方法，其特征在于：在卷绕后对电池单体进行去毛刺步骤时，是将呈乳胶状的碱性溶液以雾化喷涂的方式喷在电池单体的待处理端面上，处理时间为 5 ～ 20 分钟，再将已稍凝固的胶状处理液从电池单体的端部剥离。

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锂离子电池阴极片的去毛刺方法

技术领域

[0001] 本发明涉及一种锂离子电池阴极片的去毛刺方法。

背景技术

[0002] 随着现代社会的发展，各种移动设备，如摄像机、笔记本电脑、便携式 DVD 和数码相机等都有了越来越广泛的应用，因此，对高能电池的需求也越来越大。锂离子电池因具有重量轻、储能大、功率大、无污染、寿命长、自放电系数小、温度适应范围宽泛等许多突出的优点，逐渐受到人们的青睐，成为移动设备的最佳电源，甚至在航空、航天、航海、汽车、医疗设备等领域中也逐步取代了其他的传统电池。

[0003] 锂离子电池内一般包括若干个依次叠加的电池单体，每个电池单体包括相互卷绕或叠加的阴极片、隔离膜和阳极片，其中，隔离膜间隔于相邻的阴、阳极片之间，起到电子阻隔、离子导通的作用，同时用于保持电解液。阴极片包括一般采用铝箔制作的阴极集流体和附着在阴极集流体上、含有阴极活性物质的膜片；阳极片包括一般采用铜箔制作的阳极集流体和附着在阳极集流体上、含有阳极活性物质的膜片；隔离膜则为采用塑化、萃取等工艺制成的微孔薄膜，这样的结构有利于隔离膜对含有锂盐的有机溶剂电解液的保持。制造锂离子电池时，只要将一个或多个上述的电池单体制成电池芯，并在电池芯的外面包裹上包装薄膜，之后向其内注入电解液，经过抽空、密封即可。由于目前锂离子电池所使用的电解液为易燃的有机电解液，所以二次锂离子电池对安全性要求很高。

[0004] 但是，以铝箔作为集流体的阴极片在切割时容易于边缘处产生毛刺，因此隔离在阴、阳极片之间的隔离膜有时会被毛刺刺穿，使铝箔与阳极膜片相接触而发生短路。短路的电池会迅速升温，从而导致易燃的有机电解液着火，甚至导致电池发生爆炸。

[0005] 有鉴于此，确有必要提供一种锂离子电池阴极片的去毛刺方法。

发明内容

[0006] 本发明的目的在于：提供一种锂离子电池阴极片的去毛刺方法。

[0007] 为解决上述技术问题，本发明提供了一种锂离子电池阴极片的去毛刺方法，其通过碱性物质与铝的化学反应除去阴极集流体切割边缘的毛刺。

[0008] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，所述碱性物质为氢氧化钠、氢氧化锂或硅酸钠。

[0009] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，所述碱性物质是以碱性处理液的形式与作为阴极集流体的铝箔发生化学反应的。

[0010] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，所述碱性处理液的浓度为 0.2 ～ 5mol/L。

[0011] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，所述碱性物质在去除毛刺的同时，还将阴极集流体的切割边缘蚀刻进一定的深度 D，蚀刻深度 D 满足以下条件：0 ＜＜ D ＜ 200um。

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[0012] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，去毛刺时，所述阴极集流体只有 1 ～ 5mm 的切割边缘与碱性处理液接触。

[0013] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，所述阴极片去毛刺步骤是在阴极片切割完毕后仅针对阴极片进行，或是在阴、阳极片和隔离膜叠加或卷绕成电池单体后针对电池单体进行。

[0014] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，在卷绕前对单独的阴极片进行去毛刺步骤时，阴极片的切割边缘和碱性处理液的接触宽度为 2 ～ 5mm，处理时间不超过 5 分钟。

[0015] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，在卷绕后对电池单体进行去毛刺步骤时，电池单体的端部浸入碱性溶液的深度为 1 ～ 3mm，处理时间为 1 ～ 5 分钟，之后用清洗液清洗电池单体的浸入端部。

[0016] 作为本发明锂离子电池阴极片的去毛刺方法的一种改进，在卷绕后对电池单体进行去毛刺步骤时，是将呈乳胶状的碱性溶液以雾化喷涂的方式喷在电池单体的待处理端面上，处理时间为 5 ～ 20 分钟，再将已稍凝固的胶状处理液从电池单体的端部剥离。

[0017] 相对于现有技术，本发明通过化学处理的方法，在不影响阴极片边缘形状且保持阴极膜片涂层完整的情况下，将阴极集流体的切割毛刺去除，因此阴、阳极片之间的隔离膜也就不会再被刺破，阴极集流体不会与阳极膜片接触发生短路，从而有效保证锂离子电池的安全。

附图说明

[0018] 下面结合附图和各个具体实施方式，对本发明及其有益技术效果进行详细说明，其中：

[0019] 图 1 为根据本发明的方法在卷绕前对阴极片进行除毛刺的示意图。

[0020] 图 2 为现有技术的锂离子电池阴极片、阳极片和隔离膜叠加的示意图。

[0021] 图 3 为使用本发明的方法处理过的阴极片与阳极片及隔离膜叠加的示意图。

[0022] 图 4 为使用浸泡法处理已卷绕的锂离子电池阴极片的示意图。

[0023] 图 5 为使用雾化喷涂法处理已卷绕的锂离子电池阴极片的示意图。

具体实施方式

[0024] 锂离子电池的极片制备过程，通常包括制浆、涂膜、干燥、压型、切割等工序，虽然不同厂商或不同电池的制造工序可能会有所变化，但极片切割都是必不可少的工序。由于锂离子电池大都采用铝箔作为阴极集流体，铝自身的特性决定其切割时容易在边缘处产生毛刺。使用这样的阴极片制成的锂离子电池，其隔离膜很有可能会被毛刺刺穿，使铝箔和阳极膜片接触而短路，以致发生安全事故。为了解决这个问题，本发明根据铝的化学特性，通过化学反应的方式去除阴极片切割边缘的毛刺，从而保证阴、阳极片之间的隔离膜不会被铝箔刺破，有效提高锂离子电池的安全性能。

[0025] 本发明通过碱性物质，如氢氧化钠、氢氧化锂、硅酸钠等与铝发生的化学反应，将阴极集流体的切割边缘蚀刻一定的深度，因而能够将切割边缘的毛刺完全去除。这些碱性物质与铝发生化学反应的方程式分别为：

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[0026] $2Al+2NaOH+2H_2O = 2NaAlO_2+3H_2 \uparrow$ ；

[0027] $2Al+2LiOH+2H_2O = 2LiAlO_2+3H_2 \uparrow$ ；

[0028] $2Al+Na_2SiO_3+4H_2O = 2NaAlO_2+H_2SiO_3 \downarrow +3H_2 \uparrow$ 。

[0029] 由于上述碱性物质并不与阴极膜片及其中的阴极活性物质发生反应，因此去毛刺过程并不会对阴极膜片造成不良影响。

[0030] 请参阅图 1，在阴极片 20 切割完毕、进行卷绕之前设置一步化学去除铝箔切割边缘的工序。此工序通过夹持装置 30 将切成条状的阴极片 20 的切割边缘浸润在上述碱性物质所形成的处理液 40 中进行处理，从而将切割后暴露在阴极膜片外的铝箔腐蚀掉，并向内蚀刻一定的深度。为了减小对阴极片 20 的其他性能的影响，处理时阴极片 20 的切割边缘只有 2 ～ 5mm 接触处理液，而且浸润时间不超过 5 分钟，处理液 40 的浓度在 0.2 ～ 5mol/L 之间调配，具体数值可以根据所采用碱性溶质的反应活性、铝箔和阴极片 20 的厚度来确定。

[0031] 请参阅图 2 和图 3，在处理前，阴极片 200 上作为阴极集流体的铝箔 220 边缘与阴极膜片 240 的边缘平齐或稍微突出于阴极膜片 240 的边缘，因此与隔离膜 500 和阳极片 600 叠加后，铝箔 220 的切割毛刺就易于刺破隔离膜 500，以致与相邻的阳极膜片 640 接触而发生短路。在处理后，铝箔 22 的切割边缘及其上的毛刺都被蚀刻去掉，铝箔 22 的蚀刻深度 D 满足以下条件 ：$0 << D < 200um$。由于阴极膜片 24 并不与处理液反应，所以此时铝箔 22 的长度短于隔离膜 50，其边缘已缩入隔离膜 50 内，而且铝箔 22 上的毛刺也已经完全去除，因此不可能再发生铝箔 22 刺破隔离膜 50 后与阳极片 60 的阳极膜片 64 接触短路的安全事故。而且，即使隔离膜 50 由于其他原因发生了破损，缩入阴极膜片 24 内的铝箔 22 也很难接触到阳极膜片 64，因此以本发明的方法制成的阴极片 20 能够有效保证锂离子电池的安全。

[0032] 另外，由于上述碱性物质与电池单体中的其他物质，如阳极集流体、阳极膜片、阳极活性物质、阴阳极片间的隔离膜等，都不发生化学反应，或者是发生化学反应的活性很低，因此对阴极片 200 进行的化学除毛刺工序，也可以针对阴阳极片 200、600 及隔离膜 500 叠加或卷绕后形成的电池单体进行。

[0033] 请参阅图 2 和图 4，在将未处理的阴极片 200 和阳极片 600 及隔离膜 500 按一定顺序叠加、卷绕后形成电池单体 80，然后将电池单体 80 的一端放入事先配制好的 0.2 ～ 5mol/L 碱性处理液 400 中。所述碱性处理液 400 是放置于一个大小足够容纳电池单体 80 端部的容器 90 中，为了防止铝箔 220 被过度蚀刻，同时减小处理液 400 对电池性能的影响，所述处理液 400 在容器 90 中的高度为 1 ～ 3mm，也就是说，电池单体 80 的端部只有 1 ～ 3mm 浸入碱性处理液 400 中。处理时间根据处理液 400 的浓度、有效成分和铝的反应活性、铝箔 220 的厚度等因素确定，一般以 1 ～ 5 分钟为宜。之后将电池单体 80 的被处理端从处理容器 90 中取出，再放入清洗液 1 ～ 5 分钟，以便清洗除去附着的多余碱性处理液 400，然后通过热风吹干或其他方式进行干燥，即可完成第一端的铝箔 220 切割边缘处理。以同样的方式处理电池单体 80 的另一端，完成对电池单体 80 的第二端的铝箔 220 切割边缘处理。

[0034] 铝箔 220 经过上述方法处理后，其边缘形态与图 3 中所示阴极片 20 的铝箔 22 的边缘形态相同，此处不再赘述。

[0035] 请参阅图 5，本发明还可以雾化喷涂的方法处理电池单体 800 的铝箔边缘。处理过程为 ：将配制好的、呈乳胶状的 0.2 ～ 5mol/L 处理液 401 用雾化喷涂法直接喷在电池单体

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800 的一个待处理端面上，静止 5 ～ 20 分钟后，再将已稍凝固的胶状处理液 401 从电池单体 800 的端部剥离。然后用相同方式处理电池单体 800 的另一个待处理端面。此方法同样可以将阴极片的铝箔边缘毛刺去除，同时将铝箔蚀刻入一定的深度，处理结果与图 3 相同。

[0036] 综上所述，本发明通过化学处理的方法，在不影响阴极片边缘形状且保持阴极膜片涂层完整的情况下，将阴极集流体的切割边缘和毛刺同时去除，处理后作为阴极集流体的铝箔长度比阴极膜片还短，无法暴露在阴极片边缘，因此不会再刺破隔离膜而与阳极膜片发生短路，甚至在隔离膜由于其他原因破损的情况下，也不会与阳极膜片接触，从而有效提高锂离子电池的安全性能。

[0037] 需要说明的是，虽然本说明书仅仅以氢氧化钠、氢氧化锂或硅酸钠为例对本发明构思中的碱性物质进行说明，但是本领域的技术人员根据本说明书的揭示，也可以采用其他不影响阴极片边缘外形和不影响阴极膜片涂层完整的碱性物质。

[0038] 根据上述说明书的揭示和教导，本发明所属领域的技术人员还可以对上述实施方式进行适当的变更和修改。因此，本发明并不局限于上面揭示和描述的具体实施方式，对本发明的一些修改和变更也应当落入本发明的权利要求的保护范围内。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本发明构成任何限制。

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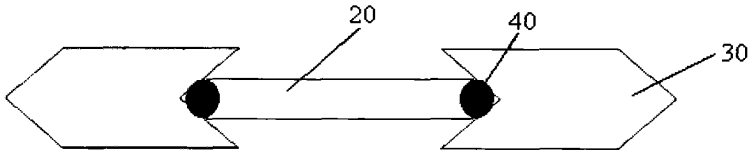


图 1

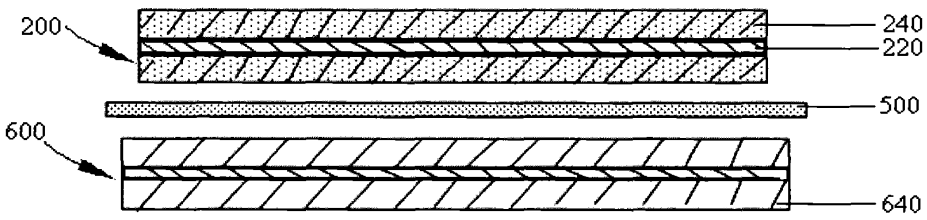


图 2

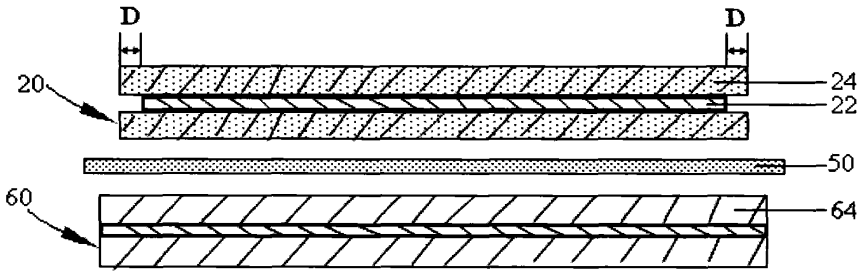


图 3

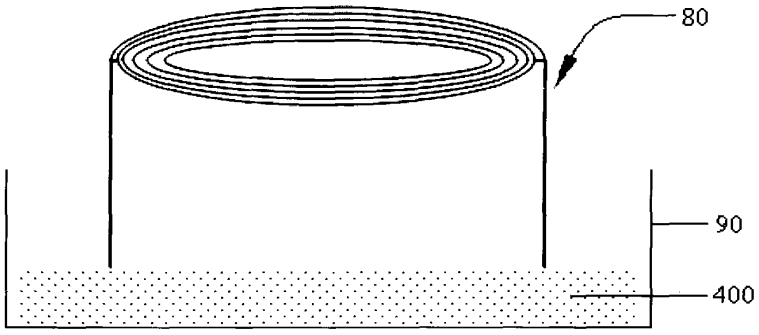


图 4

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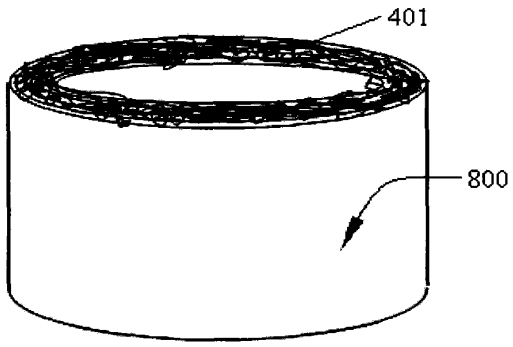


图 5

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Espacenet

Bibliographic data: CN102315477 (A) — 2012-01-11

Battery winder

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Classification: **- international:** ***H01M10/04; H01M6/00***
- cooperative: Y02E60/10 (EP)

Application number: CN201110254449 20110831 Global Dossier

Priority number (s): CN201110254449 20110831

Also published as: CN102315477 (B)

Abstract of CN102315477 (A)

The invention relates to a battery winder. The winder comprises a base body and an unwinding mechanism, wherein the unwinding mechanism is arranged on the base body and is provided for releasing a material belt. The winder further comprises a winding rectification mechanism, a material conveying mechanism, a winding pin mechanism, a gum sticking mechanism and a material discharging and detecting mechanism, wherein the winding rectification mechanism, the material conveying mechanism, the winding pin mechanism, the gum sticking mechanism and the material discharging and detecting mechanism are arranged on the base body, and are sequentially and transmittedly connected, the winding rectification mechanism is provided for automatically rectifying the material belt, the material conveying mechanism is provided for fixing the distance and conveying the material belt, the winding pin mechanism is provided for winding the material belt into the battery core, the gum sticking mechanism is provided for sticking the gum paper on the tail position of the battery core, the material discharging and detecting mechanism is provided for carrying out flatting and short-circuit detection for the battery core, the winding pin mechanism is further connected with a double winding pin transmission mechanism to be driven by the double winding pin transmission mechanism. According to the battery

winder provided by the present invention, the full automatic way is adopted for winding formation of the battery core, and automatically performing the follow-up treatments of the gum sticking and the detection; the prepared battery core has high precision, and the quality of the prepared battery core can be guaranteed; the efficiency is high, redundant operators are not required, such that the labor cost is low.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 102315477 A
(43)申请公布日 2012.01.11

(21)申请号 201110254449.7

(22)申请日 2011.08.31

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(51)Int.Cl.
H01M 10/04(2006.01)
H01M 6/00(2006.01)

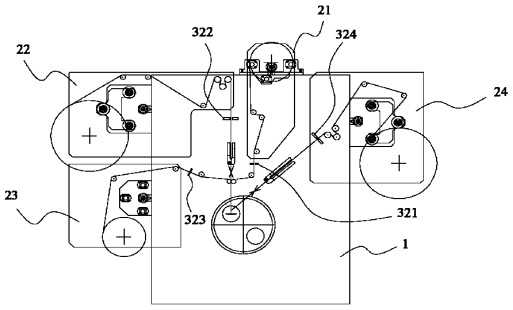
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(54)发明名称

电池卷绕机

(57)摘要

一种电池卷绕机，包括一基体以及设置在所述基体上且放出料带的一放卷机构，还包括设置在所述基体上且依次传动连接的一对料带自动纠偏的卷绕纠偏机构、一固定行程传送料带的送料机构、一将料带卷成电芯的卷针机构、一在电芯收尾处贴上胶纸的贴胶机构以及一对电芯进行压扁和短路检测的脱料及检测机构，所述卷针机构还与一双卷针传动机构相连以被其驱动。本发明的电池卷绕机采用全自动的方式将电芯卷绕成型且自动进行后续的贴胶以及检测工作，其生产出来的电芯精度高、质量能够得到保证，并且效率高、无需过多的操作人员，因而劳动力成本很低。



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1. 一种电池卷绕机，包括一基体以及设置在所述基体上且放出料带的一放卷机构，其特征在于，还包括设置在所述基体上且依次传动连接的一对料带自动纠偏的卷绕纠偏机构、一固定行程传送料带的送料机构、一将料带卷成电芯的卷针机构、一在电芯收尾处贴上胶纸的贴胶机构以及一对电芯进行压扁和短路检测的脱料及检测机构，所述卷针机构还与一双卷针传动机构相连以被其驱动。

2. 根据权利要求 1 所述的电池卷绕机，其特征在于，所述放卷机构包括至少两个放卷单元，所述卷绕纠偏机构包括与每个放卷单元对应的一纠偏单元，每个所述纠偏单元包括与所述放卷单元相连的一驱动机构以及用以检测该放卷单元上的料带是否被输送在设定位置上的一位置检测传感器，所述位置检测传感器与所述驱动机构电性连接并触发驱动机构动作以驱动各放卷单元远离或靠近所述基体上设定的各基准位。

3. 根据权利要求 1 所述的电池卷绕机，其特征在于，所述送料机构包括送料基体、固定在所述送料基体上的行走机构和夹持机构，所述夹持机构包括用以夹持物料的可相对打开和闭合的两部分，所述夹持机构固定在所述行走机构上由所述行走机构带动着相对于所述送料基体往复移动。

4. 根据权利要求 1 所述的电池卷绕机，其特征在于，所述卷针机构包括一卷针头、一第一卷针组件、一第二卷针组件、至少一滑轨、一弹性元件以及一挤压组件，所述第一卷针组件固定在所述卷针头上，各滑轨的一端固定在卷针头上，所述第二卷针组件可滑动地套设在所述滑轨上，所述弹性元件一端安装在所述卷针头上，另一端安装在所述第二卷针组件上，所述弹性元件可被所述挤压组件挤压而弹性形变以迫使所述第二卷针组件远离或靠近所述第一卷针组件。

5. 根据权利要求 1 所述的电池卷绕机，其特征在于，所述双卷针传动机构，包括 ：

一内轴 ；

一外轴，其套设在所述内轴上并可相对于所述内轴转动 ；

一第一驱动组件，其安装在所述外轴上并可驱动所述外轴转动 ；

一第二驱动组件，其安装在所述内轴上并可驱动所述内轴转动 ；

一第一旋转轴，其通过一第一同步旋转组件安装在所述外轴上并与所述外轴保持同步转动 ；以及

一第二旋转轴，其通过一第二同步旋转组件安装在所述内轴上并与所述内轴保持同步转动。

6. 根据权利要求 1 所述的电池卷绕机，其特征在于，所述贴胶机构设置在所述基体上与卷绕完毕的电芯相对应的位置，所述贴胶机构包括相对设置的一拉胶设备以及一贴胶设备，所述拉胶设备包括一胶带卷、一切胶纸段组件以及一胶纸段传递组件，所述贴胶设备包括一胶纸段附着旋转组件以及一推进组件，所述胶带卷上的胶纸被拉伸至所述切胶纸段组件后切成胶纸段，所述胶纸段传递组件将所述胶纸段传送至所述胶纸段附着旋转组件，所述推进组件推动所述胶纸段附着旋转组件贴近电芯后所述胶纸段附着旋转组件旋转将胶纸段贴在所述电芯的卷绕收尾处。

7. 根据权利要求 1 所述的电池卷绕机，其特征在于，所述脱料及检测机构包括一脱料组件、一电芯转移组件、一测试台组件以及一压电芯及测试组件，所述电芯转移组件设置在所述脱料组件与所述测试台组件之间，以接收从所述脱料组件脱出的电芯并传送至所述测

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试台组件上，所述压电芯及测试组件设置于所述测试台组件的上方，以下降对测试台组件上的所述电芯进行压扁及测试操作。

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电池卷绕机

技术领域

[0001] 本发明涉及一种卷绕机，尤其涉及一种电池卷绕机。

背景技术

[0002] 电芯的卷绕成型是电池的生产工艺中非常重要的一个生产工序，该工序一般会借助电池卷绕机实现如下的电芯卷绕成型过程：将用以放置正极卷料的正极放卷机构、用以放置负极卷料的负极放卷机构以及用以放置隔膜卷料的隔膜放卷机构上的正、负极以及隔膜卷料带一起卷绕形成电池电芯，然后在电池电芯的卷料收尾处贴上胶纸固定，再将卷绕并贴胶完毕之后的电芯脱料后最终进行检测。然而，现有的电池卷绕机实现上述的电芯卷绕成型过程往往采用的纯手工卷绕或者半自动卷绕的方式且后续的贴胶以及检测也需人工进行，因而精度不高，卷出的电芯质量得不到保证，并且效率较低，需要较多的操作人员，劳动力成本较高。

发明内容

[0003] 本发明的主要目的是为了解决现有技术的电池卷绕机卷绕形成电芯时所存在的精度不高且效率较低的技术问题。

[0004] 为了解决上述技术问题，本发明提供一种电池卷绕机，包括一基体以及设置在所述基体上且放出料带的一放卷机构，还包括设置在所述基体上且依次传动连接的一对料带自动纠偏的卷绕纠偏机构、一固定行程传送料带的送料机构、一将料带卷成电芯的卷针机构、一在电芯收尾处贴上胶纸的贴胶机构以及一对电芯进行压扁和短路检测的脱料及检测机构，所述卷针机构还与一双卷针传动机构相连以被其驱动。

[0005] 所述的电池卷绕机，其中，所述放卷机构包括至少两个放卷单元，所述卷绕纠偏机构包括与每个放卷单元对应的一纠偏单元，每个所述纠偏单元包括与所述放卷单元相连的一驱动机构以及用以检测该放卷单元上的料带是否被输送在设定位置上的一位置检测传感器，所述位置检测传感器与所述驱动机构电性连接并触发驱动机构动作以驱动各放卷单元远离或靠近所述基体上设定的各基准位。

[0006] 所述的电池卷绕机，其中，所述送料机构包括送料基体、固定在所述送料基体上的行走机构和夹持机构，所述夹持机构包括用以夹持物料的可相对打开和闭合的两部分，所述夹持机构固定在所述行走机构上由所述行走机构带动着相对于所述送料基体往复移动。

[0007] 所述的电池卷绕机，其中，所述卷针机构包括一卷针头、一第一卷针组件、一第二卷针组件、至少一滑轨、一弹性元件以及一挤压组件，所述第一卷针组件固定在所述卷针头上，各滑轨的一端固定在卷针头上，所述第二卷针组件可滑动地套设在所述滑轨上，所述弹性元件一端安装在所述卷针头上，另一端安装在所述第二卷针组件上，所述弹性元件可被所述挤压组件挤压而弹性形变以迫使所述第二卷针组件远离或靠近所述第一卷针组件。

[0008] 所述的电池卷绕机，其中，所述双卷针传动机构，包括：一内轴；一外轴，其套设在所述内轴上并可相对于所述内轴转动；一第一驱动组件，其安装在所述外轴上并可驱动所

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述外轴转动；一第二驱动组件，其安装在所述内轴上并可驱动所述内轴转动；一第一旋转轴，其通过一第一同步旋转组件安装在所述外轴上并与所述外轴保持同步转动；以及一第二旋转轴，其通过一第二同步旋转组件安装在所述内轴上并与所述内轴保持同步转动。

[0009] 所述的电池卷绕机，其中，所述贴胶机构设置在所述基体上与卷绕完毕的电芯相对应的位置，所述贴胶机构包括相对设置的一拉胶设备以及一贴胶设备，所述拉胶设备包括一胶带卷、一切胶纸段组件以及一胶纸段传递组件，所述贴胶设备包括一胶纸段附着旋转组件以及一推进组件，所述胶带卷上的胶纸被拉伸至所述切胶纸段组件后切成胶纸段，所述胶纸段传递组件将所述胶纸段传送至所述胶纸段附着旋转组件，所述推进组件推动所述胶纸段附着旋转组件贴近电芯后所述胶纸段附着旋转组件旋转将胶纸段贴在所述电芯的卷绕收尾处。

[0010] 所述的电池卷绕机，其中，所述脱料及检测机构包括一脱料组件、一电芯转移组件、一测试台组件以及一压电芯及测试组件，所述电芯转移组件设置在所述脱料组件与所述测试台组件之间，以接收从所述脱料组件脱出的电芯并传送至所述测试台组件上，所述压电芯及测试组件设置于所述测试台组件的上方，以下降对测试台组件上的所述电芯进行压扁及测试操作。

[0011] 本发明具有以下有益效果，本发明的电池卷绕机采用全自动的方式将电芯卷绕成型且自动进行后续的贴胶以及检测工作，其生产出来的电芯精度高、质量能够得到保证，并且效率高、无需过多的操作人员，因而劳动力成本很低。

附图说明

[0012] 图 1 是本发明的电池卷绕机上的卷绕纠偏机构的主视图。

[0013] 图 2 是本发明的电池卷绕机上的卷绕纠偏机构的俯视图。

[0014] 图 3 是本发明的电池卷绕机上的送料机构的主视图。

[0015] 图 4 是本发明的电池卷绕机上的送料机构的侧视图。

[0016] 图 5 是本发明的电池卷绕机上的卷针机构的主视图(图中箭头方向为卷针机构抽芯方向)。

[0017] 图 6 是本发明的电池卷绕机上的卷针机构的俯视图。

[0018] 图 7 是本发明的电池卷绕机上的双卷针传动机构的俯视图。

[0019] 图 8 是本发明的电池卷绕机上的贴胶机构的主视图。

[0020] 图 9 是本发明的电池卷绕机上的拉胶设备的左视图。

[0021] 图 10 是本发明的电池卷绕机上的贴胶设备的右视图。

[0022] 图 11 是本发明的电池卷绕机上的脱料及检测机构的主视图。

[0023] 图 12 是本发明的电池卷绕机上的脱料及检测机构的俯视图。

具体实施方式

[0024] 为了进一步说明本发明的原理和结构，现结合附图对本发明的优选实施例进行详细说明。

[0025] 请参阅图 1 至图 12 所示，本发明的电池卷绕机包括一基体 1、一放卷机构 2、一卷绕纠偏机构 3、一送料机构 4、一卷针机构 5、一双卷针传动机构 6、一贴胶机构 7 以及一脱料

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及检测机构 8，所述放卷机构 2、卷绕纠偏机构 3、送料机构 4、卷针机构 5、贴胶机构 7 以及一脱料及检测机构 8 均设置在所述基体 1 上且依次传动连接，所述双卷针传动机构 6 也设置在所述基体 1 上且与所述卷针机构 5 相连以驱动其动作。

[0026] 所述放卷机构 2 用以放出料带，其可包括至少两个放卷单元，以下以图 1 和图 2 中所示的包括四个放卷单元为例进行说明，所述四个放卷单元为：两个用以放置隔膜卷料的隔膜放卷单元 21、23、一用以放置正极卷料的正极放卷单元 24 以及一用以放置负极卷料的负极放卷单元 22。各放卷单元 21、22、23、24 均包括：一载物台以及凸出设置在载物台上的卷料固定轴，各卷料分别套装在各放卷单元 21、22、23、24 的卷料固定轴上，并可绕卷料固定轴转动而抽出料带，各卷料的料带分别经过各辊及夹持机构汇聚于卷绕机构后被卷成电芯。

[0027] 请参阅图 1 和图 2 所示，为该卷绕纠偏机构 3 的结构示意图。

[0028] 该卷绕纠偏机构 3 用以对料带自动纠偏，其包括四个分别与各放卷单元 21、22、23、24 对应的纠偏单元，每个纠偏单元均包括：与放卷单元 21、22、23、24 相连的一驱动机构 31 以及用以检测该放卷单元 21、22、23、24 上的料带是否被输送在设定位置上的一位置检测传感器 321、322、323、324。各位置检测传感器 321、322、323、324 安装在基体 1 上，其各自的安装位置分别决定了各放卷单元 21、22、23、24 的基准位。各位置检测传感器 321、322、323、324 分别与各驱动机构 31 电性连接，当各位置检测传感器 321、322、323、324 检测到正卷料、负极卷料或者隔膜卷料的料带在输送及卷绕过程中发生位置偏移时，其触发相应的驱动机构 31 动作，带动相应的放卷单元 21、22、23、24 远离或靠近其各自对应的基准位，从而将发生偏移的料带纠正到设定位置上，实现自动纠偏功能。

[0029] 该卷绕纠偏机构 3 还可包括一控制电路(图中未视出)，各位置检测传感器 321、322、323、324 检测的信号输送至该控制电路，由该控制电路触发并控制各驱动机构 31 动作。

[0030] 参阅图 2，该驱动机构 31 包括：一与基体 1 相连的支座 311、一固定在支座 311 上并可相对于支座 311 移动的行走机构 312 以及一连接轴 313，行走机构 312 包括：一丝杆 3121、一驱动丝杆 3121 转动的动力机 3122 以及一套设在丝杆 3121 上螺母 3123，动力机 3122 可为电动机，也可为气动或其他方式驱动的马达等，螺母 3123 通过一传动件 3132 与连接轴 313 的一端相连，连接轴 313 的另一端与各放卷机构 21、22、23、24 的载物台相连，连接轴 313 还通过一直线轴承 3131 与支座 311 相连。当动力机 3122 驱动丝杆 3121 转动时，由于螺母 3123 套设在丝杆 3121 上，所以螺母 3123 可沿丝杆来回移动，从而带动传动件 3132 沿着丝杆 3121 移动，进而带动连接轴 313 和各放卷机构 21、22、23、24 靠近或远离基体 1。

[0031] 显然，在其他实施例中，驱动机构 31 也可为现有技术中常见的其他结构，如：油缸驱动机构或气缸驱动机构等；该卷绕纠偏机构可不限定应用在具有四个放卷单元的电池卷绕机上，也可应用在具有两个、三个或四个以上放卷单元的电池卷绕机上。

[0032] 请参阅图 3 和图 4 所示，为所述送料机构 4 的结构示意图。

[0033] 所述送料机构 4 用于固定行程传送料带，其包括：送料基体 41、固定在送料基体 41 上的行走机构 42 和夹持机构 43，夹持机构 43 用以夹持料带，其包括一固定组件 431、一旋转轴 433 以及一通过旋转轴 433 与固定组件 431 铰接在一起并可相对于固定组件 431 打开和闭合的活动组件 432。夹持机构 43 固定在行走机构 42 上由行走机构带动着相对于送料

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基体 41 往复移动。

[0034] 所述行走机构 42 包括 :一固定在送料基体 41 上的丝杆 421、一驱动丝杆 421 转动的动力元件 422 以及一套设在丝杆 421 上螺母 423,螺母 423 与夹持机构 43 相连并可带动着夹持机构 43 沿着丝杆 421 往复移动。为使螺母 423 和夹持机构 43 沿预定轨迹移动,提高螺母 423 与丝杆 421 相对移动的顺畅性,行走机构 42 还包括 :一导向部件 424,该导向部件 424 包括 :至少一平行于丝杆 421 的线轨 4241 和至少一套装在每根线轨 4241 上的可相对于线轨 4241 移动的滑块 4242。各滑块 4242 连接在一固定板 4243 上并通过该固定板 4243 与夹持机构 43 的固定组件 431 相连,固定板 4243 与螺母 423 相连。动力元件 422 可为电动机或气动马达等,其带动丝杆 421 正向或反向转动,从而使螺母 423 沿着丝杆 421 反复移动,进而带动与螺母 423 相连的固定板 4243、夹持机构 43、滑块 4242 沿着线轨 4241 反复移动。

[0035] 所述夹持机构 43 的固定组件 431 包括一固定端 4311 和一夹取端 4312,固定端 4311 通过一固定块(未图示)与行走机构 42 的固定板 4243 相连,从而使固定组件 431 与行走机构 42 同步移动。活动组件 432 包括 :一固定部 4321、一转轴 4322、一夹取部 4323 以及一操作部 4324。固定部 4321 固定在行走机构 42 的固定板 4243 上,转轴 4322 的两端通过轴承安装在固定部 4321 上并可相对于固定部 4321 旋转。夹取部 4323 固定在转轴 4322 上,并与固定组件 431 的夹取端 4312 对应以实现夹取料带的功能。操作部 4324 的第一端与夹取部 4323 相连,操作部 4324 的第二端通过一弹簧 435 与固定组件 431 相连,而且,该第二端还连接有一可驱动该端靠近或远离固定组件 431 的驱动元件 434。该驱动元件 434 可以为气缸或油缸等,驱动元件 434 的活塞杆 4342 与操作部 4324 的第二端相连,缸体 4341 固定在固定组件 431 上。当活塞杆 4342 伸出时,操作部 4324 被推动而远离固定组件 431,从而带动操作部 4324 以及夹取部 4323 绕转轴 4322 旋转而使夹取部 4323 靠近固定组件 431 的夹取端 4312,进而完成夹取料带的动作 ;当活塞杆 4342 缩回时,操作部 4324 在弹簧 435 的弹力作用下被拉回而靠近固定组件 431,从而带动操作部 4324 以及夹取部 4323 绕转轴 4322 旋转而使夹取部 4323 远离固定组件 431 的夹取端 4312,进而完成释放料带的动作。

[0036] 显然,上述驱动元件 434 也可以为电动机或气动马达等,电动机或气动马达的输出轴与一凸轮相连,凸轮的边缘抵靠在第二支臂上,通过转动凸轮来推动第二支臂。

[0037] 请参阅图 5 和图 6 所示,为所述卷针机构 5 的结构示意图。

[0038] 所述卷针机构 5 用于将料带卷成电芯,其包括一卷针头 51、一第一卷针组件 52、一第二卷针组件 53、至少一滑轨 54、一弹性元件 55 以及一挤压组件 56。第一卷针组件 52 和第二卷针组件 53 用以卷绕电池,其中,第一卷针组件 52 包括 :第一卷针座 521 以及与第一卷针座 521 相固定连接的第一卷针 522。第二卷针组件 53 包括 :第二卷针座 531 以及与第二卷针座 531 相固定连接的第二卷针 532。各滑轨 54 的一端固定在卷针头 51 上。第一卷针座 521 固定在卷针头 51 上,第二卷针座 531 通过与其相连的至少一滑块 5311 套设在滑轨 54 上,滑轨 54 的外端设置有防止滑块 5311 掉出的挡止部(未图示)。弹性元件 55 可为弹簧,其一端通过一安装在卷针头 51 上的顶丝 551 安装在卷针头 51 上,另一端安装在第二卷针组件 53 上,第二卷针座 531 上设置有供弹性元件 55 伸入的凹槽。

[0039] 该挤压组件 56 包括 :至少一滚轮 561 以及一滑杆 562,该至少一滚轮 561 铰接在第二卷针组件 53 的远离第一卷针组件 52 的外侧,滑杆 562 包括 :一垂直于弹性元件 55 的

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自由伸展方向的工作面 5622 和一位于滑杆 562 一端的相对于工作面 5622 倾斜并与工作面 5622 相连的导向面 5621，导向面 5621 与工作面 5622 相连的一端较其另一端更靠近滚轮 561，所以，当滚轮 561 沿着导向面 5621 滑动到工作面 5622 上时，工作面 5622 可挤压滚轮 561，并进而挤压与滚轮 561 相连的第二卷针组件 53，并进而挤压与第二卷针组件 53 相连的弹性元件 55。

[0040] 显然，上述第一卷针组件 52、第二卷针组件 53 以及挤压组件 56 也可采用现有技术中的其他结构。

[0041] 卷绕电池时，第二卷针组件 53 受弹性元件 55 的弹性张力作用而被定位在滑轨 54 的最外端，从而与第一卷针组件 52 间隔开并保持一预定距离，料带沿第一卷针组件 52 和第二卷针组件 53 的宽度方向层层缠绕而被卷成电芯；抽芯时，卷针头 51 向图 1 中的箭头方向移动，进而使滚轮 561 在滑杆 562 的导向面 5621 和工作面 5622 上移动而挤压第二卷针组件 53，使弹性元件 55 被压缩而形变，从而迫使第二卷针组件 53 靠近第一卷针组件 52，缩小与第一卷针组件 52 之间的距离，从而方便抽芯。

[0042] 请参阅图 7 所示，为所述双卷针传动机构 6 的结构示意图。

[0043] 所述双卷针传动机构 6 包括一内轴 62、一外轴 61、一第一驱动组件 63、一第二驱动组件 64、一第一旋转轴 67 以及一第二旋转轴 68。第一旋转轴 67 和第二旋转轴 68 各连接一卷针。外轴 61 套设在内轴 62 上并可相对于内轴 62 转动，第一驱动组件 63 安装在外轴 61 上并可驱动外轴 61 转动，第二驱动组件 64 安装在内轴 62 上并可驱动内轴 62 转动，第一旋转轴 67 通过一第一同步旋转组件 65 安装在外轴 61 上并与外轴 61 保持同步转动，第二旋转轴 68 通过一第二同步旋转组件 66 安装在内轴 62 上并与内轴 62 保持同步转动。

[0044] 在具体实施时，可将外轴 61 设计为空心轴，内轴 62 设计为实心轴，使实心轴 62 套设在空心轴 61 中并使二者能独立旋转。实心轴 62 的两端向外伸出空心轴 61，第二驱动组件 64 安装在实心轴 62 的一端，第二同步旋转组件 66 安装在内轴 62 的另一端。

[0045] 第一驱动组件 63 包括：一第一伺服电机 631、一安装在第一伺服电机 631 输出轴上的第一主动轮 632、一安装在外轴 61 上的第一从动轮 634 以及一张紧在第一主动轮 632 和第一从动轮 634 之间的皮带 633。

[0046] 第二驱动组件 64 包括：一第二伺服电机 641、一安装在第二伺服电机 641 输出轴上的第二主动轮 642、一安装在内轴 62 上的第二从动轮 644 以及一张紧在第二主动轮 642 和第二从动轮 644 之间的皮带 643。

[0047] 第一同步旋转组件 65 包括：安装在外轴 61 上的第一同步轮 651、安装在第一旋转轴 67 上的第二同步轮 652 以及张紧在第一同步轮 651 和第二同步轮 652 之间的皮带 653。

[0048] 第二同步旋转组件 66 包括：安装在内轴 62 上的第三同步轮 661、安装在第二旋转轴 68 上的第四同步轮 662 以及张紧在第三同步轮 661 和第四同步轮 662 之间的皮带 663。

[0049] 该双卷针传动机构 6 的工作原理如下：由第一伺服电机 631 驱动第一主动轮 632 旋转，进而由第一主动轮 632 带动第一从动轮 634 旋转，从而带动外轴 61 旋转，再由外轴 61 旋转带动其上第一同步轮 651 旋转，进而带动第二同步轮 652 旋转，再由第二同步轮 652 带动第一旋转轴 67 旋转，实现连接在第一旋转轴 67 上的卷针旋转。由第二伺服电机 641 驱动第二主动轮 642 旋转，从而由第二主动轮 642 带动第二从动轮 644 旋转，进而带动内轴 62 旋转，再由内轴 62 旋转带动其上第三同步轮 661 旋转，进而带动第四同步轮 662 旋转，再由

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第四同步轮 662 带动第二旋转轴 68 旋转，实现连接在第二旋转轴 68 上的卷针旋转。

[0050] 请参阅图 8 至图 10 所示，为所述贴胶机构 7 的结构示意图。

[0051] 所述贴胶机构 7 设置在所述基体 1 上与卷绕完毕的电芯 900 相对应的位置，用于在电芯 900 的收尾处贴上胶纸，其包括相对设置的一拉胶设备 71 以及一贴胶设备 72。

[0052] 请参阅图 8 和图 9 所示，所述拉胶设备 71 包括一胶带卷 711、一切胶纸段组件 712 以及一胶纸段传递组件 713。

[0053] 所述胶带卷 711 上缠绕有胶纸 7110，所述胶带卷 711 可旋转的设置在卷绕机的机架上。

[0054] 所述切胶纸段组件 712 包括一基座 7121、一固定夹 7122、一活动夹 7123 以及一切割工具 7124，所述胶带卷 711 上的胶纸 7110 被拉伸至所述切胶纸段组件 712 后切成胶纸段。所述固定夹 7122 固定在所述基座 7121 上，所述活动夹 7123 可滑动的连接在所述基座 7121 上以远离或靠近所述固定夹 7122，所述切割工具 7124 设置在所述固定夹 7122 与所述活动夹 7123 之间且可在垂直于所述固定夹 7122 与所述活动夹 7123 的连线的方向进行切割作业，所述胶纸 7110 穿过所述固定夹 7122 后可被所述活动夹 7123 夹持并拉伸。

[0055] 所述胶纸段传递组件 713 包括一旋转接头 7131 以及一吸盘 7132，所述胶纸段传递组件 713 将所述胶纸段传送至所述贴胶设备 72。

[0056] 所述旋转接头 7131 包括一固定部 71311 以及一旋转部 71312，所述旋转部 71312 的一端可旋转连接在所述固定部 71311 上。

[0057] 所述吸盘 7132 垂直连接在所述旋转部 71312 的另一端，所述胶纸 7110 穿过所述固定夹 7122 并被所述活动夹 7123 夹持拉定长后，所述旋转部 71312 带动所述吸盘 7132 贴近吸取所述切胶纸段组件 712 上的胶纸 7110，此时所述切割工具 7124 动作将吸附在吸盘 7132 的胶纸切割成合适长度的胶纸段，进而吸盘 7132 旋转带动切成的胶纸段旋转 90 度至正对所述贴胶设备 72 的位置（图 8 中虚线所示的吸盘 7132 为旋转 90 度后正对所述贴胶设备 72 的状态）。

[0058] 请参阅图 8 和图 10 所示，所述贴胶设备 72 包括一胶纸段附着旋转组件 721 以及一推进组件 722，还可以包括一初始位置调节组件 723 以及一位移补偿组件 724。

[0059] 所述胶纸段附着旋转组件 721 包括一贴胶圆滚 7211 以及一吸附装置 7212，所述吸附装置 7212 设置在所述贴胶圆滚 7211 的外表面上以吸附所述胶纸段传递组件 713 上的胶纸段，从而实现将所述胶纸段传递组件 713 上的胶纸段传送至所述胶纸段附着旋转组件 721。在所述胶纸段附着旋转组件 721 贴近所述电芯 900 后，所述胶纸段附着旋转组件 721 旋转将所述胶纸段 711 贴在所述电芯 900 的卷绕收尾处 901。

[0060] 所述推进组件 722 推动带有胶纸段的所述胶纸段附着旋转组件 721 贴近电芯 900。所述推进组件 722 包括两线轨 7221、一输出轴可伸缩的推进动力器件 7222 以及两第一滑动块 7223，还可以包括两第二滑动块 7224 以及一弹簧 7225。

[0061] 所述两线轨 7221 平行间隔设置。

[0062] 所述推进动力器件 7222 设置在所述两线轨 7221 之间。

[0063] 所述两第一滑动块 7223 对称连接在所述胶纸段附着旋转组件 721 的两侧且分别与所述两线轨 7221 滑动连接，所述推进动力器件 7222 的输出轴与所述胶纸段附着旋转组件 721 相连以推动所述胶纸段附着旋转组件 721 贴近所述电芯 900。

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[0064] 所述两第二滑动块 7224 对称连接在所述动力器件 7222 的两侧且分别与所述两线轨 7221 滑动连接。

[0065] 所述弹簧 7225 连接在所述推进动力器件 7222 的输出轴与所述胶纸段附着旋转组件 721 之间。

[0066] 所述初始位置调节组件 723 包括轴心相连的一调节圆滚 7231 以及一调节动力器件 7232。所述调节圆滚 7231 平行设置在所述胶纸段附着旋转组件 721 的侧下方，在所述胶纸段附着旋转组件 721 被推动前，所述调节圆滚 7231 贴紧所述胶纸段附着旋转组件 721 的外表面。所述调节动力器件 7232 的中心可旋转以驱动所述调节圆滚 7231，所述调节圆滚 7231 的转动带动所述胶纸段附着旋转组件 721 转动进而使得其上的胶纸段转动调整至合适的初始位置。

[0067] 所述位移补偿组件 724 包括一连接接头 7241、一摆臂 7242、一随动器 7243 以及一凸轮 7244，还可以包括一固定座 7245。所述连接接头 7241 的两端分别与所述推进组件 722 以及所述摆臂 7242 的一端可旋转连接，所述连接接头 7241 可为一鱼眼接头。所述摆臂 7242 的另一端以及所述凸轮 7244 可旋转地连接在所述卷绕机的机架(图中未示出)上。所述随动器 7243 的外边缘可旋转地设置在所述摆臂 7242 上。所述凸轮 7244 可旋转的外边缘与所述随动器 7243 的外边缘相接触。所述固定座 7245 固定在所述卷绕机的机架(图中未示出)上，上述摆臂 7242 的另一端与所述固定座 7245 可旋转连接。当所述凸轮 7244 旋转时，由于所述凸轮 7244 的外边沿与其旋转轴之间的距离的变化，所述摆臂 7242 在平行于所述胶纸段附着旋转组件 721 的推进方向上会发生一定的位移。

[0068] 所述贴胶机构 7 的工作过程描述如下：初始状态时，所述胶带卷 711 上的胶纸 7110 被拉伸并穿过所述固定夹 7122，所述胶纸 7110 的自由端被所述固定夹 7122 所夹持。贴胶过程开始时，所述活动夹 7123 滑动至靠近所述固定夹 7122 并夹取所述胶纸 7110 的自由端；然后松开所述固定夹 7122，所述活动夹 7123 带动所述胶纸 7110 的自由端远离所述固定夹 7122；当所述胶纸 7110 被拉伸超出所述固定夹 7122 合适的长度时，所述旋转部 71311 带动所述吸盘 7132 贴近吸取所述胶纸 7110 超出所述固定夹 7122 的部分，并使得所述固定夹再次夹紧所述胶纸 7110；此时所述切割工具 7124 进行切割动作，将吸附在吸盘 7132 的胶纸 7110 切割成合适长度的胶纸段；切割完毕后，所述吸盘 7132 旋转带动切成的胶纸段旋转 90 度至正对所述贴胶圆滚 7211 的位置；在所述贴胶圆滚 7211 上的吸附装置 7212 吸取所述胶纸段后，所述推进组件 722 推动所述贴胶圆滚 7211 贴近所述电芯 900，所述电芯 900 的转动带动所述贴胶圆滚 7211 转动进而将附着其上的所述胶纸段贴在所述电芯 900 的卷绕收尾处。

[0069] 由于所述电芯 900 为长圆截面状，故而所述电芯 900 旋转时，与其贴近的所述贴胶圆滚 7211 在推进方向上会产生一定的前后位移，而由于所述弹簧 7225 的设置，上述的位移会得到一定的缓冲，但大部分的位移通过所述位移补偿组件 724 上的凸轮 7244 的旋转从而得到补偿。

[0070] 另外，当所述电芯 900 的形状有所变化时，所述胶纸段在所述贴胶圆滚 7211 上的初始位置必然需要有所变化，此时可以在所述推进组件 722 动作之前，转动所述初始位置调节组件 723 上的所述调节圆滚 7231 进而带动所述贴胶圆滚 7211 转动，进而使得其上的胶纸段转动调整至合适的初始位置。

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[0071] 所述贴胶机构 7 采用的是自动贴胶的方式，生产效率以及精度均较高，并且通过所述初始位置调节组件的设置，同一贴胶机构只需进行简单的调整即可适应不同型号的电芯，适应性强且应用范围广。

[0072] 请参阅图 11 至图 12 所示，为所述脱料及检测机构 8 的结构示意图。

[0073] 所述脱料及检测机构 8 用于对电芯 900 进行脱料以及压扁和短路检测，其包括一脱料组件 81、一电芯转移组件 82、一测试台组件 83 以及一压电芯及测试组件 84，还可以包括一废料剔除组件 85。

[0074] 所述脱料组件 81 可为一横截面呈 U 型的剥离板，所述电芯 900 进入所述剥离板的 U 型开口内侧脱料。

[0075] 所述电芯转移组件 82 设置在所述脱料组件 81 与所述测试台组件 83 之间，并且可以还设置在所述测试台组件 83 与传送电芯 900 的流水线 100 之间，所述电芯转移组件 82 接收从所述脱料组件 81 脱出的电芯 900 并传送至所述测试台组件 83 上，还可以接收压扁并测试合格的所述电芯 900 并传送至所述流水线 100。所述电芯转移组件 82 包括可横向往复运动的一电芯托板 823 以及可纵向往复运动的一第一吸盘组 824，还可以包括横向延伸的至少一第一导轨 821、纵向延伸的至少一第二导轨 822、一第一气缸 825、一第二气缸 826、至少一第三导轨 827、一第二吸盘组 828 以及一第三气缸 829。

[0076] 所述第一导轨 821 以及所述第二导轨 822 均水平设置，且所述第一导轨 821 与所述第二导轨 822 的一端垂直交叉设置，所述第一导轨 821 的一端靠近所述脱料组件 81 的一侧。

[0077] 所述电芯托板 823 可沿所述第一导轨 821 滑动地设置在所述第一导轨 821 上方，所述电芯托板 823 从所述脱料组件 81 的一侧接收从所述脱料组件 81 脱出的所述电芯 900 并横向运动传送给所述第一吸盘组 824。所述电芯托板 823 可包括一托板本体 8231 以及一托板偏转装置 8232，所述托板本体 8231 为水平方向设置，所述托板偏转装置 8232 设置在所述托板本体 8231 的一端以驱动所述托板本体 8231 在竖直方向上偏转一定角度接收从所述脱料组件 81 脱出的电芯 900，待接收所述电芯 900 之后，所述托板偏转装置 8232 又驱动所述托板本体 8231 回转复位至水平位置。

[0078] 所述第一吸盘组 824 可沿所述第二导轨 822 滑动地设置在所述第二导轨 822 的上方，所述第一吸盘组 824 纵向运动将所述电芯 900 传送到所述测试台组件 83 上。

[0079] 所述第一气缸 825 的输出轴与所述电芯托板 823 相连，以驱动所述电芯托板 823 沿着所述第一导轨 821 横向往复运动。

[0080] 所述第二气缸 826 的输出轴与所述第一吸盘组 824 相连，以驱动所述第一吸盘组 824 沿着所述第二导轨 822 纵向往复运动。

[0081] 所述第三导轨 827 与所述第二导轨 822 的另一端垂直交叉设置。

[0082] 所述第二吸盘组 828 可沿所述第三导轨 827 滑动地设置在所述第三导轨 827 的上方，所述第二吸盘组 828 接收压扁并测试合格的所述电芯 900 后纵向移动将所述电芯 900 传送至所述流水线 100。

[0083] 所述第三气缸 829 的输出轴与所述第二吸盘组 828 相连，以驱动所述第二吸盘组 828 沿着所述第三导轨 827 纵向往复运动。

[0084] 所述测试台组件 83 包括并排设置且可在水平方向上左右晃动的一左规正板 831

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以及一右规正板 832，当所述电芯 900 落在所述测试台组件 82 上时，可通过所述左规正板 831 以及所述右规正板 832 在水平方向上左右晃动以调整所述电芯 900 使其位于所述测试台组件上的中间位置。

[0085] 所述压电芯及测试组件 84 设置于所述测试台组件 83 的上方，以下降对测试台组件 83 上的所述电芯 900 进行压扁及测试操作。所述压电芯及测试组件 84 可包括一光电开关（图中未示出）、一压块 841 以及一第四气缸 842，所述光电开关设置在与所述测试台组件 83 相对应的位置且与所述第四气缸 842 电性连接，以在感测到所述电芯 900 落入所述测试台组件 83 上后启动所述第四气缸 842，所述压块 841 连接在所述第四气缸 842 的输出轴的底端以被所述第四气缸 842 驱动下降后对所述电芯 900 进行压扁及测试操作。

[0086] 所述废料剔除组件 85 设置在所述压电芯及测试组件 84 的一侧，所述废料剔除组件 85 接收经所述压电芯及测试组件 84 测试不合格的电芯 900 并传递出去。

[0087] 所述脱料及检测机构 8 的工作过程描述如下：初始状态时，所述电芯托板 823 停留在所述第一导轨 821 临近所述脱料组件 81 的端部上，所述第一吸盘组 824 停留在所述第二导轨 822 与所述第一导轨 821 垂直交叉位置的上方，所述第二吸盘组 828 停留在所述测试台组件 83 的上方；首先，通过所述电芯托板 823 上的托板偏转装置 8232 驱动所述托板本体 8231 在竖直方向上偏转一定角度接收从所述脱料组件 81 脱出的电芯 900，待接收所述电芯 900 之后再驱动所述托板本体 8231 回转复位至水平位置；然后，所述电芯托板 823 的整体沿着所述第一导轨 821 横向移动至所述第一导轨 821 与所述第二导轨 822 垂直交叉的位置；接着，所述第一吸盘组 824 下降并吸取所述电芯托板 823 上的电芯 900 后上升，所述第一吸盘组 824 带着所述电芯 900 沿着所述第二导轨 822 纵向移动至所述测试台组件 83 的上方后所述第一吸盘组 824 下降将所述电芯 900 放置在所述测试台组件 83 上，此时，如若所述电芯 900 未能位于所述测试台组件 83 的中间则左右晃动所述左规正板 831 以及所述右规正板 832 以调整所述电芯 900 的位置使其位于所述测试台组件 83 的中间；再接着，所述压电芯及测试组件 84 下降对测试台组件 83 上的所述电芯 900 进行压扁及测试操作；最后，对于测试合格的电芯 900，所述第二吸盘组 828 下降并吸取所述测试合格的电芯 900 后沿着所述第三导轨 827 纵向移动将所述电芯 900 传送到流水线 100 上，对于测试不合格的电芯 900，所述废料剔除组件 85 接收测试不合格的电芯 900 并传递出去。

[0088] 所述脱料及检测机构 8 使得电芯 900 的脱料及短路检测可在同一个工位进行，且脱料及检测的过程均为自动化进行，因而仅需很少的操作人员，劳动力成本大大降低且大幅度提高了工作效率。

[0089] 本发明的电池卷绕机采用全自动的方式将电芯卷绕成型且自动进行后续的贴胶以及检测工作，其生产出来的电芯精度高、质量能够得到保证，并且效率高、无需过多的操作人员，因而劳动力成本很低。

[0090] 然而，以上所述仅为本发明的较佳可行实施例，并非限制本发明的保护范围，故凡运用本发明说明书及附图内容所作出的等效结构变化，均包含在本发明的保护范围内。

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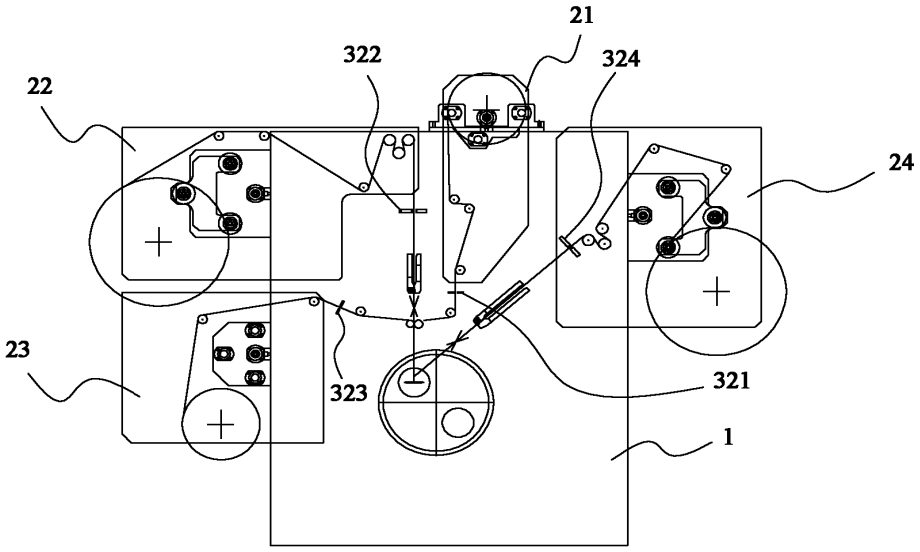


图 1

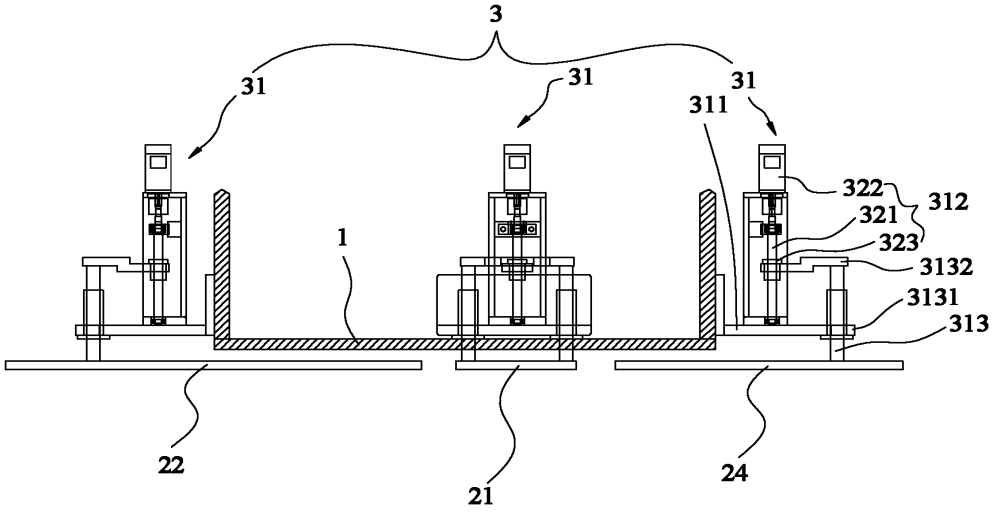


图 2

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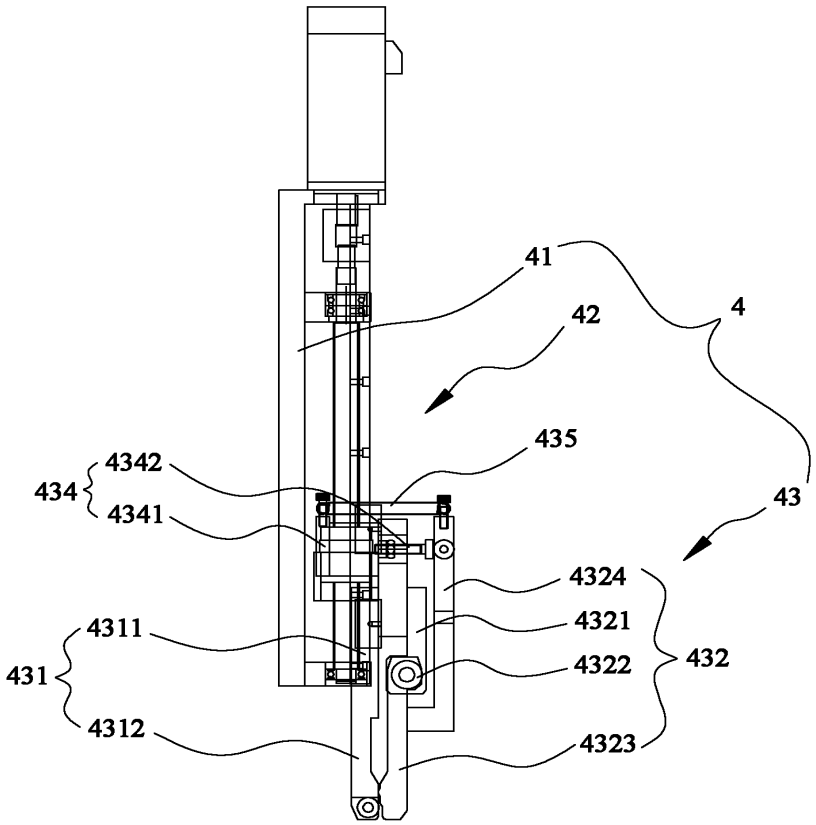


图 3

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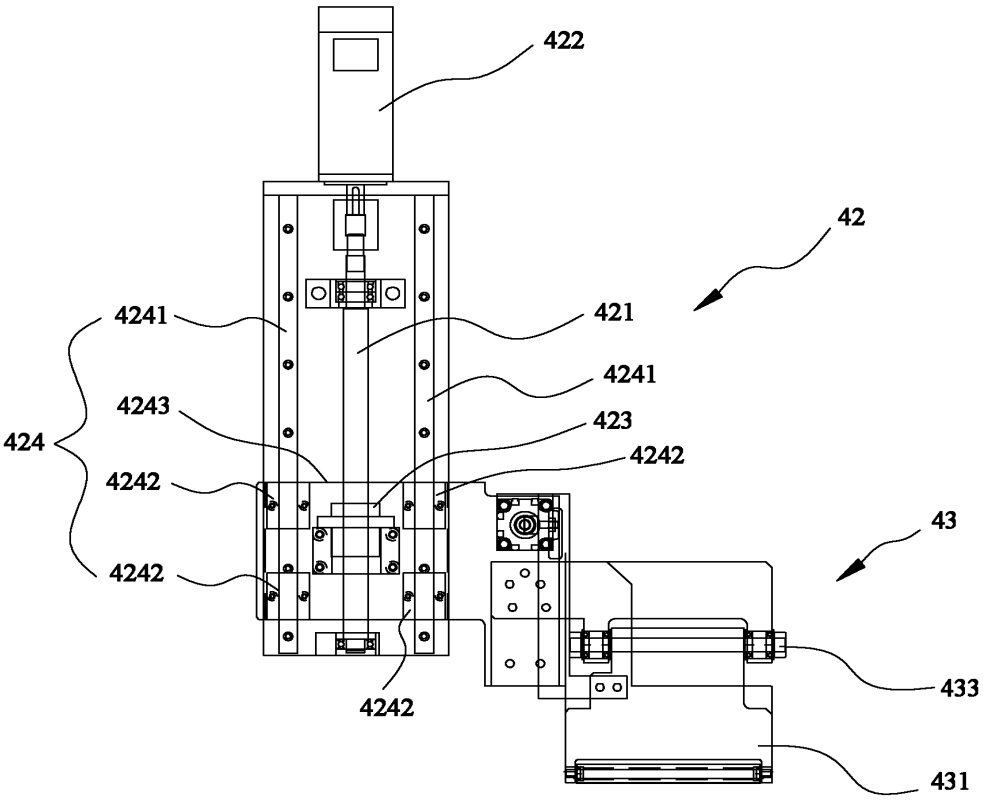


图 4

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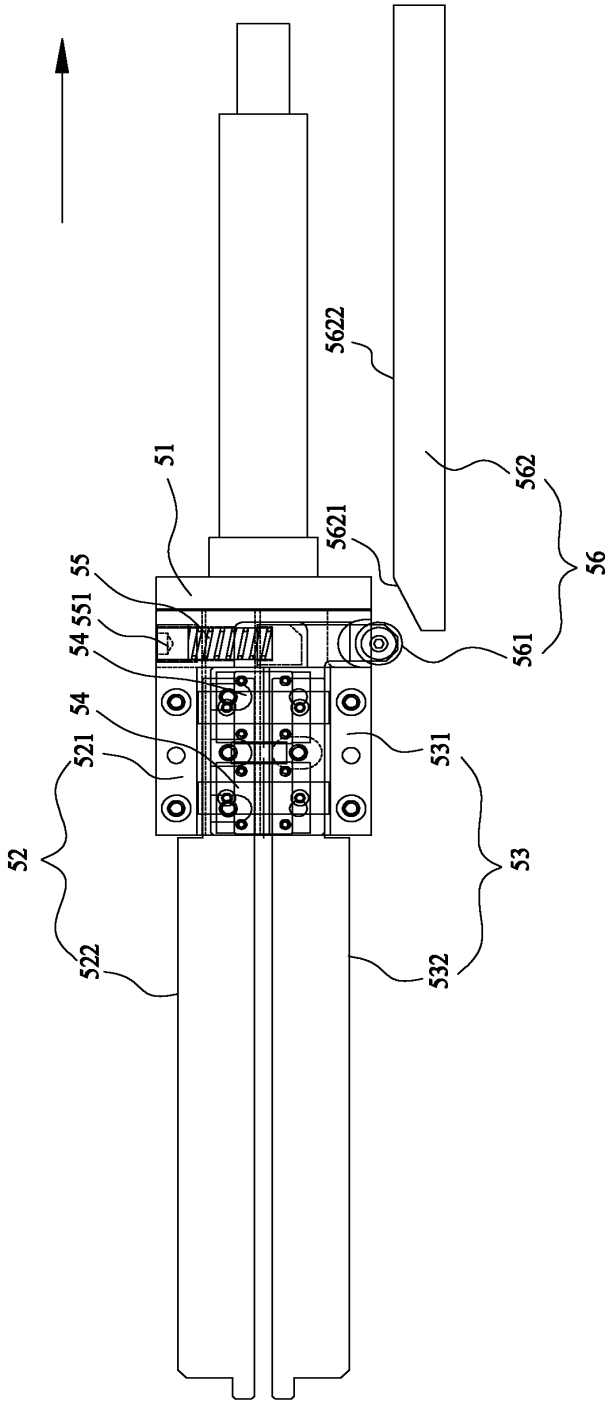


图 5

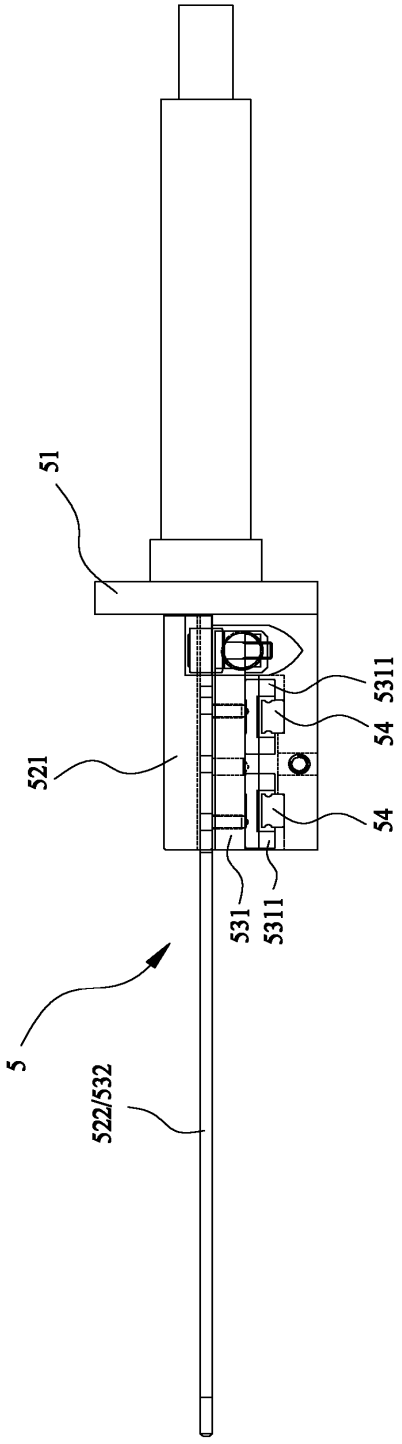


图 6

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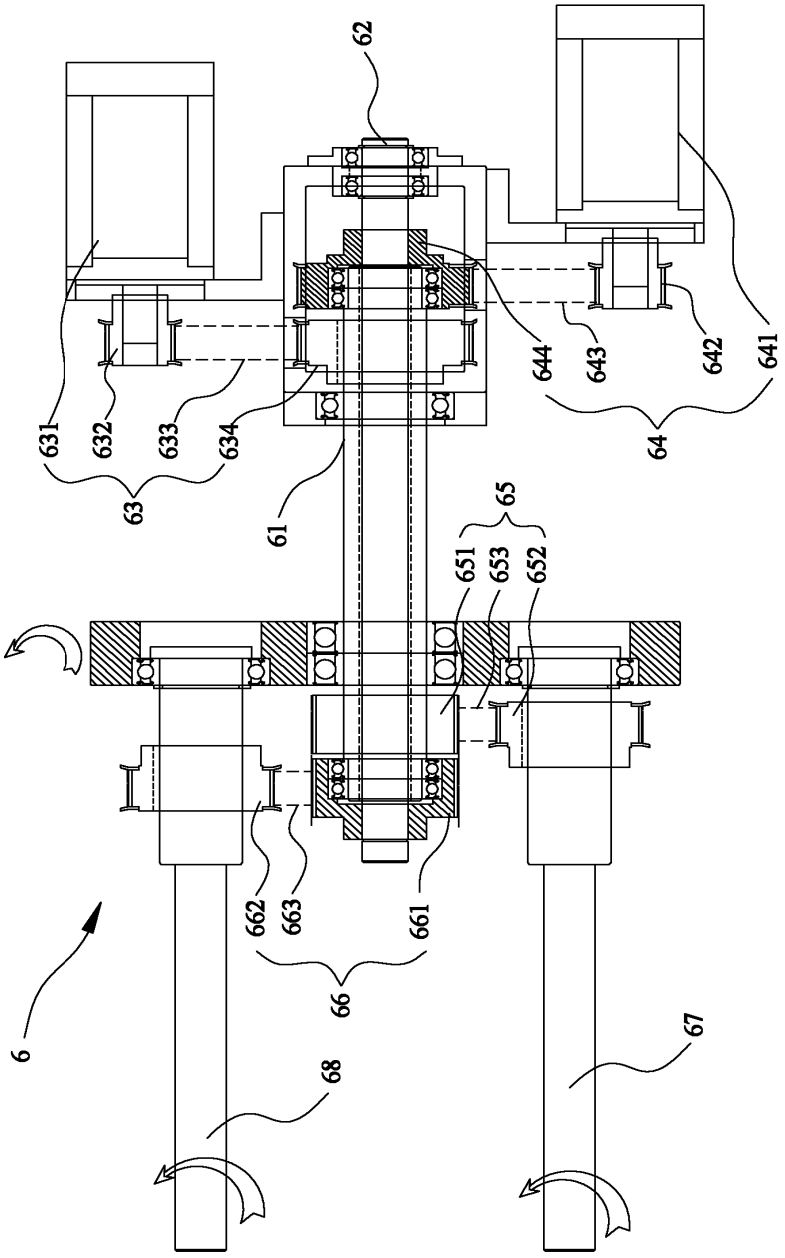


图 7

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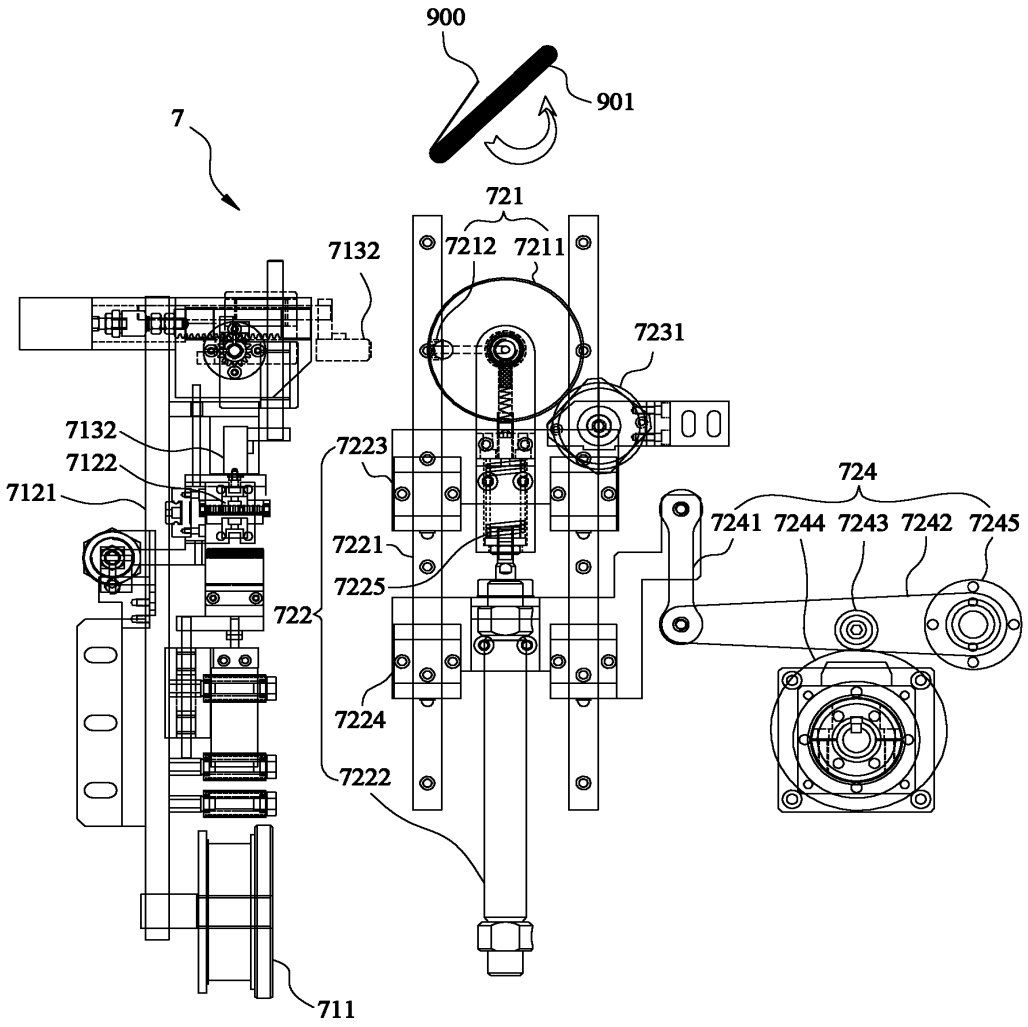


图 8

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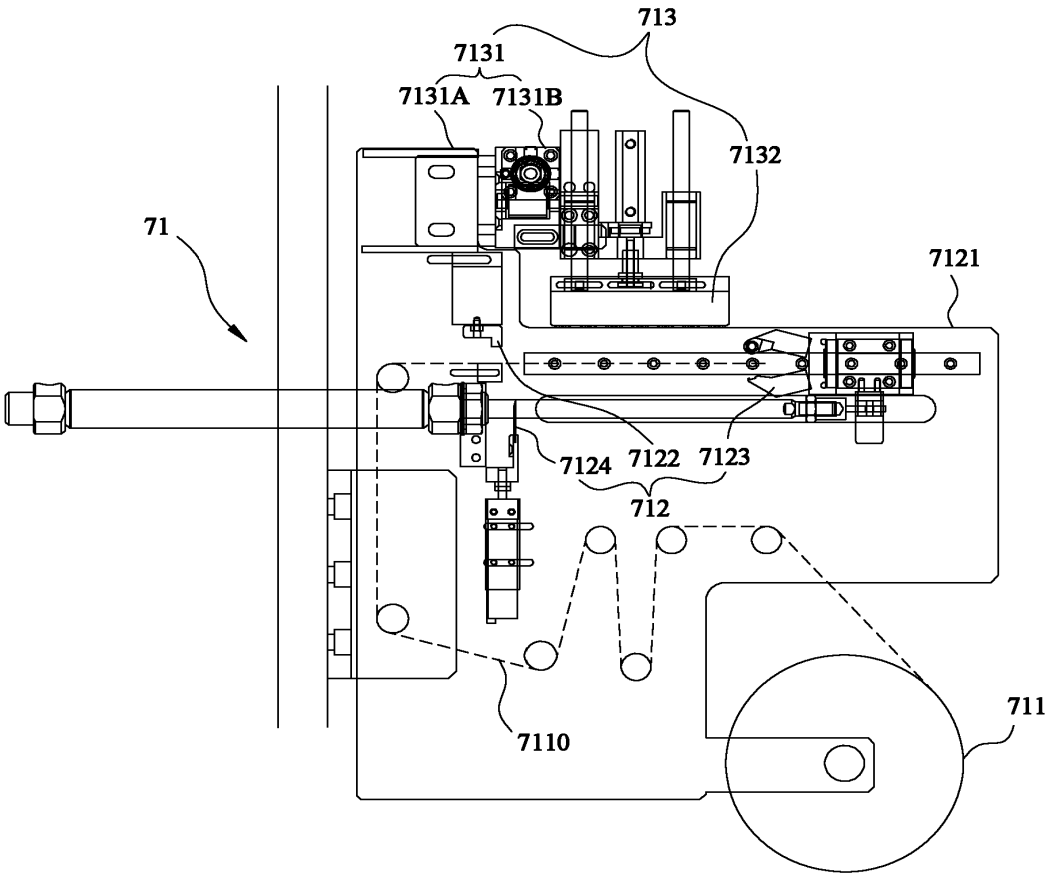


图 9

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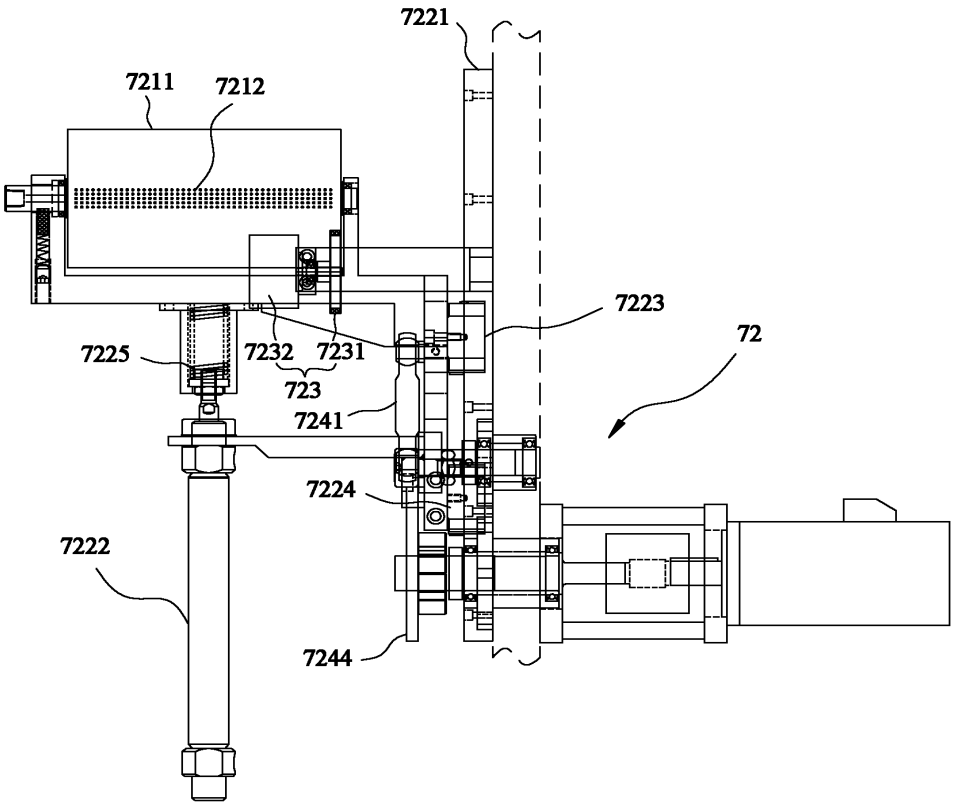


图 10

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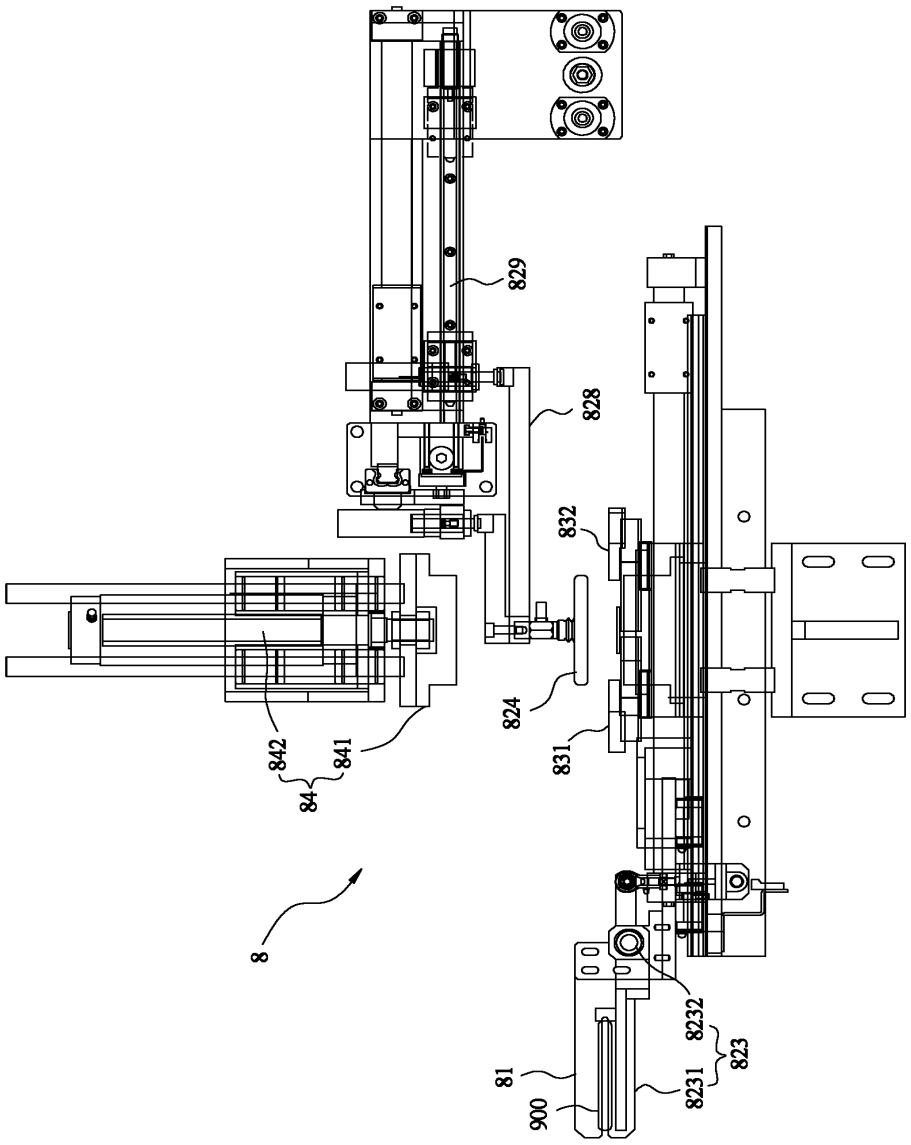


图 11

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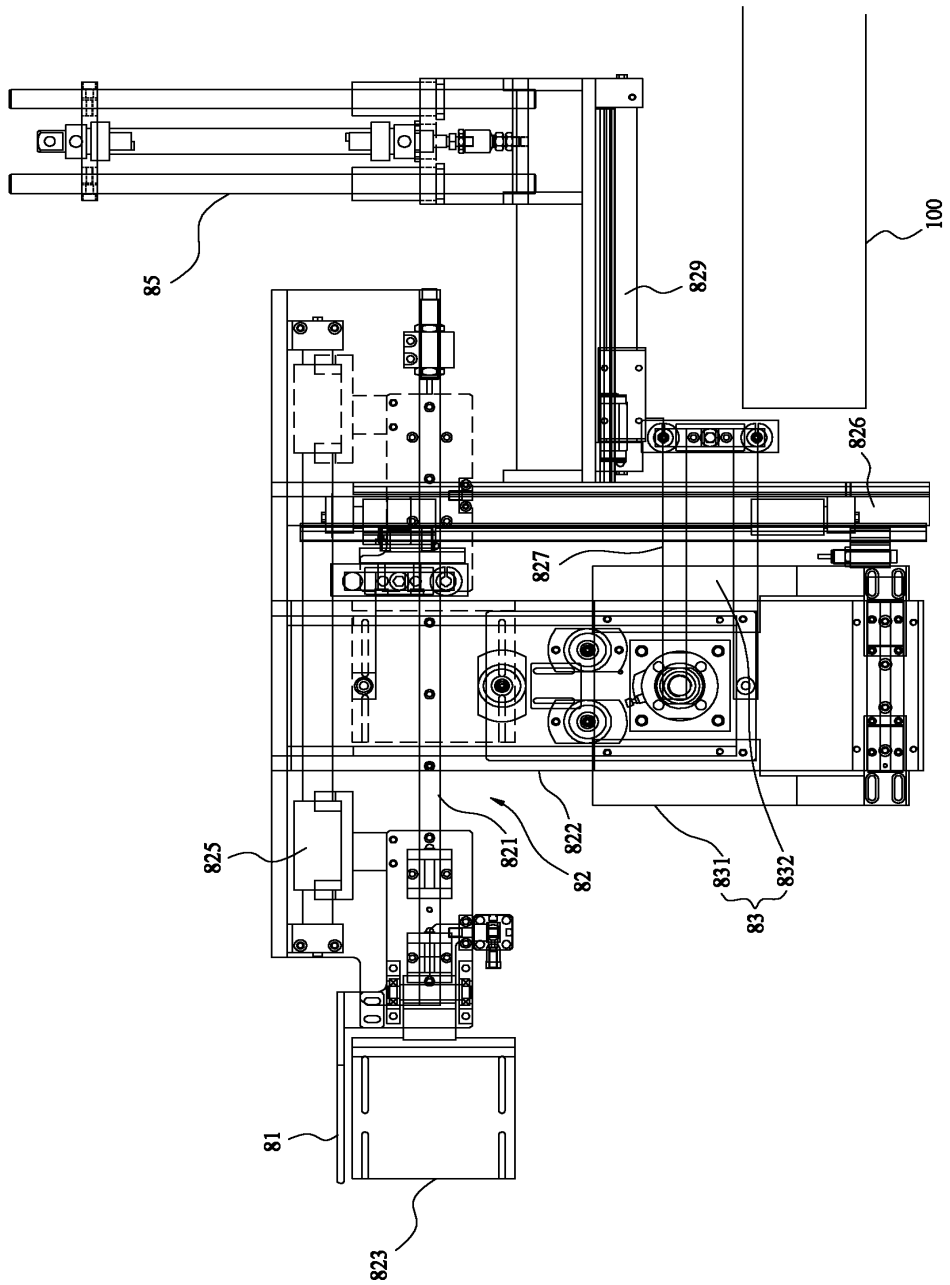


图 12

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Espacenet

Bibliographic data: CN103579666 (A) — 2014-02-12

Composite lithium-ion battery cell with low internal resistance, and preparation technology thereof

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Classification:	**- international:** ***H01M10/0525; H01M10/058; H01M2/26; H01M4/13*** **- cooperative:** **H01M10/0525 (CN)**; **H01M10/0587 (CN)**; **H01M4/13 (CN)**; **H01M50/54 (CN)**; Y02E60/10 (EP)
Application number:	CN201310536690 20131104 Global Dossier
Priority number (s):	CN201310536690 20131104
Also published as:	CN103579666 (B)

Abstract of CN103579666 (A)

The invention provides a composite lithium-ion battery cell with low internal resistance, and a preparation technology of the composite lithium-ion battery cell, aiming at overcoming the defects. The battery cell internally comprises at least two single winding cells which are respectively provided with a positive pole lug and a negative pole lug; the pole lugs with the same polarity of the single winding cells are welded to form a whole body in a way of ultrasonic welding, so that the composite battery cell can be formed; the pole lugs of a positive pole piece and a negative pole piece of each single winding cell are arranged in the middle. After the composite lithium-ion battery cell is adopted, the internal resistance of a battery is effectively reduced under the condition that the battery capacity is not changed, so that the multiplying performance of the battery is improved, and the safety of the battery is improved.

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(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 103579666 A
(43)申请公布日 2014.02.12

(21)申请号 201310536690.8

(22)申请日 2013.11.04

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(51)Int.Cl.
H01M 10/0525(2010.01)
H01M 10/058(2010.01)
H01M 4/13(2010.01)
H01M 2/26(2006.01)

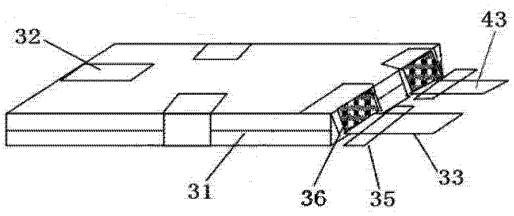
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(54)发明名称

一种低内阻复合锂离子电芯及其制作工艺

(57)摘要

本发明的目的就是针对上述存在的缺陷而提供一种低内阻复合锂离子电芯及其制作工艺，电芯内部包括至少两个卷绕单体电芯，各卷绕单体电芯都分别设置有正负极耳，其中所述单体电芯极性相同的极耳通过超声波焊接的方式焊接为一体形成复合电芯，每个单体电芯的正、负极片极耳设置在中间。其能够在保证电池容量不变的情况下有效降低电池内阻，改善电池的倍率性能，提高其安全性。



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1. 一种低内阻复合锂离子电芯，其特征在于，电芯内部包括至少两个卷绕单体电芯，单体电芯包括正极片、负极片和隔膜，极片由极片带、极耳和隔膜组成，其中极片带展开时，极耳位于极片带中间部位，其中单体电芯之间极性相同的极耳焊接为一体形成复合电芯。

2. 根据权利要求 1 所述的一种低内阻复合锂离子电芯，其特征在于，极片带上焊接极耳的位置为空白箔区，空白箔区之外的极片带两面涂覆有极片活性物质。

3. 根据权利要求 2 所述的一种低内阻复合锂离子电芯，其特征在于，极耳宽度为 5-15mm，厚度为 0.1-0.2mm，极耳外露长度为 10-20mm，空白箔区宽度比极耳宽度宽 1-3mm。

4. 根据权利要求 3 所述的一种低内阻复合锂离子电芯，其特征在于，正极片的极片带上空白箔区粘贴有绿色聚酯 PET 绝缘胶带，胶带厚度为 0.02-0.04mm，绝缘胶带上边缘比极片上边缘长 2.5-6.5mm。

5. 根据权利要求 4 所述的一种低内阻复合锂离子电芯，其特征在于，负极片的极片带上空白箔区粘贴有黄色聚酰亚胺亚克力绝缘胶带，胶带厚度为 0.055-0.065mm，绝缘胶带上边缘比极片上边缘长 1.5-5.5mm。

6. 根据权利要求 5 所述的一种低内阻复合锂离子电芯，其特征在于，极耳外露部分设置有极耳胶，极耳胶距离极片带边缘 2±0.5mm。

7. 根据权利要求 6 所述的一种低内阻复合锂离子电芯，其特征在于，正极片的极片带为铝箔，负极片的极片带为铜箔。

8. 根据权利要求 7 所述的一种低内阻复合锂离子电芯，其特征在于，极性相同的极耳通过超声波焊接为一体。

9. 如权利要求 8 所述的一种低内阻复合锂离子电芯制作工艺，其特征在于， 包括以下步骤：

①配料：按照工艺参数要求，经高速真空搅拌均匀后，制成浆状的正负极活性物质；

②涂布：将制成的浆料按工艺要求厚度均匀地涂覆在金属箔的表面，经烘干，分别制成正负极极片；

涂布时正极单面面密度范围：190-230mg/cm^2

涂布时负极单面面密度范围：7-11 mg/cm^2

③制片：将涂布工序出来的合格极片，辊压、分切、制成规定尺寸的小片；

④卷绕：按负极片—隔膜—正极片—隔膜的顺序卷绕，并贴上终止胶带，卷芯最外层为隔膜；

⑤点焊正负极耳：将卷绕好的 2 个以上电芯并联，使用绝缘胶带先将其固定，点焊好正负极耳；

⑥封装：将点焊好极耳的合格电芯封装，用以制备电池。

10. 根据权利要求 9 所述的一种低内阻复合锂离子电芯制作工艺，其特征在于， 步骤②涂布具体为：

正极片结构：在极片带上涂覆活性物质，其中，极片带的中间部位设置一段未涂覆活性物质的空白箔区，用来焊接极耳，在空白箔区的正反面都用聚酯 PET 绝缘胶带粘贴，在极耳的右侧 25-32mm 处设置一段无涂覆活性物质区，无涂覆活性物质区与极耳处于极片带的同一面；

负极片结构：在极片带上涂覆活性物质，其中，极片带的中间段设置一段未涂布负极活

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性物质的空白箔区，用来焊接极耳，在空白箔区的正反面用聚酰亚胺亚克力绝缘胶带粘贴，在极片带的右端，与极耳相背的一面设置一段宽度为 135-138mm 的无涂覆活性物质区。

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一种低内阻复合锂离子电芯及其制作工艺

技术领域

[0001] 本发明属于锂离子电池领域，具体涉及一种降低锂离子电池内阻及提高安全性的具有极耳中置极片结构的低内阻复合锂离子电芯及其制作工艺。

背景技术

[0002] 锂离子电池因具有输出电压高，能量密度高、放电电压平稳，循环寿命长的优点，被广泛应用于各类3C产品。同时，凭借输出功率大，使用寿命长的优势，锂离子电池的应用也从通讯行业延伸到电动工具、大型储能及动力电池领域。动力型电池是锂离子电池的主要发展方向之一，这就要求其具有较好的倍率性能和较高的功率能量密度。同时，为满足市场对于大容量动力电池的要求，在严格控制极片面密度的情况下需要通过增加极片长度来实现。对于采用卷绕工艺的锂离子电池来讲，过长的极片会给制程带来不必要的麻烦，使得产品不良率上升，且采用长极片的电池内阻大，不利于电池的大电流充放电，严重阻碍电池朝着大容量高功率方向发展。而现有的卷绕式锂离子电池极片采用极耳设在极片一端的结构，由于极耳一般设置在电芯内部，内阻大散热情况差，会导致电池内部温度急剧上升，该种状况下电池存在一定的安全隐患。

[0003] 要改善电池的倍率性能提高其功率能量密度和安全性，就需要降低电池内阻。这是由于当工作电压相同时，电池的内阻越低，放电电流会越大，电池的功率能量密度也会越高；同时由于欧姆内阻低，电池的产热量也会降低，电池的安全性得到保障。

发明内容

[0004] 本发明的目的就是针对上述存在的缺陷而提供一种低内阻复合锂离子电芯及其制作工艺，电芯内部包括至少两个卷绕单体电芯，各卷绕单体电芯都分别设置有正负极耳，其中所述单体电芯极性相同的极耳通过超声波焊接的方式焊接为一体形成复合电芯，每个单体电芯的正、负极片极耳设置在中间。其能够在保证电池容量不变的情况下有效降低电池内阻，改善电池的倍率性能，提高其安全性。

[0005] 本发明的一种低内阻复合锂离子电芯及其制作工艺技术方案为，该电芯内部包括至少两个卷绕单体电芯，单体电芯包括正极片、负极片和隔膜，极片由极片带、极耳和隔膜组成，其中极片带展开时，极耳位于极片带中间部位，其中单体电芯之间极性相同的极耳焊接为一体形成复合电芯。

[0006] 极片带上焊接极耳的位置为空白箔区，空白箔区之外的极片带两面涂覆有极片活性物质。

[0007] 极耳宽度为5-15mm，厚度为0.1-0.2mm，极耳外露长度为10-20mm，空白箔区宽度比极耳宽度宽1-3mm。

[0008] 正极片的极片带上空白箔区粘贴有绿色聚酯PET绝缘胶带，胶带厚度为0.02-0.04mm，绝缘胶带上边缘比极片上边缘长2.5-6.5mm。

[0009] 负极片的极片带上空白箔区粘贴有黄色聚酰亚胺亚克力绝缘胶带，胶带厚度为

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0.055-0.065mm，绝缘胶带上边缘比极片上边缘长 1.5-5.5mm。

[0010] 极耳外露部分设置有极耳胶，极耳胶距离极片带边缘 2±0.5mm。

[0011] 正极片的极片带为铝箔，负极片的极片带为铜箔。

[0012] 极性相同的极耳通过超声波焊接为一体。

[0013] 所述的一种低内阻复合锂离子电芯制作工艺，包括以下步骤：

①配料：按照工艺参数要求，经高速真空搅拌均匀后，制成浆状的正负极活性物质；

②涂布：将制成的浆料按工艺要求厚度均匀地涂覆在金属箔的表面，经烘干，分别制成正负极极片；

涂布时正极单面面密度范围：190-230mg/cm^2

涂布时负极单面面密度范围：7-11 mg/cm^2

③制片：将涂布工序出来的合格极片，辊压、分切、制成规定尺寸的小片；

④卷绕：按负极片—隔膜—正极片—隔膜的顺序卷绕，并贴上终止胶带，卷芯最外层为隔膜；

⑤点焊正负极耳：将卷绕好的 2 个以上电芯并联，使用绝缘胶带先将其固定，点焊好正负极耳；

⑥封装：将点焊好极耳的合格电芯封装，用以制备电池。

[0014] 其中，步骤②涂布具体为：

正极片结构：在极片带上涂覆活性物质，其中，极片带的中间部位设置一段未涂覆活性物质的空白箔区，用来焊接极耳，在空白箔区的正反面都用聚酯 PET 绝缘胶带粘贴，在极耳的右侧 25-32mm 处设置一段无涂覆活性物质区，无涂覆活性物质区与极耳处于极片带的同一面。

[0015] 负极片结构：在极片带上涂覆活性物质，其中，极片带的中间段设置一段未涂布负极活性物质的空白箔区，用来焊接极耳，在空白箔区的正反面用聚酰亚胺亚克力绝缘胶带粘贴，在极片带的右端，与极耳相背的一面设置一段宽度为 135-138mm 的无涂覆活性物质区。

[0016] 本发明的有益效果为：本发明的一种低内阻复合锂离子电芯及其制作工艺，电芯内部包括至少两个卷绕单体电芯，各卷绕单体电芯都分别设置有正负极耳，其中所述单体电芯极性相同的极耳通过超声波焊接的方式焊接为一体形成复合电芯，每个单体电芯的正、负极片极耳设置在中间。

[0017] 在正极极耳的右侧 25-32mm 处设置一段无涂覆活性物质区，无涂覆活性物质区与极耳处于极片带的同一面，卷绕时对应于负极极耳，将其包裹，避免正极活性物质正对负极极耳胶，产生析锂。

[0018] 由于本发明所述的复合电芯为多个单体电芯通过极性相同的极耳焊接并联而成，因而在保证动力电池容量不变的基础上，有效降低电池内阻，进而降低电池放电时的产热量，改善电池的倍率性能，提高其安全性。

[0019] 附图说明：

图 1 所示为本发明正极片展开时的剖面示意图；

图 2 所示为本发明负极片展开时的剖面示意图；

图 3 所示为复合锂离子卷芯立体结构示意图；

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图 4 所示为双电芯并联后所制 10Ah 电池的倍率放电曲线。

[0020] 图 1 中，11- 极片带，12- 活性物质，13- 极耳，14- 空白箔区，15- 无涂覆活性物质区；

图 2 中，21- 极片带，22- 活性物质，23- 极耳，24- 空白箔区，25- 无涂覆活性物质区；

图 3 中，31- 电芯，32- 绝缘胶带，33- 正极耳，35- 极耳胶，36- 焊接部位， 43- 负极耳。

[0021] 具体实施方式：

为了更好地理解本发明，下面用具体实例来详细说明本发明的技术方案，但是本发明并不局限于此。

[0022] 本发明的一种低内阻复合锂离子电芯及其制作工艺，电芯内部包括至少两个卷绕单体电芯，单体电芯包括正极片、负极片和隔膜，极片由极片带、极耳和隔膜组成，其中极片带展开时，极耳位于极片带中间部位，其中单体电芯之间极性相同的极耳焊接为一体形成复合电芯。

[0023] 极片带上焊接极耳的位置为空白箔区，空白箔区之外的极片带两面涂覆有极片活性物质。

[0024] 极耳宽度为 5-15mm，厚度为 0.1-0.2mm，极耳外露长度为 10-20mm，空白箔区宽度比极耳宽度宽 1-3mm。

[0025] 正极片的极片带 11 上空白箔区 14 粘贴有绿色聚酯 PET 绝缘胶带，胶带厚度为 0.02-0.04mm，绝缘胶带上边缘比极片上边缘长 2.5-6.5mm。

[0026] 负极片的极片带 21 上空白箔区 24 粘贴有黄色聚酰亚胺亚克力绝缘胶带，胶带厚度为 0.055-0.065mm，绝缘胶带上边缘比极片上边缘长 1.5-5.5mm

极耳外露部分设置有极耳胶，极耳胶距离极片带边缘 2±0.5mm。

[0027] 正极片的极片带 11 为铝箔，负极片的极片带 21 为铜箔。

[0028] 极性相同的极耳通过超声波焊接为一体。

[0029] 所述的一种低内阻复合锂离子电芯制作工艺， 包括以下步骤：

①配料：按照工艺参数要求，经高速真空搅拌均匀后，制成浆状的正负极活性物质；

②涂布：将制成的浆料按工艺要求厚度均匀地涂覆在金属箔的表面，经烘干，分别制成正负极极片；

涂布时正极单面面密度范围：190-230mg/cm^2

涂布时负极单面面密度范围：7-11 mg/cm^2

③制片：将涂布工序出来的合格极片，辊压、分切、制成规定尺寸的小片；

④卷绕：按负极片—隔膜—正极片—隔膜的顺序卷绕，并贴上终止胶带，卷芯最外层为飞、隔膜；

⑤点焊正负极耳：将卷绕好的 2 个以上电芯并联，使用绝缘胶带先将其固定，点焊好正负极耳。

[0030] ⑥封装：将点焊好极耳的合格电芯封装，用以制备电池。

[0031] 其中，步骤②涂布具体为：

正极片结构：在极片带 11 上涂覆活性物质 12，其中，极片带 11 的中间部位设置一段未涂覆活性物质的空白箔区 14，用来焊接极耳 13，在空白箔区 14 的正反面都用聚酯 PET 绝缘胶带粘贴，在极耳 13 的右侧 25-32mm 处设置一段无涂覆活性物质区 15，无涂覆活性物质区

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15 与极耳 13 处于极片带 11 的同一面。

[0032] 负极片结构：在极片带 21 上涂覆活性物质 22，其中，极片带 21 的中间段设置一段未涂布负极活性物质的空白箔区 24，用来焊接极耳 23，在空白箔区 24 的正反面用聚酰亚胺亚克力绝缘胶带粘贴，在极片带 21 的右端，与极耳 23 相背的一面设置一段宽度为 135-138mm 的无涂覆活性物质区 25。

[0033] 实施例 1

下面结合附图以单体为 5Ah，双电芯并联后为 10Ah 的电芯为例对本发明的具体实施方式作进一步的详细说明。

[0034] 如图 1 所示，一种 5Ah 锂离子电池卷芯所用正极片，其包括极片带 11、正极活性物质 12、极耳 12。在极片带 11 的中间部位设置一段宽 12mm 未涂覆活性物质 12 的空白箔区 14，用来焊接极耳 13。极耳 13 的宽度为 10mm，厚度为 0.2mm，顶端没有包极耳胶 35。极耳 13 外露 20mm，在空白箔区 14 的正反面都用厚度为 0.03mm 的聚酯 PET 绝缘胶带粘贴，绝缘胶带长度高出极片带 11 上端 2.5±0.5mm。在极耳 13 的右边 28mm 处设置一段宽 29mm 的无涂覆活性物质区 15，所述无涂覆活性物质区 15 与极耳 13 处于同一面。

[0035] 图 2 为负极片结构，包括极片带 21、负极活性物质 22、极耳 23。在极片带 21 的中间段设置一段未涂布负极活性物质 22 的空白箔区 24，用来焊接极耳 23。极耳 23 的宽度为 10mm, 厚度为 0.2mm，顶端没有包极耳胶 35。在空白箔区 24 的正反面用厚度为 0.060mm 的聚酰亚胺亚克力绝缘胶带粘贴。绝缘胶带长度高出极片带 21 1.5±0.5mm。在极片带 21 的右端，与极耳 23 相反的一面设置一段不涂覆活性物质宽度为 135-138mm 的无涂覆活性物质区 25。

[0036] 卷绕时，极片带 11 和极片带 21 都以焊接有极耳的一面朝上放置卷绕成卷芯。正极在最内层，以负极收尾。卷绕结束后，露在卷芯的最外层为隔膜。

[0037] 如图 3 所示，一种复合锂离子电芯立体结构示意图。复合电芯包括至少两个单体电芯 31。每个电芯 31 分别设置有一个正极耳 33 和一个负极耳 43。两只电芯 31 并联时按照极耳“左正右负”的顺序放置，为保证电池的安全性，放置在前端的电芯 31 正极空白箔区 14 所贴绝缘胶带长出极片带 11 的宽度 6.5mm，负极空白箔区 24 所贴绝缘胶带长出极片带 21 的宽度 5.5mm；电芯 31 按照上述图 1、图 2 的结构和尺寸制作，用绝缘胶带 32 将两只电芯 31 固定好后再进行后续操作。两只电芯 31 极性相同的极耳叠在一起，正极耳与一个带极耳胶的极耳 33 通过超声波焊接的方式并联在一起，所述极耳材质为铝转镍；负极耳与一个带极耳胶的极耳 43 通过超声波焊接的方式并联在一起，所述极耳材质为纯镍。其中极耳 33 宽度为 12mm，厚度为 0.2mm，极耳 33 外露部分长 10-20mm；所述极耳 43 宽度为 12mm，厚度为 0.2mm，极耳 43 外露部分长 10-20mm。

[0038] 焊接时极耳 33 和 43 头部朝下放置，极耳胶 35 上边缘距隔膜上边缘 1±0.5mm。极耳并联焊接结束后，将极耳 33 和 43 朝上翻折，用剪刀修剪焊接部位 36，将多余的极耳减掉，使焊接部位 36 正好与最外端的电芯 31 边缘平齐。焊接部位 36 下端贴绝缘胶带 32，绝缘胶带 32 比焊接部位 36 宽 1-2mm，并用绝缘胶带 32 将焊接部位固定在卷芯上端。

[0039] 将并联好的卷芯装入铝塑膜袋中，按照顶侧封→真空烘烤→注液→化成→热冷压→二封→分容的工序制作成了一种具有极耳中置极片结构的双电芯复合锂离子电池。

[0040] 表 1 为采用不同极耳焊接位置的单体 5Ah 电池电性能对比

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表 1

极耳位置	内阻（mΩ）	0.5C 容量（mAh）	0.5C 放电平台（min）	1C 容量（mAh）	1C 放电平台（min）	首次充放电效率
极耳置于中间	9	5335	72.95	5282	29.3	88%
极耳置于顶端	15	5203	72.21	5129	29.09	87.16%

。

[0041] 通过数据对比说明，采用极耳置于中间的结构设计，5Ah 单体电池的内阻大大降低，电池的容量、放电平台时间和首次放电效率都要高于极耳置于顶端的方式。而双电芯并联后电芯内阻仅有 5.7mΩ，与 5Ah 单体电芯相比，10Ah 电池的内阻几乎降低一半。图 4 所示为双电芯并联后所制 10Ah 电池的倍率放电曲线。通过倍率放电曲线可以看出按照本发明所描述的方法所制备的 10Ah 动力电池其进行 3A 大电流放电时，放电容量能够达到 10A 放电容量的 91.73%，倍率性能优良。

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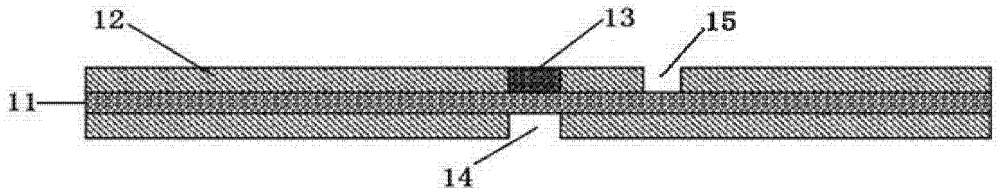


图 1

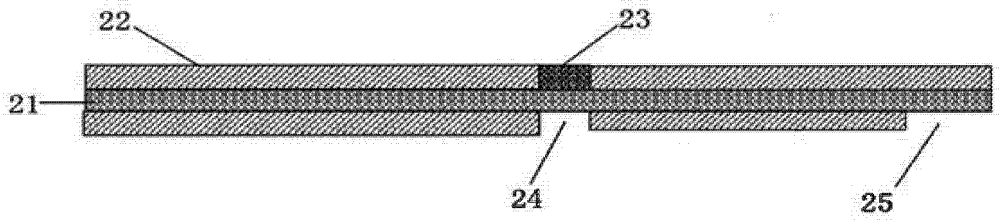


图 2

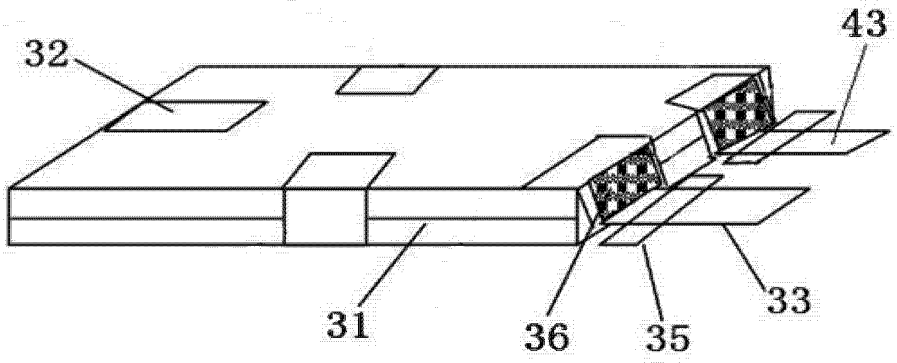


图 3

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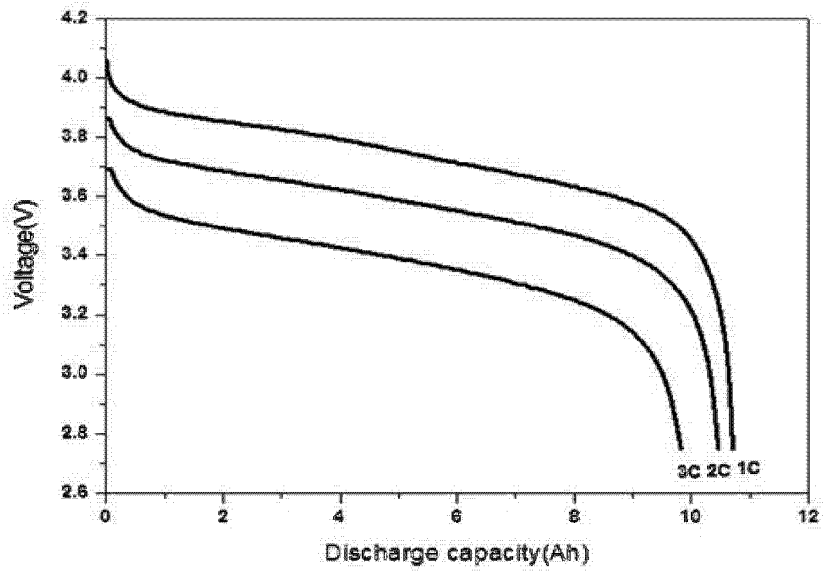


图 4

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Espacenet

Bibliographic data: CN1805183 (A) — 2006-07-19

Manufacturing method of negative electrode plate of Ni-H cell

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Classification: **- international:** ***H01M4/26***
- cooperative: Y02E60/10 (EP)

Application number: CN20061033280 20060120

Priority number (s): CN20061033280 20060120

Also published as: CN100347883 (C) TW200838294 (A) TWI339065 (B)

Abstract of CN1805183 (A)

The invention relates to a method for preparing the cathode sheet of nickel-hydrogen battery. The electrode plate uses the cut network fluid band material as basic material; first fills the active dry powder into the mesh of sand band material. And the invention is characterized in that: there are following steps between the compressing and incising steps: dipping the adhesive, drying, compressing, cutting off broken teeth and plating pastern. The invention uses secondary compression and cutting off broken teeth to improve the shape of electrode plate, increase the compressed density without falling powder, avoid short circuit of coiled electrode and the low voltage of final battery, improve the yield, safety and uniformity of battery. The empty rate at two sides and the middle part of band material are nearly same, the filled powder is improved 1-5%, the height of burr is less the thickness of baffle film, the utilization of cathode plate is improved 2-6%, the utilization of anode is improved 0.5-1.0mm, the assemble parameter is improved, and the capacity of nickel-hydrogen battery is improved 3-9% then general ones.

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[19] 中华人民共和国国家知识产权局

[51] Int. Cl.
H01M 4/26 (2006.01)

[12] 发明专利申请公开说明书

[21] 申请号 200610033280.1

[43] 公开日 2006 年 7 月 19 日

[11] 公开号 CN 1805183A

[22] 申请日 2006.1.20
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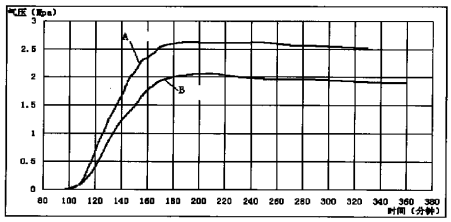
权利要求书 2 页 说明书 4 页 附图 1 页

[54] 发明名称

一种氢镍电池负极片材的制作方法

[57] 摘要

本发明公开了一种氢镍电池负极片材的制作方法，极片以切拉网状集流体带材为基材，首先将活性物质干粉料填充在切拉网状集流体带材的网孔内，其特征在于：在压实和裁片步骤之间依次有以下步骤：浸润粘结剂、烘干、压实、切除断齿和涂胶。采用再次压实和切除断齿方法改善电池极片形状，增加了极片压实密度，不会脱粉，有效防止了卷绕后电极短路、成品电池出现低压现象，提高了电池的成品率、安全性和一致性。集流体带材两侧边和中间部位的空率基本相同，填粉总量提高 1%～5%，毛刺上一些晶枝生长的高度也小于配用隔膜的厚度，负极片的利用率提高 2%～6%，而且，正极片相应可以加高 0.5mm～1.0mm，提高了电池的装配系数，增加了氢镍电池的容量，一般比氢镍电池提高 3%～9%。



1. 一种氢镍电池负极片材的制作方法，极片以切拉网状集流体带材为基材，包括首先将活性物质干粉料填充在切拉网状集流体带材的网孔内，然后压实，还包括最后裁片，将经过各个步骤处理的集流体带材裁切成所要求长度的极片成品，其特征在于：

在压实和裁片步骤之间依次有以下步骤：

（1）浸润粘结剂，采用粘结剂将网孔内充实活性物质干粉料的切拉网状集流体带材浸润，即在活性物质干粉料中嵌渗粘结剂：

（2）烘干，清除残留在集流体带材表面多余的粘结剂，然后在防氧化条件下烘干；

（3）压实，将烘干的集流体带材再次压实；

（4）切除断齿，将再次压实的集流体带材两侧边由网孔双层折边形成的断齿切除；

（5）涂胶，在切除两侧边断齿的集流体带材表面进行滚动式涂胶，然后风干。

2. 如权利要求 1 所述的氢镍电池负极片材的制作方法，其特征在于：

所述切拉网状集流体带材包括切拉铜网状集流体带材、切拉镀镍钢网状集流体带材和切拉银网状集流体带材。

3. 如权利要求 1 或 2 所述的氢镍电池负极片材的制作方法，其特征在于：

所述活性物质干粉料是稀土贮氢合金粉，或按重量比 100:（0.1~5）添加镍粉、钴粉、乙炔黑、炭粉或铜粉的稀土贮氢合金粉混料。

4. 如权利要求 3 所述的氢镍电池负极片材的制作方法，其特征在于：

所述粘结剂是聚四氟乙烯 PTFE 水溶液、羟甲基纤维素 CMC 水溶液、聚乙烯醇 PVA 水溶液、丁苯橡胶 SBR 水溶液的一种或任意两种以上的混合物。

5. 如权利要求 4 所述的氢镍电池负极片材的制作方法，其特征在于：

所述清除残留在集流体带材表面多余的粘结剂是，将集流体带以 0.5 米/分钟~3 米/分钟的速度通过吹气设备吹除表面多余的粘结剂。

6. 如权利要求 4 所述的氢镍电池负极片材的制作方法，其特征在于：

所述吹气设备的气压为 1Mpa~4Mpa。

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7. 如权利要求 6 所述的氢镍电池负极片材的制作方法，其特征在于：

所述在防氧化条件下烘干是，在充满惰性保护气体且温度为 60℃~150℃的烘箱中烘干 1 分钟~4 分钟。

8. 如权利要求 7 所述的氢镍电池负极片材的制作方法，其特征在于：

所述再次压实的压力至少为 100 顿/平方厘米，使活性物质干粉料密度达到 6.0 克/立方厘米~8.0 克/立方厘米。

9. 如权利要求 8 所述的氢镍电池负极片材的制作方法，其特征在于：

所述切除断齿是，使半成品极片的宽度偏差小于 0.2mm，并使毛刺高度低于 0.04mm。

10. 如权利要求 9 所述的氢镍电池负极片材的制作方法，其特征在于：

所述涂胶后风干是，在 60 秒内快速风干。

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一种氢镍电池负极片材的制作方法

技术领域

本发明涉及用于直接转变化学能为电能的电池用电化学方法在载体上沉积活性材料制造碱性蓄电池氢氧化镍电极，尤其是涉及一种氢镍电池负极片材的制作方法。

背景技术

氢镍电池是继镉镍电池之后的新一代高能碱性二次电池，具有高容量、大功率、无污染等特点，是当今二次电池重要的发展方向之一。目前，AA 型氢镍电池容量已达到 2500mAh，4/3A 型氢镍电池容量已达到 4500mAh，体积比能量为 400Wh/L 以上，是镍镉电池体积比能量的 2.5 倍，接近目前锂离子电池的水平。但是，现有氢镍电池以切拉网状集流体带材为基材的负极片折边的宽度为 2 mm ~5mm，折边处的空率比其它小 50％左右，极片两边的合金粉的填充量减小，占整个极片的 5％~10％，对于制作高容量电池时，将严重影响到负极合金粉的填充量。而且，极片两侧边存在由网孔双层折边形成的断齿，断齿宽度一般为 0.5 mm ~2.0mm，断齿部位不能填充合金粉，使电池容量低，强度不及其它部位，在后续的操作过程中非常容易被折弯，卷绕时易脱粉，易短路，在卷绕成电池进行活化、循环后，合金粉会部分粉化、脱落，使电池出现低压现象，断齿形成高度一般为 0.05 mm ~0.15mm 的毛刺。如果毛刺上一些晶枝生长的高度大于配用隔膜的厚度，卷绕后还会发生正负极短路的现象，使氢镍电池的一致性、安全性变劣，特别是直接制约了氢镍电池的应用和容量的进一步提高。

发明内容

本发明所要解决的技术问题是克服现有技术的缺陷，提出一种氢镍电池负极片材的制作方法。

本发明的技术问题通过以下技术方案予以解决。

这种氢镍电池负极片材的制作方法，极片以切拉网状集流体带材为基材，包括首先将活性物质干粉料填充在切拉网状集流体带材的网孔内，然后压实，还包括最后裁片，将经过各个步骤处理的集流体带材裁切成所要求长度的极

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片成品。

这种氢镍电池负极片材的制作方法的特点是：在压实和裁片步骤之间依次有以下步骤：

（1）嵌渗粘结剂，采用粘结剂将网孔内充实活性物质干粉料的切拉网状集流体带材浸润，即在活性物质干粉料中嵌渗粘结剂，防止活性物质干粉料脱落，以增加极片的稳定性能和电池的安全性能；

（2）烘干，清除残留在集流体带材表面多余的粘结剂，然后在防氧化条件下烘干；

（3）压实，将烘干的集流体带材再次压实，使活性物质干粉料结合在集流体带材网孔内，以增强活性物质干粉料的压实密度；

（4）切除断齿，再次压实的集流体带材两侧边由网孔双层折边形成的断齿切除；

（5）涂胶，在切除两侧边断齿的集流体带材表面进行滚动式涂胶，然后风干，进一步防止活性物质干粉料脱落和集流体带材外露出，提高电池的安全性。

所述切拉网状集流体带材包括切拉铜网状集流体带材、切拉镀镍钢网状集流体带材和切拉银网状集流体带材。所述切拉网是在所述集流体带材横向成行切出多个切口，并纵向牵拉成菱形、方形或扇形的孔，切口周边的片材随牵拉而扭转成孔的框边，一行切口周边部分正对其相邻两行的切口。

所述活性物质干粉料是稀土贮氢合金粉，或按重量比 100:（0.1~5）添加镍粉、钴粉、乙炔黑、炭粉或铜粉的稀土贮氢合金粉混料。

所述粘结剂是聚四氟乙烯 PTFE 水溶液、羟甲基纤维素 CMC 水溶液、聚乙烯醇 PVA 水溶液、丁苯橡胶 SBR 水溶液的一种或任意两种以上的混合物。

所述清除残留在集流体带材表面多余的粘结剂是，将集流体带以 0.5 米/分钟~3 米/分钟的速度通过吹气设备吹除表面多余的粘结剂。

所述吹气设备的气压为 1Mpa~4Mpa。

所述在防氧化条件下烘干是，在充满惰性保护气体且温度为 60℃~150℃的烘箱中烘干 1 分钟~4 分钟，以防止活性物质被氧化。

所述再次压实的压力至少为 100 顿/平方厘米，使活性物质干粉料密度达到 6.0 克/立方厘米~8.0 克/立方厘米，集流体带材将变得更薄，更柔软，并有效地增加了压实密度，使极片不脱粉，卷绕后防止短路、低压等现象，提高了电池容量及成品率。

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所述切除断齿是使半成品极片的宽度偏差小于 0.2mm，半成品极片两侧边和中间部位的空率基本相同，填粉量基本相同且有所增加，并使毛刺高度低于 0.04mm，小于配用隔膜的厚度一半。有效地提高电池的的一致性和安全可靠性。

所述涂胶后风干是在 60 秒内快速风干。

本发明方法采用再次压实和切除断齿方法改善电池极片形状，增加了极片压实密度，不会脱粉，有效防止了卷绕后电极短路、成品电池出现低压现象，提高了电池的成品率、安全性和一致性。集流体带材两侧边和中间部位的空率基本相同，填粉总量提高 1%~5%，毛刺上一些晶枝生长的高度也小于配用隔膜的厚度，负极片的利用率提高 2%~6%，而且，正极片相应可以加高 0.5 mm ~1.0mm，提高了电池的装配系数，增加了氢镍电池的容量，一般比氢镍电池提高 3%~9%。

附图说明

下面结合具体实施方式并对照附图对本发明作进一步描述。

附图是本发明方法制作的电池与现有方法制作的同容量氢镍电池的内压测试曲线图。

具体实施方式：

一种容量为 2400mAh 的 AA 型氢镍电池，采用厚度为 0.30mm 切拉铜网状集流体带材填充稀土贮氢合金粉再辊压，然后在粘结剂聚四氟乙烯 PTFE 水溶液中浸泡 1 秒~60 秒，再烘干、二次辊压后切除两侧边断齿再涂胶，最后裁切成所要求长度的极片成品，供卷成负极用。

烘干前采用平行吹气管吹除集流体带材上多余的粘结剂，气枪与集流体带材的间隙为 0.5cm~10.0cm，平行吹气管与集流体带材的夹角为 1° ~45° 。

二次辊压的压力至少 100 吨/平方厘米。

下面以实验数据说明本发明方法制作的电池与现有方法制作的同容量氢镍电池的物理参数和电化学性能的差异。

物理参数测试结果见表 1：

表 1

类型 / 对比	本发明方法制作的电池	现有方法制作的电池
负极填充量	10.10g	9.78g
基材重量	1.55g	1.62g

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极片厚度	0.315mm	0.325mm
极片宽度	44.4 mm ~44.5mm	44.3 mm ~45.1mm
毛刺平均高度	0.02mm	0.08mm

电化学性能测试是在电池活化后，采用广州电器研究所的 BS9300 检测柜按照 IEC61951-2、GB/T15100-2003 的要求进行，测试结果见表 2：

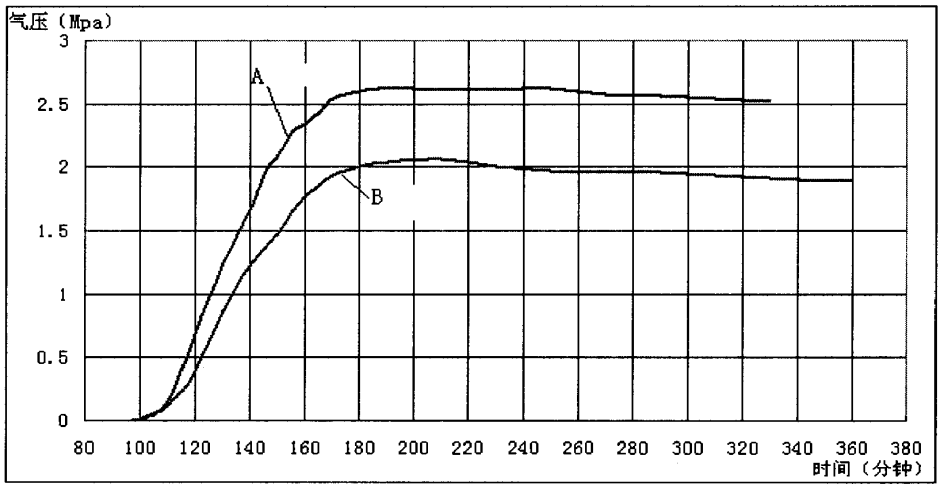
表 2

类型 / 对比	本发明方法制作的电池	现有方法制作的电池
平均容量	2445 mAh	2356 mAh
内阻	19.2mΩ	19.5mΩ

在电池进行活化之后，采用美国 OMEGA ENGINEERING INC 公司出品的 PSS-5B 压力传感测试仪，电池以 0.5C 充电进行内压测试，测试结果见附图。图中 A 是现有方法制作的电池充电内压与时间的关系曲线， B 是本发明方法制作的电池充电的内压与时间的关系曲线。

以上内容是结合具体的优选实施方式对本发明所作的进一步详细说明，不能认定本发明的具体实施只局限于这些说明。对于本发明所属技术领域的普通技术人员来说，在不脱离本发明构思的前提下，还可以做出若干简单推演或替换，都应当视为属于本发明由所提交的权利要求书确定的专利保护范围。

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Espacenet

Bibliographic data: CN201336332 (Y) — 2009-10-28

Positive plate of nickel battery and battery using same

Inventor(s): XIANG LONG [CN]; KAI YE [CN] ± (LONG XIANG, ; YE KAI)

Applicant(s): SHENZHEN BETTERPOWER BATTERY C [CN] ± (SHENZHEN BETTERPOWER BATTERY CO., LTD)

Classification: - international: ***H01M10/30; H01M4/24; H01M4/70***
- cooperative: Y02E60/10 (EP)

Application number: CN200820214288U 20081205

Priority number (s): CN200820214288U 20081205

Abstract of CN201336332 (Y)

The utility model relates to a positive plate of a nickel battery and a battery using the positive plate of the nickel battery. The positive plate of the nickel battery comprises a foamed nickel substrate and positive active substance arranged in the foamed nickel substrate; round corners or bevel edges are formed on the four corners of the foamed nickel substrate; and the battery is a battery using the positive plate. Round corners or bevel edges are formed on the four corners of the foamed nickel substrate, thereby preventing the positive plate from piercing a diaphragm during the rolling process of pole pieces, reducing the occurrence rate of short circuit of the battery, and improving the qualification rate of products.

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[19] 中华人民共和国国家知识产权局

[51] Int. Cl.
H01M 4/24 (2006.01)
H01M 4/70 (2006.01)
H01M 10/30 (2006.01)

[12] 实用新型专利说明书

专利号 ZL 200820214288.2

[45] 授权公告日 2009 年 10 月 28 日

[11] 授权公告号 CN 201336332Y

[22] 申请日 2008.12.5
[21] 申请号 200820214288.2
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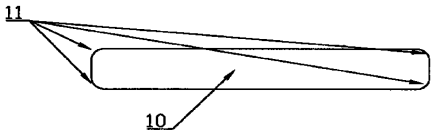
权利要求书 1 页 说明书 3 页 附图 1 页

[54] 实用新型名称

一种镍电池正极片以及使用该正极片的电池

[57] 摘要

一种镍电池正极片以及使用该正极片的电池，其镍电池正极片包括发泡镍基材以及设置在发泡镍基材中的正极活性物质，所述发泡镍基材的四角设置为圆角或倒角；其电池在于使用该正极片的电池。由于在电池的正极片的发泡镍基材的四角设置为圆角或倒角，避免在极片卷绕过程中正极片刺穿隔膜，降低了电池的短路率，提高了产品的合格率。



1、一种镍电池正极片，其特征在于，包括发泡镍基材以及设置在所述发泡镍基材中的正极活性物质，所述发泡镍基材四角设置为圆角或倒角。

2、根据权利要求 1 所述的镍电池正极片，其特征在于，所述倒角为 30～60 度。

3、根据权利要求 1 所述的镍电池正极片，其特征在于，所述圆角的半径为 0.2～4mm。

4、一种电池，其特征在于，包括权利要求 1 至 3 任一项所述的镍电池正极片。

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一种镍电池正极片以及使用该正极片的电池

技术领域

本实用新型涉及电池领域，更具体地说，涉及一种镍电池正极片以及使用该正极片的电池。

背景技术

现有电池，特别是镍电池，发泡镍作为基材的电池正极片的四角为直角，参看图 1，极片 10 的四角 11 均为直角，这些直角相对比较锋利，有的还会带有一些毛刺，在极片的卷绕过程中，这些直角以及毛刺有可能会刺穿正负极片之间的隔膜，造成短路，使电池的短路率和次品率居高不下，导致生产成本过高和原材料浪费。

实用新型内容

本实用新型要解决的技术问题在于，针对现有技术的上述电池正极片的四角的直角以及毛刺导致电池短路率高的缺陷，提供一种镍电池正极片以及使用该正极片的电池。

本实用新型解决其技术问题所采用的技术方案是：构造一种镍电池正极片，其特征在于，包括发泡镍基材以及设置在发泡镍基材中的正极活性物质，所述发泡镍基材的四角设置为圆角或倒角。

在本实用新型所述的镍电池正极片中，所述倒角为 30～60 度。

在本实用新型所述的镍电池正极片中，所述圆角的半径为 0.2～4mm。

在本实用新型所述的镍电池正极片中，所述正极活性物质为覆钴球镍与添加剂的混合物，或 $Ni(OH)_2$ 和 CoO 与添加剂的混合物。

本发明还提供一种包括上述镍电池正极片的电池。

实施本实用新型的镍电池正极片以及使用该正极片的电池，具有以下有益效果：由于在电池的正极片的发泡镍基材的四角设置为圆角或倒角，避免在极

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片卷绕过程中正极片刺穿隔膜的现象，降低了电池的短路率，提高了产品的合格率。

附图说明

下面将结合附图及实施例对本实用新型作进一步说明，附图中：

图 1 是现有技术的镍电池正极片的示意图；

图 2 是本实用新型的镍电池正极片第一实施例的示意图；

图 3 是本实用新型的镍电池正极片第二实施例的示意图。

具体实施方式

如图 2 所示，在本实用新型的镍电池正极片第一实施例中，包括发泡镍基材 10 以及设置在发泡镍基材中的正极活性物质（未示出），发泡镍基材 10 的四角 11 设置为圆角，所述圆角可以采用冲压的方式制成，所述圆角的半径为 0.2～4mm。由于在发泡镍基材的四角设置为圆角，去除了正极片四角可能存在的毛刺，避免正极片在卷绕的过程中刺穿隔膜造成短路。

在本实用新型的镍电池正极片第一实施中，所述活性物质为覆钴球镍与添加剂的混合物，或 $Ni(OH)_2$ 和 CoO 与添加剂的混合物。

如图 3 所示，在本实用新型的镍电池正极片第二实施例中，发泡镍基材 10 的四角 11 设置为倒角，可以采用冲制或磨削的方式制成，倒角的角度在 30～60 度，由于在发泡镍基材的四角设置为倒角，去除了正极片四角可能存在的毛刺，避免正极片在卷绕的过程中刺穿隔膜造成短路。

在本实用新型的镍电池正极片第二实施中，所述活性物质为覆钴球镍与添加剂的混合物，或 $Ni(OH)_2$ 和 CoO 与添加剂的混合物。

本实用新型的电池的第一实施例是使用本实用新型镍电池正极片第一实施例的正极片的电池。

本实用新型的电池的第二实施例是使用本实用新型镍电池正极片第二实施例的正极片的电池。

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上面结合附图对本实用新型的实施例进行了描述，但是本实用新型并不局限于上述的具体实施方式，上述的具体实施方式仅仅是示意性的，而不是限制性的，本领域的普通技术人员在本实用新型的启示下，在不脱离本实用新型宗旨和权利要求所保护的范围情况下，还可做出很多形式，这些均属于本使用新型的保护之内。

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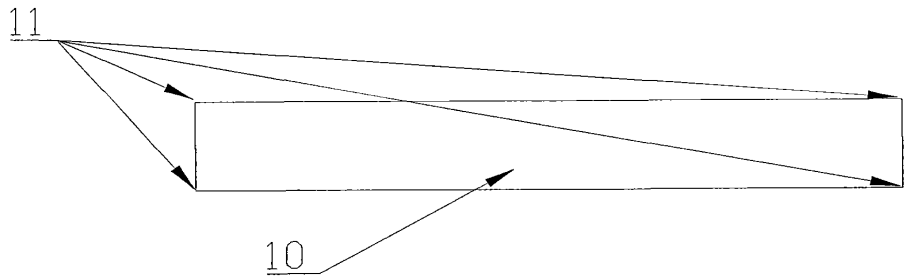


图 1

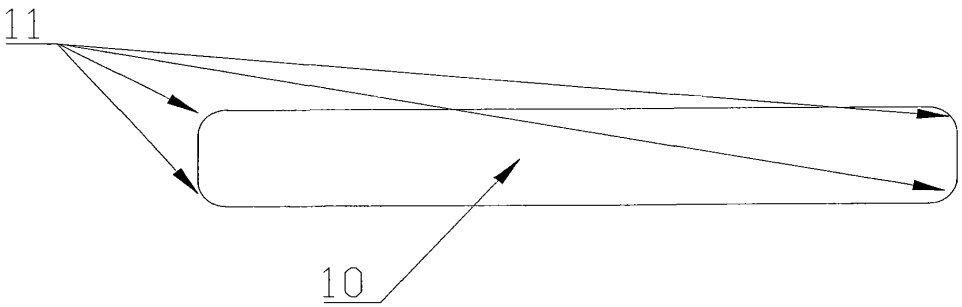


图 2

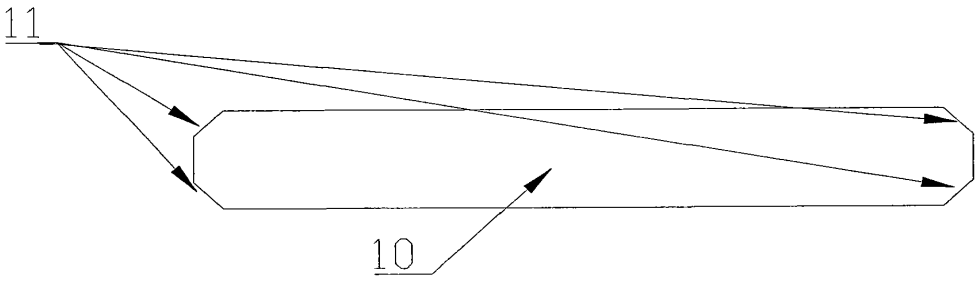


图 3

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Espacenet

Bibliographic data: CN202373667 (U) — 2012-08-08

Electrical core of lithium ion battery and pole piece thereof

Inventor(s): MINGLIANG MO; TING TAN; JIE CHEN ± (MO MINGLIANG, ; TAN TING, ; CHEN JIE)

Applicant(s): AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD ± (AMPEREX TECHNOLOGY LTD, ; NINGDE AMPEREX TECHNOLOGY LTD)

Classification: **- international:** ***H01M10/0525; H01M10/058; H01M2/26; H01M4/13***
- cooperative: Y02E60/10 (EP)

Application number: CN201120538276U 20111221

Priority number (s): CN201120538276U 20111221

Abstract of CN202373667 (U)

The utility model discloses an electrical core of a lithium ion battery. The electrical core comprises a positive plate, a negative plate, an isolating membrane arranged between the positive plate and the negative plate, a positive tab and a negative tab, wherein the positive tab and the negative tab are arranged on the edges of the lateral parts of the positive and the negative plates respectively, and the edges of the lateral parts of the positive and the negative plates are higher than the bottom edges of the positive and the negative tabs respectively. The electrical core of the lithium ion battery can effectively prevent waste of space in a tab welding area, and improve the energy density of the lithium ion battery. Besides, the utility model further discloses a pole piece of the lithium ion battery.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 202373667 U
(45)授权公告日 2012.08.08

(21)申请号 201120538276.7

(22)申请日 2011.12.21

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(51)Int.Cl.
H01M 10/058(2010.01)
H01M 4/13(2010.01)
H01M 2/26(2006.01)
H01M 10/0525(2010.01)

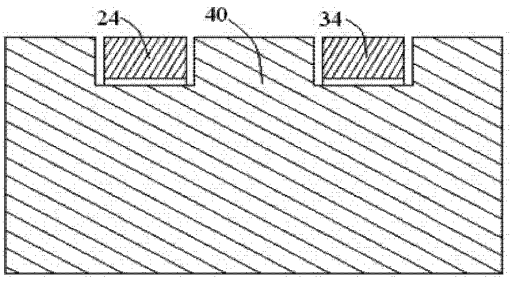
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(54)实用新型名称

锂离子电池的电芯及其极片

(57)摘要

本实用新型公开了一种锂离子电池的电芯，其包括正极片、负极片、间隔于正负极片之间的隔离膜，以及分别设于正负极片侧部边缘的正负极耳，正负极片的侧部边缘高于正负极耳的底部边缘。与现有技术相比，本实用新型锂离子电池的电芯可以有效避免极耳焊接区域的空间浪费，提高锂离子电池的能量密度。此外，本实用新型还公开了一种锂离子电池极片。



CN 202373667 U

1. 一种锂离子电池的电芯，包括正极片、负极片、间隔于正负极片之间的隔离膜，以及分别设于正负极片侧部边缘的正负极耳，其特征在于：所述正负极片的侧部边缘高于正负极耳的底部边缘。

2. 根据权利要求 1 所述的锂离子电池的电芯，其特征在于：所述正负极片的侧部边缘与正负极耳的顶部边缘平齐。

3. 根据权利要求 1 或 2 所述的锂离子电池的电芯，其特征在于：所述正负极片上分别开设空位槽，正负极耳设于空位槽中且只有底部与正负极集流体连接。

4. 根据权利要求 3 所述的锂离子电池的电芯，其特征在于：所述隔离膜上开设有与正负极片上的空位槽对应的凹槽，凹槽的深度等于或小于空位槽的深度。

5. 根据权利要求 3 所述的锂离子电池的电芯，其特征在于：所述正 / 负极片包括正 / 负极集流体和涂布于正 / 负极集流体上的正 / 负极活性物质膜片，正 / 负极耳为正 / 负极集流体的一部分且未涂布正 / 负极活性物质膜片。

6. 一种锂离子电池极片，包括集流体和涂布于集流体上的活性物质膜片，其特征在于：所述集流体的一个宽度边缘上开设有多个空位槽，部分空位槽中设有未涂布活性物质膜片的极耳；每一个极耳的底部与集流体连接，顶部边缘与集流体的宽度边缘平齐，两侧边通过切口与集流体及其上的活性物质膜片间隔开。

7. 根据权利要求 6 所述的锂离子电池极片，其特征在于：所述锂离子电池极片为正极片或负极片。

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锂离子电池的电芯及其极片

技术领域

[0001] 本实用新型涉及一种锂离子电池，尤其是一种具有高能量密度的锂离子电池的电芯及其极片。

背景技术

[0002] 目前，锂离子电池一般通过从正负极片引出极耳的方式实现电芯与外电路的电性连接，上述极耳可以是焊接于极片的导电片，也可以是相应集流体的延伸部。为了减小电池的内阻并提高其倍率性能，多层极片的同极极耳通常固定在一起共同引出。

[0003] 但是，现有锂离子电池至少存在以下缺陷：请参阅图 1 所示的现有锂离子电池的电芯结构示意图，其两个极耳 12 的顶部边缘和卷绕或叠加好的正负极片 14 的侧部边缘之间存在一定高度差 L，当电芯装入电池壳时，高度差 L 所对应的区域将无法得到有效利用，这无疑会造成电池壳内的空间浪费，也降低了电池的能量密度。

[0004] 有鉴于此，确有必要提供一种具有高能量密度的锂离子电池的电芯及其极片。

实用新型内容

[0005] 本实用新型的目的在于：提供一种具有高能量密度的锂离子电池的电芯及其极片。

[0006] 为了实现上述发明目的，本实用新型提供了一种锂离子电池的电芯，其包括正极片、负极片、间隔于正负极片之间的隔离膜，以及分别设于正负极片侧部边缘的正负极耳，正负极片的侧部边缘高于正负极耳的底部边缘。

[0007] 作为本实用新型锂离子电池的电芯的一种改进，所述正负极片的侧部边缘与正负极耳的顶部边缘平齐。

[0008] 作为本实用新型锂离子电池的电芯的一种改进，所述正负极片上分别开设空位槽，正负极耳设于空位槽中且只有底部与正负极集流体连接。

[0009] 作为本实用新型锂离子电池的电芯的一种改进，所述隔离膜上开设有与正负极片上的空位槽对应的凹槽，凹槽的深度等于或小于空位槽的深度。

[0010] 作为本实用新型锂离子电池的电芯的一种改进，所述正 / 负极片包括正 / 负极集流体和涂布于正 / 负极集流体上的正 / 负极活性物质膜片，正 / 负极耳为正 / 负极集流体的一部分且未涂布正 / 负极活性物质膜片。

[0011] 为了实现上述发明目的，本实用新型还提供一种锂离子电池极片，其包括集流体和涂布于集流体上的活性物质膜片，集流体的一个宽度边缘上开设有多个空位槽，部分空位槽中设有未涂布活性物质膜片的极耳；每一个极耳的底部与集流体连接，顶部边缘与集流体的宽度边缘平齐，两侧边通过切口与集流体及其上的活性物质膜片间隔开。

[0012] 作为本实用新型锂离子电池极片的一种改进，所述锂离子电池极片为正极片或负极片。

[0013] 与现有技术相比，本实用新型锂离子电池的电芯可以有效避免极耳焊接区域的空

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间浪费，提高锂离子电池的能量密度。

附图说明

[0014] 下面结合附图和具体实施方式，对本实用新型锂离子电池的电芯及其极片进行详细说明。

[0015] 图 1 为现有锂离子电池的电芯的结构示意图。

[0016] 图 2 为本实用新型锂离子电池的正极片俯视示意图。

[0017] 图 3 为本实用新型锂离子电池的负极片俯视示意图。

[0018] 图 4 为本实用新型锂离子电池的电芯的结构示意图。

具体实施方式

[0019] 请参阅图 2 至图 4，本实用新型锂离子电池的电芯包括正极片 20、负极片 30 和间隔在正负极片 20、30 之间的隔离膜（图未示）。

[0020] 正极片 20 包括正极集流体和涂布于正极集流体上的正极活性物质膜片 22，正极活性物质膜片 22 中含有正极活性物质。正极集流体的一个宽度边缘上开设有多个空位槽 26，部分空位槽 26 中设有未涂布正极活性物质膜片 22 的正极极耳 24。每一个正极极耳 24 的底部与正极集流体连接，顶部边缘与正极集流体的宽度边缘平齐，两侧边则通过切口 240 与正极集流体及其上的正极活性物质膜片 22 间隔开。设有正极极耳 24 的空位槽 26 与未设正极极耳 24 的空位槽 26 以一定的规律间隔排列。

[0021] 负极片 30 的结构与正极片 20 类似，包括负极集流体、涂布于负极集流体上的负极活性物质膜片 32、开设于负极集流体的一个宽度边缘的多个空位槽 36，以及设于部分空位槽 36 中的负极极耳 34，负极极耳 34 的两侧边通过切口 340 与负极集流体及其上的负极活性物质膜片 32 间隔开。所不同的是，负极集流体的一个长度端部上有一段未涂布负极活性物质膜片 32 的裸露部 38。另外，空位槽 36 中设置负极极耳 34 的规律可以与正极相同或不同。

[0022] 隔离膜上也开设有与空位槽 26、36 相对应的凹槽，凹槽的作用在于保证同极极耳间的正常焊接，因此其深度最好等于或小于空位槽 26、36 的深度。

[0023] 请参阅图 4，使用上述正极片 20、负极片 30 与隔离膜一起制成卷绕或叠片结构的电芯 40 后，多个正极极耳 24 全部对齐在一起，多个负极极耳 34 也全部对齐，空位槽 26、36 及隔离膜的凹槽所提供的预留空间保证了同极极耳之间能够彼此接触而便于固定在一起。电芯 40 即通过正极极耳 24 和负极极耳 34 与外电路进行连接。

[0024] 在其他实施方式中，根据实际需要，正负极片 20、30 的侧部边缘也可以略低于正负极耳 24、34 的顶部边缘，此种情况下，只要同极极耳之间能够实现正常焊接，隔离膜也可以无需专门开设凹槽。

[0025] 综上所述，由于所制得的电芯 40 的正负极片 20、30 的侧部边缘高于正负极耳 24、34 的底部边缘，甚至与正负极耳 24、34 的顶部边缘平齐，因此能有效避免极耳焊接区域的空间浪费，有效提高锂离子电池的能量密度；而多层极耳焊接在一起后引出的结构能够有效地降低电池内阻，从而减少电池发热，提高其倍率性能。

[0026] 根据上述说明书的揭示和教导，本实用新型所属领域的技术人员还可以对上述实

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施方式进行适当的变更和修改。因此，本实用新型并不局限于上面揭示和描述的具体实施方式，对本实用新型的一些修改和变更也应当落入本实用新型的权利要求的保护范围内。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本实用新型构成任何限制。

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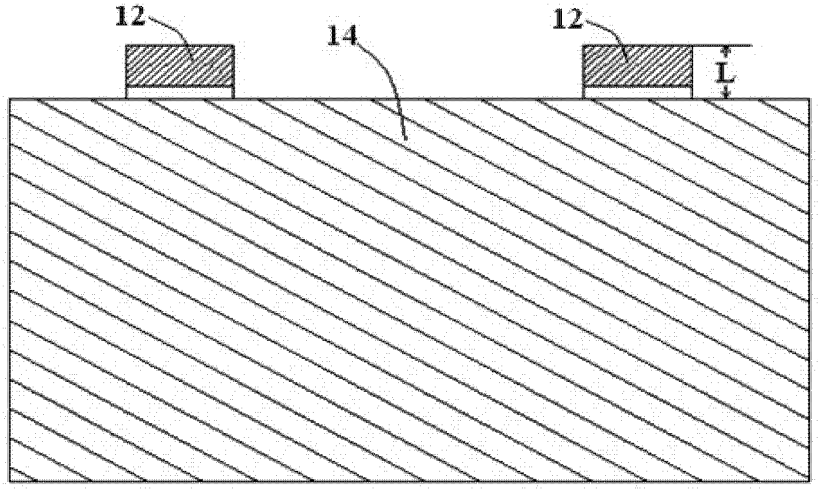


图 1

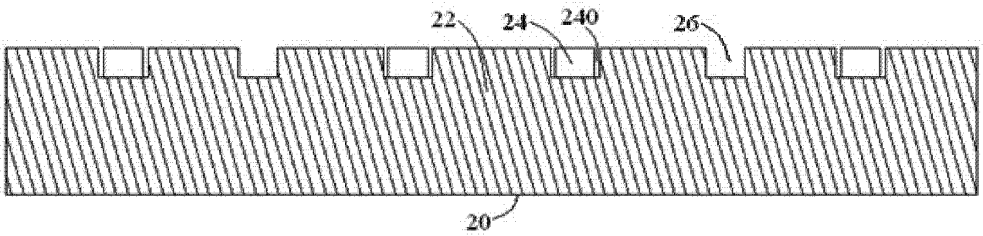


图 2

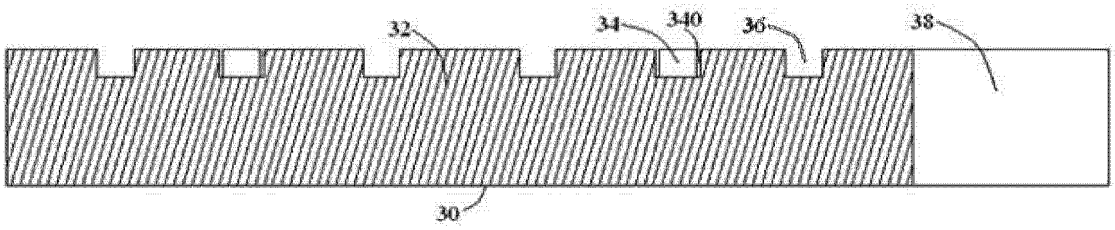


图 3

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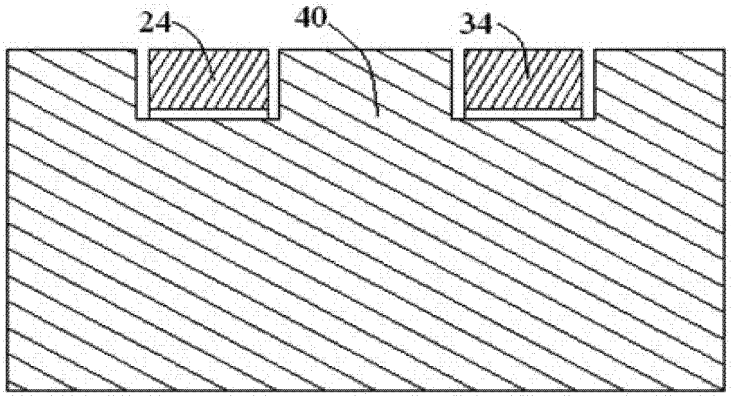


图 4

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Espacenet

Bibliographic data: CN202423456 (U) — 2012-09-05

Device for round-cornering pole piece

Inventor(s): ZHENGKUN WAN; LIN FENG; YOUYUN FAN; SHUSHENG YANG; JUNWEI GAO; JIANMING ZHOU ± (WAN ZHENGKUN, ; FENG LIN, ; FAN YOUYUN, ; YANG SHUSHENG, ; GAO JUNWEI, ; ZHOU JIANMING)

Applicant(s): YIYANG KELIYUAN BATTERY CO LTD ± (YIYANG KELIYUAN BATTERY CO.,LTD)

Classification: **- international:** ***H01M4/04***
- cooperative: Y02E60/10 (EP)

Application number: CN20122032103U 20120201

Priority number (s): CN20122032103U 20120201

Abstract of CN202423456 (U)

The utility model provides a device for round-cornering a pole piece, which comprises a punching machine, at least one upper shear mouth, at least two lower shear mouths and at least two positioning plate parts; the central position of a platform of the cubic upper shear mouth is provided with a hollow cylinder mouth, the cylinder mouth is connected with the punching machine, one or more corners of the platform are respectively provided with hollow arc bodies, the center on a platform of each rectangular lower shear mouth is provided with a hollow cylinder mouth, each lower shear mouth is fixedly connected with a working board of the punching machine through a fixed piece via the cylinder mouth, one or more corners of the working board are ground into a solid arc body, and the positioning plates are arranged on the position to be tangential to the solid arc bodies of the lower shear mouths; and the upper shear mouth platform is parallel to the lower shear mouth platform, and a right angle is formed between the positioning plates. After the device is used, the sharp corners in four direction of the pole piece can be trimmed into arc shapes, so that the pole piece is difficult for scratching a diaphragm, and the influence of burrs on the sharp corners on the tail part of the pole piece on internal circuits of a battery can be reduced.

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(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 202423456 U
(45)授权公告日 2012.09.05

(21)申请号 201220032103.2

(22)申请日 2012.02.01

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(51)Int.Cl.
H01M 4/04(2006.01)

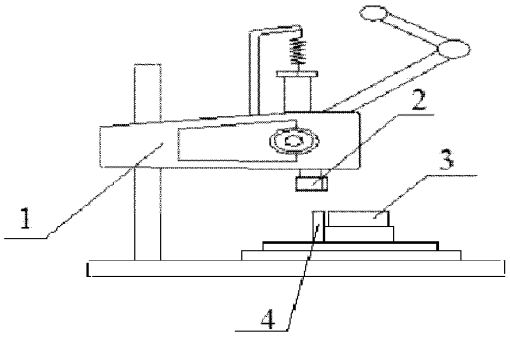
权利要求书 1 页 说明书 2 页 附图 2 页

(54)实用新型名称

用于极片切圆角的装置

(57)摘要

本实用新型提供了一种用于极片切圆角的装置，包括冲压机、至少一块上剪口、至少两块下剪口、至少2块定位板部件；正方体上剪口的平台中心位置开有空心圆柱体口，该圆柱体口与冲压机连接，在任意一角或多个角开有空心圆弧体，长方体下剪口的平台中间开空心圆柱体口，固定件通过圆柱体口将下剪口与冲压机的工作台面连接固定，一角或多个角打磨成实心圆弧体，定位板放置于与下剪口实心圆弧体相切的位置；上、下剪口的平台平行，定位板相互之间成直角。用本实用新型的装置后，可将极片的四个方向的尖角修切成弧状，从而可以使极片不易刮破隔膜，降低尾部尖角毛刺对电池内部短路的影响。



CN 202423456 U

1. 一种用于极片切圆角的装置，其特征在于：包括冲压机、至少一块上剪口、至少两块下剪口、至少 2 块定位板部件；所述上剪口部件呈正方体的平台，在平台的中心位置开有一个半径为 5 ～ 90 毫米的从上至下完全贯穿正方体的空心圆柱体口，该圆柱体口与冲压机连接，在正方体的任意一角或多个角开有相同特定半径、相同特定弧度的从上至下完全贯穿正方体的空心圆弧体，所述特定弧度为 90±3 度，所述特定半径为 2 ～ 8 毫米；下剪口呈长方体的平台，在平台的中间开一个或多个半径 2 ～ 150 毫米的从上至下完全贯穿长方体的空心圆柱体口，固定件通过圆柱体口将下剪口与冲压机的工作台面连接固定，将该长方体的一角或多个角打磨成实心圆弧体，该实心圆弧体的半径和弧度均与上剪口的空心圆弧体半径和弧度相同；定位板放置于与下剪口实心圆弧体相切的位置；上、下剪口的平台平行，定位板相互之间成直角。

2. 如权利要求 1 所述的用于极片切圆角的装置，其特征在于：优选方案为上剪口部件数量优选 1 块，下剪口部件优选 2 块，定位板 2 块，1 台手动冲压机。

3. 如权利要求 1 所述的用于极片切圆角的装置，其特征在于：优选方案为上剪口部件数量优选 4 块，下剪口部件优选 2 块，定位板 3 块，1 台气动冲压机。

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用于极片切圆角的装置

技术领域

[0001] 本实用新型涉及一种用于电池极片生产的装置，特别涉及将极片切圆角的装置。

背景技术

[0002] 目前由于电池容量的高要求，增加了正负极活性物质、隔膜等的质量，使电池内部空间更加狭小、极片与隔膜之间的挤压更加明显，加上电池充放电时活性物质体积的膨胀，使电池因极片毛刺、特别是极片尾部毛刺发生内部短路，导致电池失效，甚至爆炸。实验发现，对极片尾部的尖角毛刺需要作圆角处理，可很好的解决这个问题，但目前并未有适合的装置。

实用新型内容

[0003] 本实用新型旨在提供一种对极片作圆角处理的装置，通过切除尾部尖角毛刺，消除电池尾部尖角毛刺短路威胁。

[0004] 本实用新型方案如下：

[0005] 一种用于极片切圆角的装置，包括冲压机、至少一块上剪口、至少两块下剪口、至少 2 块定位板部件；所述上剪口部件呈正方体的平台，在平台的中心位置开有一个半径为 5 ～ 90 毫米的从上至下完全贯穿正方体的空心圆柱体口，该圆柱体口与冲压机连接，在正方体的任意一角或多个角开有相同特定半径、相同特定弧度的从上至下完全贯穿正方体的空心圆弧体（即正方体某一高度方向形成了向里凹的圆弧体状），所述特定弧度为 90±3 度，所述特定半径为 2 ～ 8 毫米；下剪口呈长方体的平台，在平台的中间开一个或多个半径 2 ～ 150 毫米的从上至下完全贯穿长方体的空心圆柱体口，固定件通过圆柱体口将下剪口与冲压机的工作台面连接固定，将该长方体的一角或多个角打磨成实心圆弧体，（即长方体上下两个面的同一高度方向的两个角分别被打磨成圆弧形，形成往外凸的圆弧体状）该实心圆弧体的半径和弧度均与上剪口的空心圆弧体半径和弧度相同；定位板放置于与下剪口实心圆弧体相切的位置；上、下剪口的平台平行，定位板相互之间成直角。

[0006] 实践中如果采用手动方式，则优选方案为上剪口部件数量优选 1 块，下剪口部件优选 2 块，定位板 2 块，1 台手动冲压机。

[0007] 实践中如果采用气动方式，优选方案为上剪口部件数量优选 4 块且并排放置，下剪口部件优选 2 块，定位板 3 块，1 台气动冲压机，且装置中还包括有感应器。

[0008] 采用本实用新型的装置后，可将极片的四个方向的尖角修切成弧状，从而可以使极片不易刮破隔膜，在电池制作流程中的套钢壳时对隔膜的刮伤威胁降至最低，从而降低尾部尖角毛刺对电池内部短路的影响。

附图说明

[0009] 图 1 实施例 1 手动式的切圆角装置示意图

[0010] 图 2 上剪口部件结构剖视图

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[0011] 图 3 下剪口部件结构剖视图

[0012] 图 4 各部件放置示意图

具体实施方式

[0013] 实施例只是为了说明本实用新型的一种实现方式，不作为对本实用新型保护范围的限制性说明。

[0014] 实施例 1

[0015] 手动式极片切圆角机，示意图如图 1。包括有手动式的冲压机 1、一块上剪口 2，一块下剪口 3 和两块定位板 4。

[0016] 上剪口部件 2 的结构示意见图 2，使用淬火锋钢，呈边长为 15.5 毫米的正方体平台，在平台的中心位置开有一个半径为 7.6 毫米的从上至下完全贯穿正方体的空心圆柱体口 21，该圆柱体口与冲压机 1 连接，在正方体的任意一角开有半径为 3.5 毫米、弧度为 90 度的从上至下完全贯穿正方体的空心圆弧体 22（即正方体某一高度方向形成了向里凹的圆弧体状）。

[0017] 下剪口 3 结构示意图见图 3，使用淬火锋钢，呈长方体的平台长、宽、高尺寸为 51 毫米、51 毫米、27 毫米，在平台的中间对称开两个半径 7.5 毫米的从上至下完全贯穿长方体的空心圆柱体口 31，固定件通过圆柱体口将下剪口与冲压机 1 的工作台面连接固定，将该长方体的一角打磨成实心圆弧体 32，（即长方体上下两个面的同一高度方向的两个角分别被打磨成圆弧形，形成往外凸的圆弧体状），该实心圆弧体的半径和弧度均与上剪口的空心圆弧体半径和弧度相同。

[0018] 各部件的放置示意见图 4，定位板放置于与下剪口 3 实心圆弧体 32 相切的位置；上剪口 2、下剪口 3 的平台平行，两块定位板 4 相互之间成直角。

[0019] 实施例 2

[0020] 使用时，取一片正极片或负极片沿着定位板置于水平的下剪口 3 平台上，下压手动式冲压机 1 的压力臂，成 90 度弧形的上剪口随之切下，在上下切力的作用下将极片尖角切除，重复操作即可对极片的四个尖角分别切圆角，使极片原本 90 度直角变为约 90 度圆弧，从而消除尾部尖角毛刺对电池隔膜的刮伤威胁。

[0021] 实施例 3

[0022] 气动式极片切圆角机，采用气动式的冲压机、四块并排排列的上剪口，两块并排的下剪口和三块定位板，以及感应器。

[0023] 上、下剪口 6 与手动式极片切圆角机的上、下剪口结构及尺寸基本相同，三块定位板两两成直角。

[0024] 使用时，取两片正极片或负极片分别沿着定位板两侧并行置于水平的下剪口平台上，触发感应器，并排的、成 90 度弧形的四个上剪口随之切下，在上下切力的作用下将极片尖角切除，使极片原本 90 度直角变为 90 度圆弧，重复操作即可对极片的四个尖角分别切圆角。

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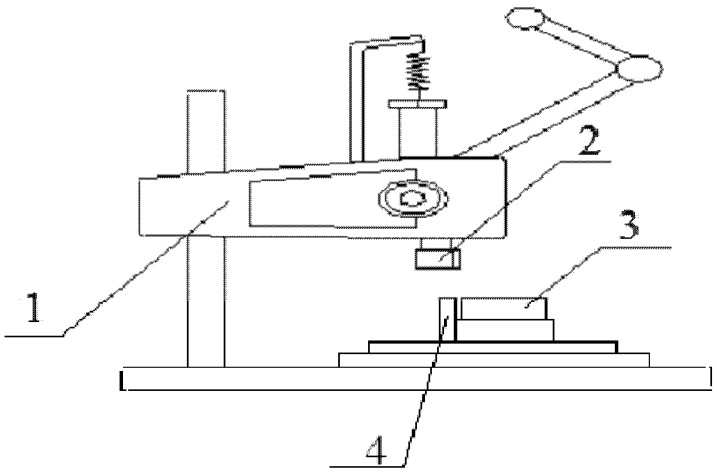


图 1

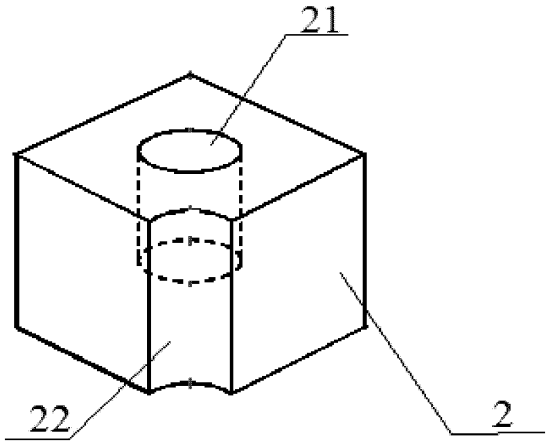


图 2

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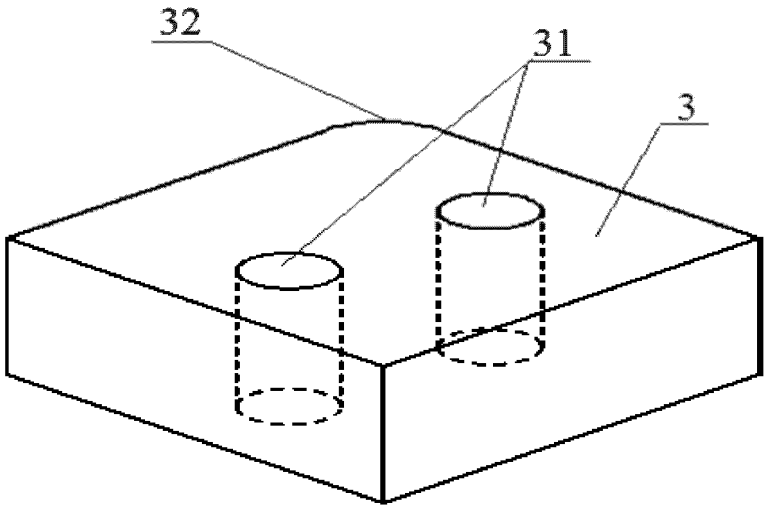


图 3

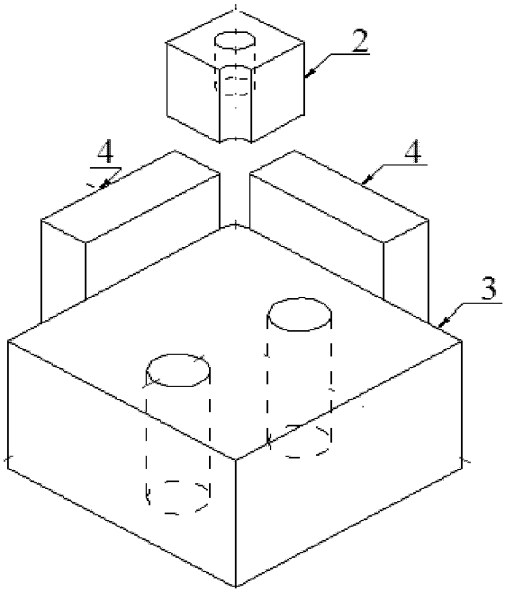


图 4

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Espacenet

Bibliographic data: CN202839841 (U) — 2013-03-27

Positive pole piece of lithium ion battery

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Classification: - international: ***H01M4/13; H01M4/70***
- cooperative: Y02E60/10 (EP)

Application number: CN201220373126U 20120731

Priority number (s): CN201220373126U 20120731

Abstract of CN202839841 (U)

The utility model belongs to the technical field of lithium ion batteries, and particularly relates to a positive pole piece of a lithium ion battery. The positive pole piece of the lithium ion battery comprises a positive pole current collector and a positive pole film piece, wherein the edge of the positive pole current collector is treated with gas plasma etching, the positive pole film piece is arranged on the surface of the positive pole current collector, the width of the positive pole current collector is smaller than the width of the positive pole film piece, and an oxide layer is arranged on the edge of the positive pole current collector. Compared with the prior art, a special positive pole piece structure with the indented current collector is formed by means of the gas plasma etching treatment, and therefore under the condition that the whole shape of the positive pole piece is not affected and complete coating of the positive pole film piece is kept, cutting burrs of the positive pole current collector can be eliminated on one hand, and on the other hand, by means of the indented structure of the positive pole current collector and insulation effect of the oxide layer outside the positive pole current collector, danger of a separation film being pierced by protruding out of un-eliminated burrs or an uneven surface produced from etching is avoided, and further safety of the lithium ion battery is effectively guaranteed.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 202839841 U
(45)授权公告日 2013.03.27

(21)申请号 201220373126.X

(22)申请日 2012.07.31

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(51)Int.Cl.
H01M 4/13(2010.01)
H01M 4/70(2006.01)

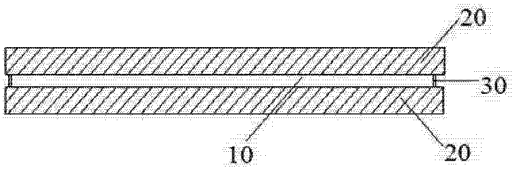
权利要求书 1 页 说明书 4 页 附图 2 页

(54)实用新型名称

一种锂离子电池正极极片

(57)摘要

本实用新型属于锂离子电池技术领域，尤其涉及一种锂离子电池正极极片，包括其边缘经气体等离子体刻蚀处理的正极集流体和设置于所述正极集流体表面的正极膜片，所述正极集流体的宽度小于所述正极膜片的宽度，所述正极集流体的边缘设置有氧化层。相对于现有技术，本实用新型的锂离子电池正极极片通过气体等离子体刻蚀处理的方法，形成集流体“缩进”的特殊的正极极片结构，在不影响正极极片整体形状且保持正极膜片涂层完整的情况下，一方面可以将正极集流体的切割毛刺去除，另一方面正极集流体的缩进结构和其外侧的氧化层的绝缘作用，可以避免未除尽的毛刺或由于刻蚀产生的粗糙表面伸出从而刺破隔离膜的风险，有效保证锂离子电池的安全。



CN 202839841 U

1. 一种锂离子电池正极极片，包括其边缘经气体等离子体刻蚀处理的正极集流体和设置于所述正极集流体表面的正极膜片，其特征在于：所述正极集流体的宽度小于所述正极膜片的宽度，所述正极集流体的边缘设置有氧化层。

2. 根据权利要求 1 所述的锂离子电池正极极片，其特征在于：所述氧化层的厚度为 1~10 μm。

3. 根据权利要求 2 所述的锂离子电池正极极片，其特征在于：所述氧化层的厚度为 1~3 μm。

4. 根据权利要求 3 所述的锂离子电池正极极片，其特征在于：所述氧化层的厚度为 2 μm。

5. 根据权利要求 1 所述的锂离子电池正极极片，其特征在于：在宽度方向上，所述正极集流体的左边缘与所述正极膜片的左边缘之间的距离为 0~50 μm，所述正极集流体的右边缘与所述正极膜片的右边缘之间的距离为 0~50 μm，并且所述正极集流体的左边缘和右边缘均位于所述正极膜片的左边缘和右边缘之间。

6. 根据权利要求 5 所述的锂离子电池正极极片，其特征在于：在宽度方向上，所述正极集流体的左边缘与所述正极膜片的左边缘之间的距离为 10~45 μm，所述正极集流体的右边缘与所述正极膜片的右边缘之间的距离为 10~45 μm。

7. 根据权利要求 6 所述的锂离子电池正极极片，其特征在于：在宽度方向上，所述正极集流体的左边缘与所述正极膜片的左边缘之间的距离为 30 μm，所述正极集流体的右边缘与所述正极膜片的右边缘之间的距离为 30 μm。

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一种锂离子电池正极极片

技术领域

[0001] 本实用新型属于锂离子电池技术领域，尤其涉及一种锂离子电池正极极片。

背景技术

[0002] 随着现代社会的发展，各种移动设备，如摄像机、笔记本电脑、便携式 DVD 和数码相机等都有了越来越广泛的应用，因此，对高能电池的需求也越来越大。锂离子电池因具有重量轻、储能大、功率大、无污染、寿命长、自放电系数小、温度适应范围宽泛等许多突出的优点，逐渐受到人们的青睐，成为移动设备的最佳电源，甚至在航空、航天、航海、汽车、医疗设备等领域中也逐步取代了其他的传统电池。

[0003] 锂离子电池内一般包括若干个依次叠加的电池单体，每个电池单体包括相互卷绕或叠加的正极极片、隔离膜和负极片，其中，隔离膜间隔于相邻的正、负极片之间，起到电子阻隔、离子导通的作用，同时用于保持电解液。正极极片包括一般采用铝箔制作的正极集流体和附着在正极集流体上、含有正极活性物质的正极膜片；负极片包括一般采用铜箔制作的负极集流体和附着在负极集流体上、含有负极活性物质的负极膜片；隔离膜则为采用塑化、萃取等工艺制成的微孔薄膜，这样的结构有利于隔离膜对含有锂盐的有机溶剂电解液的保持。制造锂离子电池时，只要将一个或多个上述的电池单体制成电池芯，并在电池芯的外面包裹上包装薄膜，之后向其内注入电解液，经过抽空、密封即可。由于目前锂离子电池所使用的电解液为易燃的有机电解液，所以二次锂离子电池对安全性要求很高。

[0004] 锂离子电池的极片制备过程，通常包括制浆、涂膜、干燥、压型、切割等工序，虽然不同厂商或不同电池的制造工序可能会有所变化，但极片切割都是必不可少的工序。由于锂离子电池大都采用铝箔作为正极集流体，铝自身的特性决定其切割时容易在边缘处产生毛刺。如图 1 所示，正极极片 200 上作为正极集流体的铝箔 220 边缘与正极膜片 240 的边缘平齐或稍微突出于正极膜片 240 的边缘并且有一些切割产生的毛刺，因此将该正极极片 200 与隔离膜和负极片叠加后，铝箔 220 的切割毛刺就易于刺破隔离膜，以致与相邻的负极膜片接触而发生短路。短路的电池会迅速升温，从而导致易燃的有机电解液着火，甚至导致电池发生爆炸。

[0005] 为了去除正极极片边缘的毛刺，申请号为 CN200910036707.7 的中国专利申请公开了一种将正极极片卷料用碱液浸泡来去除毛刺的方法。该湿法处理虽然也可以将正极集流体切割边缘的毛刺去除，但是存在毛细现象以及工序实现困难等问题。而且，用碱液浸泡后的卷料边缘可能还会产生一定的毛刺，也就是说，在去毛刺的同时又会产生毛刺，还是有一定的安全隐患。

[0006] 有鉴于此，确有必要提供一种锂离子电池正极极片，该正极极片的正极集流体的边缘毛刺大大减少甚至没有，从而大大提高使用该正极极片的电池的安全性。

实用新型内容

[0007] 本实用新型的目的在于：针对现有技术的不足，而提供一种锂离子电池正极极片，

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该正极极片的正极集流体的边缘毛刺大大减少甚至没有，从而大大提高使用该正极极片的电池的安全性。

[0008] 为了达到上述目的，本实用新型采用如下技术方案：一种锂离子电池正极极片，包括其边缘经气体等离子体刻蚀处理的正极集流体和设置于所述正极集流体表面的正极膜片，所述正极集流体的宽度小于所述正极膜片的宽度，所述正极集流体的边缘设置有氧化层。

[0009] 作为本实用新型锂离子电池正极极片的一种改进，所述氧化层的厚度为 1~10μm。

[0010] 作为本实用新型锂离子电池正极极片的一种改进，所述氧化层的厚度为 1~3μm。

[0011] 作为本实用新型锂离子电池正极极片的一种改进，所述氧化层的厚度为 2μm。

[0012] 作为本实用新型锂离子电池正极极片的一种改进，在宽度方向上，所述正极集流体的左边缘与所述正极膜片的左边缘之间的距离为 0~50μm，所述正极集流体的右边缘与所述正极膜片的右边缘之间的距离为 0~50μm，并且所述正极集流体的左边缘和右边缘均位于所述正极膜片的左边缘和右边缘之间。

[0013] 作为本实用新型锂离子电池正极极片的一种改进，在宽度方向上，所述正极集流体的左边缘与所述正极膜片的左边缘之间的距离为 10~45μm，所述正极集流体的右边缘与所述正极膜片的右边缘之间的距离为 10~45μm。

[0014] 作为本实用新型锂离子电池正极极片的一种改进，在宽度方向上，所述正极集流体的左边缘与所述正极膜片的左边缘之间的距离为 30μm，所述正极集流体的右边缘与所述正极膜片的右边缘之间的距离为 30μm。

[0015] 相对于现有技术，本实用新型的锂离子电池正极极片通过气体等离子体刻蚀处理的方法，形成集流体“缩进”的特殊的正极极片结构(即正极集流体的宽度小于正极膜片的宽度)，在不影响正极极片整体形状且保持正极膜片涂层完整的情况下，一方面可以将正极集流体的切割毛刺去除，另一方面正极集流体的缩进结构和其外侧的氧化层的绝缘作用，可以避免未除尽的毛刺或由于刻蚀产生的粗糙表面伸出从而刺破隔离膜的风险，有效保证锂离子电池的安全。

附图说明

[0016] 下面结合附图和各个具体实施方式，对本实用新型及其有益技术效果进行详细说明。

[0017] 图 1 为现有技术中的正极极片的结构示意图。

[0018] 图 2 为本实用新型的俯视示意图。

[0019] 图 3 为本实用新型的剖视示意图。

[0020] 图 4 为本实用新型具体实施方式中去除正极集流体上的毛刺所采用的装置的结构示意图。

具体实施方式

[0021] 如图 2 和图 3 所示，本实用新型提供的一种锂离子电池正极极片，包括其边缘经气体等离子体刻蚀处理的正极集流体 10 和设置于正极集流体 10 表面的正极膜片 20，正极集流体 10 的宽度小于正极膜片 20 的宽度，正极集流体 10 的边缘设置有氧化层 30。氧化层

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30 的设置可以避免未除尽的毛刺或由于刻蚀产生的粗糙表面伸出从而刺破隔离膜的风险。

[0022] 其中，氧化层 30 的厚度为 1~10μm。若氧化层 30 的厚度太小，无法有效避免未除尽的毛刺或由于刻蚀产生的粗糙表面伸出从而刺破隔离膜的风险。而若氧化层 30 的厚度太大，又会造成不必要的材料的浪费。

[0023] 氧化层 30 的厚度为 1~3μm，这是优选的范围。

[0024] 氧化层 30 的厚度为 2μm，这是较佳的而选择。氧化层 30 可以通过喷溅、真空镀层或涂覆等方式设置在正极集流体 10 的边缘。

[0025] 在宽度方向上，正极集流体 10 的左边缘与正极膜片 20 的左边缘之间的距离为 0~50μm（即蚀刻深度），正极集流体 10 的右边缘与正极膜片 20 的右边缘之间的距离为 0~50μm，并且正极集流体 10 的左边缘和右边缘均位于正极膜片 20 的左边缘和右边缘之间。刻蚀深度在 0~50μm 范围内。刻蚀深度的限定是为了既保证达到去除毛刺的目的，又不破坏正极极片。缩进距离越大，可能未被除尽的毛刺以及由气体刻蚀产生的粗糙凸起都会被外层的膜片包裹住，安全性能越好。但距离太大会导致膜片的边缘没有集流体支撑，出现脱落。而且刻蚀深度太大，会对正极集流体 10 上无正极活性物质的区域产生不应该的破坏，影响后续工序的极耳焊接。因此缩进的距离在 0~ 50μm 是较优的结果。

[0026] 优选的，在宽度方向上，正极集流体 10 的左边缘与正极膜片 20 的左边缘之间的距离为 10~45μm，正极集流体 10 的右边缘与正极膜片 20 的右边缘之间的距离为 10~45μm。

[0027] 更优选的，在宽度方向上，正极集流体 10 的左边缘与正极膜片 20 的左边缘之间的距离为 30μm，正极集流体 10 的右边缘与正极膜片 20 的右边缘之间的距离为 30μm。

[0028] 具体操作时，通过气体电离产生等离子体高速轰击并与正极集流体 10 上的毛刺（毛刺为铝或铝的氧化物）发生化学反应以除去正极集流体 10 切割边缘的毛刺，同时产生正极集流体 10 缩进的结构且其外侧通过涂覆等方式设置有一层氧化层起绝缘作用。去除正极集流体 10 上的毛刺所采用的装置如图 4 所示，该装置包括真空腔体 1、用于放置正极极片 2 的可旋转的托盘架 3、气体分配系统 4、电离腔体 5、等离子体发生器 6、负偏压电源 7 和用于进行尾气处理的真空控制系统 8，可旋转的托盘架 3 设置于真空腔体 1 内，电离腔体 5 位于等离子体发生器 6 和真空腔体 1 之间并且与气体分配系统 4 连接，负偏压电源 7 分别与电离腔体 5 和可旋转的托盘架 3 电连接，真空控制系统 8 与真空腔体 1 连接。

[0029] 其中，等离子体发生器 6 包括射频电源 61 和电极 62，电极 62 与电离腔体 5 连接，电极 62 与射频电源 61 电连接。

[0030] 实际使用时，先将经过刀模组件切割的正极极片的边缘置于电子扫描显微镜下观察，发现正极集流体 10 切痕边缘出现毛刺，毛刺长度范围在 0~30μm 之间。

[0031] 再将正极极片卷绕放置在可以旋转的托盘架 3 上，此托盘置于密封的真空腔体 1 内，气体混合物（Cl_2、BCl_3、Ar 和 O_2）由气体分配系统 4 按照体积比例（1~5）：（1~5）：（0.5~2）：（5~15）流入电离腔体 5 内，等离子体发生器 6 的电极 62 在射频电源 61 的作用下产生足够强的磁场，将进入电离腔体 5 的气体混合物变成等离子体。

[0032] 负偏压电源 7 在电离腔体 5 和正极极片间形成电场，电离腔体 5 内的等离子体在电场作用下进入真空腔体 1，高速轰击正极极片，并与正极极片中裸露的正极集流体 10 切痕边缘的毛刺（毛刺成分为铝或铝的氧化物）发生反应，反应时间为 20~60min，从而将正极极片上的毛刺除去。这些气体与毛刺发生化学反应的方程式分别为：A12O3 + 3BC13 →

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2Al2Cl3 + 3BOCl (1);2Al + 3Cl2 → 2AlCl3 (2);2Al + 3O2 → 2Al2O3 (3)。

[0033] 反应后的产物由真空控制系统 8 抽吸排出并经过尾气处理。由于上述气体物质并不与正极膜片 20 及其中的正极活性物质发生反应，因此去毛刺过程基本上不会对正极膜片 20 造成不良影响。最后在正极集流体 10 的外侧通过涂覆等方式形成一层起绝缘作用的氧化层 30。

[0034] 在处理后，如图 3 所示，正极集流体 10 上的切割边缘及其上的毛刺都被刻蚀去掉。将经过等离子气体处理后的正极极片的边缘再次置于电子扫描显微镜下观察，发现正极集流体 10 的切痕边缘已无毛刺，正极集流体 10 的边缘光滑，部分微锯齿状突起(由气体刻蚀导致)，正极集流体 10 的缩进距离为 0~50μm。

[0035] 由于正极膜片 20 并不与处理气体反应，所以此时正极集流体 10 的宽度短于隔离膜，其边缘已缩入隔离膜内，而且由于正极集流体 10 上的毛刺也已经完全去除，并在正极集流体 10 的外侧钝化形成一层起绝缘作用的氧化层 30，因此不可能再发生正极集流体 10 刺破隔离膜后与负极极片的负极膜片接触短路的安全事故。而且，即使隔离膜由于其他原因发生了破损，缩入正极膜片 20 内的正极集流体 10 也很难接触到负极膜片，因此本实用新型的正极极片能够有效保证锂离子电池的安全。

[0036] 另外，上述气体物质与电池单体中的其他物质，如负极集流体、负极膜片、负极活性物质、正负极片间的隔离膜等，都不发生化学反应，或者是发生化学反应的活性很低。

[0037] 综上所述，本实用新型通过等离子刻蚀处理的方法，在不影响正极极片边缘形状且保持正极膜片 20 涂层完整的情况下，将正极集流体 10 的切割边缘和毛刺同时去除，处理后作为正极集流体 10 的宽度比正极膜片 20 还短，无法暴露在正极极片边缘，因此不会再刺破隔离膜而与负极膜片发生短路，甚至在隔离膜由于其他原因破损的情况下，也不会与负极膜片接触，从而有效提高锂离子电池的安全性能。

[0038] 需要说明的是，虽然本说明书仅仅以 Cl_2、BCl_3、Ar、O2 为例对本实用新型构思中的气体物质进行说明，但是本领域的技术人员根据本说明书的揭示，也可以采用不影响正极极片边缘外形和不影响正极膜片涂层完整的其他气体物质。另外，不排除采用相类似的干法处理方法对负极极片进行刻蚀处理去掉负极极片边缘集流体切割后的毛刺。

[0039] 根据上述说明书的揭示和教导，本实用新型所属领域的技术人员还可以对上述实施方式进行适当的变更和修改。因此，本实用新型并不局限于上面揭示和描述的具体实施方式，对本实用新型的一些修改和变更也应当落入本实用新型的权利要求的保护范围内。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本实用新型构成任何限制。

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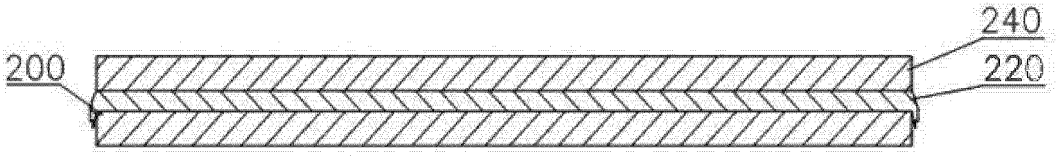


图 1

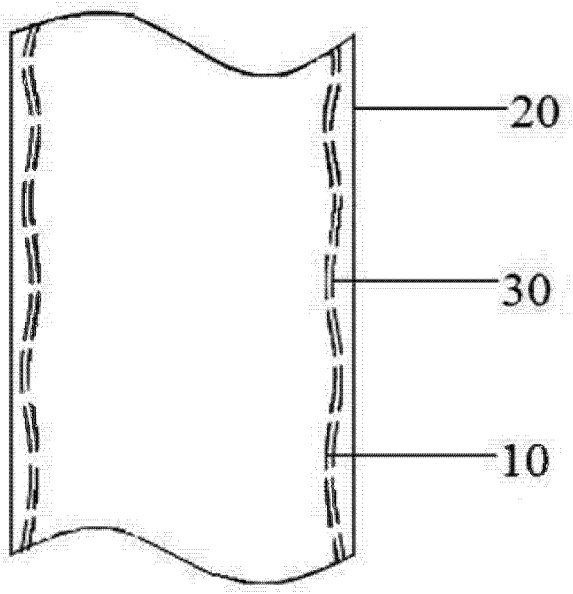


图 2

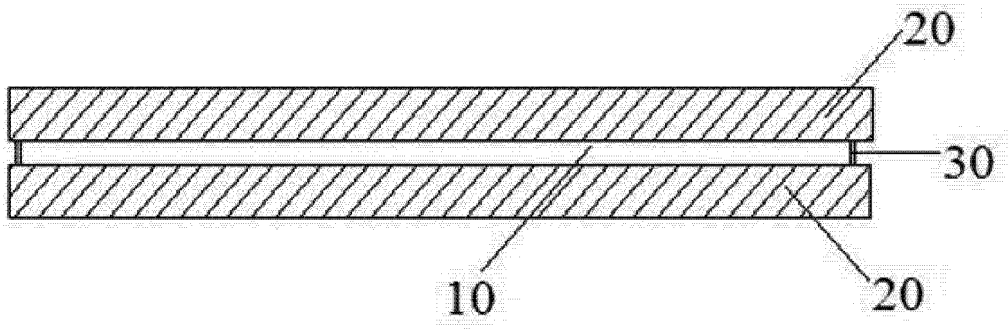


图 3

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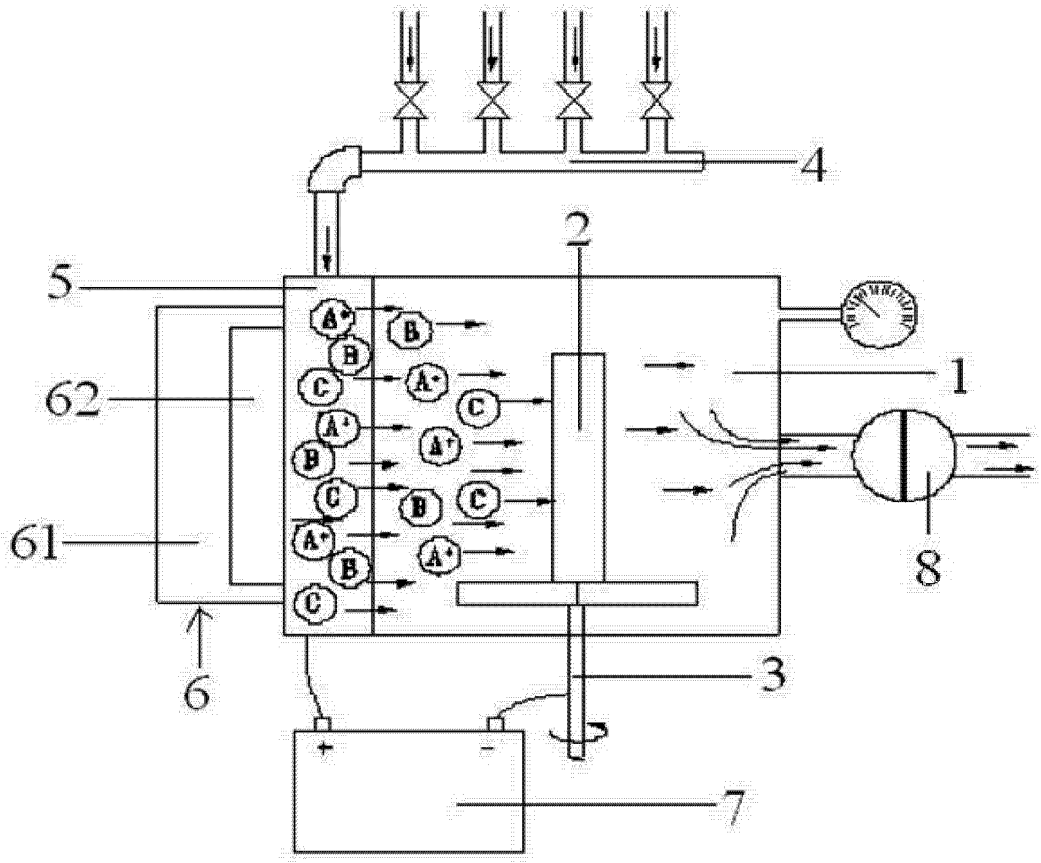


图 4

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Espacenet

Bibliographic data: CN203574050 (U) — 2014-04-30

Strap-type battery cell and lithium ion battery

Inventor(s):	CHEN DAWEI; HE PING; FANG HONGXIN ± (CHEN DAWEI, ; HE PING, ; FANG HONGXIN)
Applicant(s):	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD ± (AMPEREX TECHNOLOGY LTD, ; NINGDE AMPEREX TECHNOLOGY LTD)
Classification:	**- international:** ***H01M10/0525; H01M2/26; H01M4/13*** **- cooperative:** Y02E60/10 (EP)
Application number:	CN201320746558U 20131121
Priority number (s):	CN201320746558U 20131121

Abstract of CN203574050 (U)

The utility model provides a strap-type battery cell and a lithium ion battery. The strap-type battery cell comprises a first electrode plate, a first electrode lug foil, a first electrode lug, a second electrode plate, a second electrode lug foil, a second electrode lug, a barrier film and a protective adhesive, wherein the first electrode lug is provided with a first insulator, first welding parts and a first external connecting part; the first electrode plate is provided with first welding slots used for accommodating the first welding parts, and a first accommodating slot, and the first welding parts and a first current collector are welded together; the second electrode lug is provided with a second insulator, second welding parts and a second external connecting part; the second electrode plate is provided with second welding slots used for accommodating the second welding parts, and a second accommodating slot, and the second welding parts and a second current collector are welded together; the parts, which face to the first electrode plate electrically connected with the first electrode lug and are isolated and protected by the barrier film, of the second welding parts are accommodated in the first accommodating slots; the parts, which face to the second electrode plate electrically connected with the second electrode lug and are isolated and protected by the barrier film, of the first welding parts are accommodated in the second accommodating slot.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 203574050 U
(45)授权公告日 2014.04.30

(21)申请号 201320746558.5

(22)申请日 2013.11.21

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(51)Int.Cl.
H01M 4/13(2010.01)
H01M 2/26(2006.01)
H01M 10/0525(2010.01)

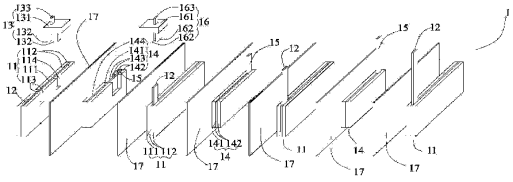
权利要求书2页 说明书5页 附图6页

(54)实用新型名称

叠片式电芯及锂离子电池

(57)摘要

本实用新型提供了一种叠片式电芯及锂离子电池。叠片式电芯包括第一极片、第一极耳箔、第一极耳、第二极片、第二极耳箔、第二极耳、隔离膜、保护胶。第一极耳具有第一绝缘体、第一焊接部、第一外接部。第一极片具有:第一焊接槽,容置第一焊接部,第一焊接部与第一集流体焊接;第一容纳槽。第二极耳具有、第二绝缘体、第二焊接部、第二外接部。第二极片具有:第二焊接槽,容置第二焊接部,第二焊接部与第二集流体焊接,第二焊接部中的面向与第一极耳电连接的第一极片的第二焊接部受隔离膜隔离保护地部分容纳在第一容纳槽内;第二容纳槽,第一焊接部中的面向与第二极耳电连接的第二极片的第一焊接部受隔离膜隔离保护地部分容纳在第二容纳槽内。



CN 203574050 U

1. 一种叠片式电芯(1),包括 :

多个第一极片(11),各第一极片(11)具有第一集流体(111)、形成于第一集流体(111)正反面上的含有第一活性物质的第一膜片(112);

多个第一极耳箔(12),电连接在一起且各第一极耳箔(12)电连接于相应一个第一极片(11)的第一集流体(111);

第一极耳(13),设置并电连接于所述多个第一极片(11)的其中一个之上 ;

多个第二极片(14),各第二极片(14)具有第二集流体(141)、形成于第二集流体(141)正反面上的含有第二活性物质的第二膜片(142);

多个第二极耳箔(15),电连接在一起且各第二极耳箔(15)电连接于相应一个第二极片(14)的第二集流体(141);

第二极耳(16),设置并电连接于所述多个第二极片(14)的其中一个之上 ;以及

隔离膜(17),设置在所述多个第一极片(11)和所述多个第二极片(14)之间 ;

其特征在于,

与第一极耳(13)电连接的第一极片(11)和与第二极耳(16)电连接的第二极片(14)设置为相邻 ;

第一极耳(13)具有 :

第一绝缘体(131);

两个第一焊接部(132),设置于第一绝缘体(131)且相互间隔开 ;以及

第一外接部(133),设置于第一绝缘体(131)且电连接于所述两个第一焊接部(132);

与第一极耳(13)电连接的第一极片(11)具有 :

两个第一焊接槽(113),通过使该第一极片(11)的第一膜片(112)露出第一集流体(111)形成,分别容置第一极耳(13)的两个第一焊接部(132),所述两个第一焊接部(132)分别与所述两个第一焊接槽(113)内的第一集流体(111)焊接 ;

第一容纳槽(114),面向与第二极耳(16)电连接的第二极片(14)设置且与两个第一焊接槽(113)间隔开 ;

第二极耳(16)具有 :

第二绝缘体(161);

两个第二焊接部(162),设置于第二绝缘体(161)且相互间隔开 ;以及

第二外接部(163),设置于第二绝缘体(161)且电连接于所述两个第二焊接部(162);

与第二极耳(16)电连接的第二极片(14)具有 :

两个第二焊接槽(143),通过使该第二极片(14)的第二膜片(142)露出第二集流体(141)形成,分别容置第二极耳(16)的两个第二焊接部(162),所述两个第二焊接部(162)分别与所述两个第二焊接槽(143)内的第二集流体(141)焊接,且所述两个第二焊接部(162)中的面向与第一极耳(13)电连接的第一极片(11)的第二焊接部(162)受隔离膜(17)隔离保护地部分容纳在第一容纳槽(114)内 ;以及

第二容纳槽(144),面向与第一极耳(13)电连接的第一极片(11)设置且与所述两个第二焊接槽(143)间隔开,所述两个第一焊接部(132)中的面向与第二极耳(16)电连接的第二极片(14)的第一焊接部(132)受隔离膜(17)隔离保护地部分容纳在第二容纳槽(144)内 ;

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所述叠片式电芯(1)还包括：

保护胶，分别涂布在两个第一焊接槽(113)、两个第二焊接槽(143)内，以覆盖相应第一极耳(13)的第一焊接部(132)的焊接部位和第二极耳(16)的第二焊接部(162)的焊接部位。

2. 根据权利要求1所述的叠片式电芯(1)，其特征在于，与第一极耳(13)电连接的第一极片(11)设置在最外层。

3. 根据权利要求1所述的叠片式电芯(1)，其特征在于，第一极片(11)为负极片，第二极片(14)为正极片。

4. 根据权利要求1所述的叠片式电芯(1)，其特征在于，

第一极耳(13)的第一绝缘体(131)覆盖所述两个第一焊接槽(113)和第二容纳槽(144)；

第二极耳(16)的第二绝缘体(161)覆盖所述两个第二焊接槽(143)和第一容纳槽(114)。

5. 根据权利要求1所述的叠片式电芯(1)，其特征在于，

第一极耳(13)的第一绝缘体(131)与第一极耳(16)的第一绝缘体(161)内外边缘齐平。

6. 根据权利要求1所述的叠片式电芯(1)，其特征在于，

容纳在对应的第一焊接槽(113)和第二容纳槽(144)内的第一焊接部(132)的厚度小于或等于对应位置处的第一膜片(112)和第二膜片(142)的厚度之和；

容纳在对应的第二焊接槽(143)和第一容纳槽(114)内的第二焊接部(162)的厚度小于或等于对应位置处的第二膜片(142)和第一膜片(112)的厚度之和。

7. 根据权利要求3所述的叠片式电芯(1)，其特征在于，

第二容纳槽(144)边缘围成的区域覆盖与第二容纳槽(144)相对的第一焊接槽(113)的边缘围成的区域；

第二焊接槽(143)边缘围成的区域覆盖与第二焊接槽(143)相对的第一容纳槽(114)的边缘围成的区域。

8. 根据权利要求1所述的叠片式电芯(1)，其特征在于，

各第一焊接槽(113)为底侧封闭的凹槽或上下贯通的通槽；

各第二焊接槽(143)为底侧封闭的凹槽或上下贯通的通槽；

第一容纳槽(114)为底侧封闭的凹槽或上下贯通的通槽；

第二容纳槽(144)为底侧封闭的凹槽或上下贯通的通槽。

9. 一种锂离子电池，其特征在于，包括：

根据权利要求1-8中任一项所述的叠片式电芯(1)；

电解液；以及

包装袋(2)，封装叠片式电芯(1)并容纳电解液以使电解液浸润叠片式电芯(1)的多个第一极片(11)以及多个第二极片(14)。

10. 根据权利要求9所述的锂离子电池，其特征在于；

与第一极耳(13)电连接的第一极片(11)设置在最外层且紧靠包装袋(2)的未冲坑面(21)。

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叠片式电芯及锂离子电池

技术领域

[0001] 本实用新型涉及储能器件领域，尤其涉及一种叠片式电芯及锂离子电池。

背景技术

[0002] 随着现代社会的发展，移动设备呈现多元化和多样化。如手机的屏幕越来越大，功能越来越多；原有的手提笔记本电脑发展到现在的超极本；各种各样的PAD和电子书等。与之相应的二次锂离子电池的需求也不断增加，要求锂离子电池的续航时间更长，对能量密度的要求更苛刻。

[0003] 因此，如何充分利用各种手段来提高电池的能量密度，提升锂离子二次电池性能的问题显得十分迫切。其中就催生了一种新的叠片电芯结构设计，通过将外接极耳嵌入到电芯其中的一层极片中，其他极片通过极耳箔连接通电的方式，提升电池内部空间利用率，提升叠片电池的能量密度空间，同时提高了电池的安全性和稳定性。

[0004] 目前叠片锂电池常规的加工工艺，正负极片和隔膜交错叠合，每层正负极片通过极耳箔焊接在一起，然后再与外接设备的极耳焊接，这样就造成了极耳胶到电芯主体之间的这部分空间被浪费，消耗电池内部空间，致使电池的容量减少。

实用新型内容

[0005] 鉴于背景技术中存在的问题，本实用新型的目的在于提供一种叠片式电芯及锂离子电池，其能减少焊接极耳造成的电芯内部空间的浪费。

[0006] 本实用新型的另一目的在于提供一种叠片式电芯及锂离子电池，其能提高极耳焊接的可靠性。

[0007] 本实用新型的再一目的在于提供一种叠片式电芯及锂离子电池，其能提高电芯的能量密度。

[0008] 本实用新型的再一目的在于提供一种叠片式电芯及锂离子电池，其能提高极耳设计的灵活性。

[0009] 本实用新型的又一目的在于提供一种叠片式电芯及锂离子电池，其能保证电芯与包装袋完好匹配。

[0010] 为了实现上述目的，在第一方面，本实用新型提供了一种叠片式电芯，其包括：多个第一极片，各第一极片具有第一集流体、形成于第一集流体正反面上的含有第一活性物质的第一膜片；多个第一极耳箔，电连接在一起且各第一极耳箔电连接于相应一个第一极片的第一集流体；第一极耳，设置并电连接于所述多个第一极片的其中一个之上；多个第二极片，各第二极片具有第二集流体、形成于第二集流体正反面上的含有第二活性物质的第二膜片；多个第二极耳箔，电连接在一起且各第二极耳箔电连接于相应一个第二极片的第二集流体；第二极耳，设置并电连接于所述多个第二极片的其中一个之上；隔离膜，设置在所述多个第一极片和所述多个第二极片之间；以及保护胶。其中，与第一极耳电连接的第一极片和与第二极耳电连接的第二极片设置为相邻。第一极耳具有：第一绝缘体；两个第

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一焊接部，设置于第一绝缘体且相互间隔开；以及第一外接部，设置于第一绝缘体且电连接于所述两个第一焊接部。与第一极耳电连接的第一极片具有：两个第一焊接槽，通过使该第一极片的第一膜片露出第一集流体形成，分别容置第一极耳的两个第一焊接部，所述两个第一焊接部分别与所述两个第一焊接槽内的第一集流体焊接；第一容纳槽，面向与第二极耳电连接的第二极片设置且与两个第一焊接槽间隔开。第二极耳具有：第二绝缘体；两个第二焊接部，设置于第二绝缘体且相互间隔开；以及第二外接部，设置于第二绝缘体且电连接于所述两个第二焊接部。与第二极耳电连接的第二极片具有：两个第二焊接槽，通过使该第二极片的第二膜片露出第二集流体形成，分别容置第二极耳的两个第二焊接部，所述两个第二焊接部分别与所述两个第二焊接槽内的第二集流体焊接，且所述两个第二焊接部中的面向与第一极耳电连接的第一极片的第二焊接部受隔离膜隔离保护地部分容纳在第一容纳槽内；以及第二容纳槽，面向与第一极耳电连接的第一极片设置且与所述两个第二焊接槽间隔开，所述两个第一焊接部中的面向与第二极耳电连接的第二极片的第一焊接部受隔离膜隔离保护地部分容纳在第二容纳槽内。所述保护胶分别涂布在两个第一焊接槽、两个第二焊接槽内，以覆盖相应第一极耳的第一焊接部的焊接部位和第二极耳的第二焊接部的焊接部位。

[0011] 为了实现上述目的，在第二方面，本实用新型提供了一种锂离子电池，其包括：根据本实用新型第一方面所述的叠片式电芯；电解液；以及包装袋，封装叠片式电芯并容纳电解液以使电解液浸润叠片式电芯的多个第一极片以及多个第二极片。

[0012] 本实用新型的有益效果如下：

[0013] 本实用新型的叠片式电芯在第一极片上设置用于焊接第一极耳的第一焊接槽以及容纳部分第二极耳的第一容纳槽，且对应地在第二极片上设置用于焊接第二极耳的第二焊接槽以及容纳部分第一极耳的第二容纳槽，并且所述保护胶分别涂布在两个第一焊接槽、两个第二焊接槽内，由此，减少焊接极耳造成的电芯内部空间的浪费，极耳焊接的可靠性更高，且提高了电芯的能量密度；同时提高了极耳设计的灵活性，可以设置在电芯四周的任何位置。

[0014] 与第一极耳电连接的第一极片在设置于最外层时可紧靠包装袋的未冲坑面，由此可使极耳与包装袋封装边平齐，紧靠未冲坑面，从而电芯与包装袋完好匹配。

附图说明

[0015] 图 1 是根据本实用新型的叠片式电芯的相关部件的分解立体图；

[0016] 图 2 是图 1 的部分相关部件组合在一起的立体图；

[0017] 图 3 是根据本实用新型的叠片式电芯的立体图，但为了清楚起见，省略了隔离膜；

[0018] 图 4 是根据本实用新型的叠片式电芯及锂离子电池的立体图，其中，以虚线示出包装袋，但为了清楚起见，省略了隔离膜；

[0019] 图 5 是根据本实用新型的叠片式电芯的第一极片及第一极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第一焊接槽；

[0020] 图 6 是根据本实用新型的叠片式电芯的第一极片及第一极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第一焊接槽；

[0021] 图 7 是根据本实用新型的叠片式电芯的第一极片及第一极耳箔的一实施例的立

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体图，其中为清楚起见，以虚线示出一个第一焊接槽；

[0022] 图 8 是根据本实用新型的叠片式电芯的第一极片及第一极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第一焊接槽；

[0023] 图 9 是根据本实用新型的叠片式电芯的第一极片及第一极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第一焊接槽；

[0024] 图 10 是根据本实用新型的叠片式电芯的第一极片及第一极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第二焊接槽及第二容纳槽；

[0025] 图 11 是根据本实用新型的叠片式电芯的第二极片及第二极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第二焊接槽及第二容纳槽；

[0026] 图 12 是根据本实用新型的叠片式电芯的第二极片及第二极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第二焊接槽及第二容纳槽；

[0027] 图 13 是根据本实用新型的叠片式电芯的第二极片及第二极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第二焊接槽及第二容纳槽；

[0028] 图 14 是根据本实用新型的叠片式电芯的第二极片及第二极耳箔的一实施例的立体图，其中为清楚起见，以虚线示出一个第二焊接槽及第二容纳槽；

[0029] 其中，附图标记说明如下：

[0030] 1 叠片式电芯　　141 第二集流体

[0031] 11 第一极片　　142 第二膜片

[0032] 111 第一集流体　　143 第二焊接槽

[0033] 112 第一膜片　　144 第二容纳槽

[0034] 113 第一焊接槽　　15 第二极耳箔

[0035] 114 第一容纳槽　　16 第二极耳

[0036] 12 第一极耳箔　　161 第二绝缘体

[0037] 13 第一极耳　　162 第二焊接部

[0038] 131 第一绝缘体　　163 第二外接部

[0039] 132 第一焊接部　　17 隔离膜

[0040] 133 第一外接部　　2 包装袋

[0041] 14 第二极片　　21 未冲坑面

具体实施方式

[0042] 下面参照附图来详细说明根据本实用新型的叠片式电芯及锂离子电池。

[0043] 首先说明根据本实用新型第一方面的叠片式电芯。

[0044] 参照图 1 至图 14，根据本实用新型的叠片式电芯 1 包括：多个第一极片 11，各第一极片 11 具有第一集流体 111、形成于第一集流体 111 正反面上的含有第一活性物质的第一膜片 112；多个第一极耳箔 12，电连接在一起且各第一极耳箔 12 电连接于相应一个第一极片 11 的第一集流体 111；第一极耳 13，设置并电连接于所述多个第一极片 11 的其中一个之上；多个第二极片 14，各第二极片 14 具有第二集流体 141、形成于第二集流体 141 正反面上的含有第二活性物质的第二膜片 142；多个第二极耳箔 15，电连接在一起且各第二极耳箔 15 电连接于相应一个第二极片 14 的第二集流体 141；第二极耳 16，设置并电连接于所述多

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个第二极片 14 的其中一个之上；隔离膜 17，设置在所述多个第一极片 11 和所述多个第二极片 14 之间；以及保护胶(未示出)。其中，与第一极耳 13 电连接的第一极片 11 和与第二极耳 16 电连接的第二极片 14 设置为相邻。第一极耳 13 具有：第一绝缘体 131；两个第一焊接部 132，设置于第一绝缘体 131 且相互间隔开；以及第一外接部 133，设置于第一绝缘体 131 且电连接于所述两个第一焊接部 132。与第一极耳 13 电连接的第一极片 11 具有：两个第一焊接槽 113，通过使该第一极片 11 的第一膜片 112 露出第一集流体 111 形成，分别容置第一极耳 13 的两个第一焊接部 132，所述两个第一焊接部 132 分别与所述两个第一焊接槽 113 内的第一集流体 111 焊接；第一容纳槽 114，面向与第二极耳 16 电连接的第二极片 14 设置且与两个第一焊接槽 113 间隔开。第二极耳 16 具有：第二绝缘体 161；两个第二焊接部 162，设置于第二绝缘体 161 且相互间隔开；以及第二外接部 163，设置于第二绝缘体 161 且电连接于所述两个第二焊接部 162。与第二极耳 16 电连接的第二极片 14 具有：两个第二焊接槽 143，通过使该第二极片 14 的第二膜片 142 露出第二集流体 141 形成，分别容置第二极耳 16 的两个第二焊接部 162，所述两个第二焊接部 162 分别与所述两个第二焊接槽 143 内的第二集流体 141 焊接，且所述两个第二焊接部 162 中的面向与第一极耳 13 电连接的第一极片 11 的第二焊接部 162 受隔离膜 17 隔离保护地部分容纳在第一容纳槽 114 内；以及第二容纳槽 144，面向与第一极耳 13 电连接的第一极片 11 设置且与所述两个第二焊接槽 143 间隔开，所述两个第一焊接部 132 中的面向与第二极耳 16 电连接的第二极片 14 的第一焊接部 132 受隔离膜 17 隔离保护地部分容纳在第二容纳槽 144 内。所述保护胶分别涂布在两个第一焊接槽 113、两个第二焊接槽 143 内，以覆盖相应第一极耳 13 的第一焊接部 132 的焊接部位和第二极耳 16 的第二焊接部 162 的焊接部位。

[0045] 本实用新型的叠片式电芯 1 在第一极片 11 上设置用于焊接第一极耳 13 的第一焊接槽 113 以及容纳部分第二极耳 16 的第一容纳槽 114，且对应地在第二极片 14 上设置用于焊接第二极耳 16 的第二焊接槽 143 以及容纳部分第一极耳 13 的第二容纳槽 144，并且所述保护胶分别涂布在两个第一焊接槽 113、两个第二焊接槽 143 内，由此，减少焊接极耳造成的电芯内部空间的浪费，极耳焊接的可靠性更高，且提高了电芯的能量密度；同时提高了极耳设计的灵活性，可以设置在电芯四周的任何位置。

[0046] 在根据本实用新型的叠片式电芯 1 的一实施例中，与第一极耳 13 电连接的第一极片 11 设置在最外层。

[0047] 在根据本实用新型的叠片式电芯 1 的一实施例中，第一极片 11 可为负极片，第二极片 14 可为正极片。在另一实施例中，第一极片 11 可以为正极极片，而第二极片 12 可以为负极极片。相应地，可以选用合适的与极片的极性对应的第一活性物质和第二活性物质。

[0048] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 2 并结合图 1、图 3 和图 4，第一极耳 13 的第一绝缘体 131 覆盖所述两个第一焊接槽 113 和第二容纳槽 144；第二极耳 16 的第二绝缘体 161 覆盖所述两个第二焊接槽 143 和第一容纳槽 114。

[0049] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 3 和图 4，第一极耳 13 的第一绝缘体 131 与第二极耳 16 的第二绝缘体 161 内外边缘齐平。

[0050] 在根据本实用新型的叠片式电芯 1 的一实施例中，容纳在对应的第一焊接槽 113 和第二容纳槽 144 内的第一焊接部 132 的厚度小于或等于对应位置处的第一膜片 112 和第二膜片 142 的厚度之和；容纳在对应的第二焊接槽 143 和第一容纳槽 114 内的第二焊接部

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162 的厚度小于或等于对应位置处的第二膜片 142 和第一膜片 112 的厚度之和。

[0051] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 1 和图 2，第二容纳槽 144 边缘围成的区域覆盖与第二容纳槽 144 相对的第一焊接槽 113 的边缘围成的区域；第二焊接槽 143 边缘围成的区域覆盖与第二焊接槽 143 相对的第一容纳槽 114 的边缘围成的区域。

[0052] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 5 至图 14，各第一焊接槽 113 可为底侧封闭的凹槽（参照图 5 中左右侧、图 6 中左侧、图 7 中左右侧、图 8 中左侧和图 9 中右侧）或上下贯通的通槽（参照图 6 中右侧、图 8 中右侧和图 9 中左侧）；各第二焊接槽 143 可为底侧封闭的凹槽（参照图 10 中左右侧、图 11 中左右侧、图 12 中右侧、图 13 中右侧和图 14 中左侧）或上下贯通的通槽（参照图 12 中左侧、图 13 中左侧和图 14 中右侧）；第一容纳槽 114 为底侧封闭的凹槽（参照图 5、图 6 和图 9）或上下贯通的通槽（参照图 7 和图 8）；第二容纳槽 144 为底侧封闭的凹槽（参照图 10、图 12、和图 14）或上下贯通的通槽（参照图 11 和图 13）。

[0053] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 3 和图 4 并结合图 1 和图 2，所述多个第一极耳箔 12 彼此对齐；所述多个第二极耳箔 15 彼此对齐。

[0054] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 3 和图 4，所述多个第一极耳箔 12 通过弯折焊接而电连接；所述多个第二极耳箔 15 通过弯折焊接而电连接。在另一实施例中，参照图 3 和图 4，第一极耳箔 12 弯折 45-90 度。第二极耳箔 15 弯折 45-90 度。需说明的是在图 3 和图 4 中，最外层的第一极耳箔 12 及与其相邻的第二极耳箔 15 没有弯折，因为其尺寸较短（参照图 1 和图 2），无需弯折，第一极耳箔 12 和第二极耳箔 15 的弯折可根据不同的生产需要进行改变，只要保证不超出叠片式电芯 1 的尺寸情况下，多个第一极耳箔 12 和多个第二极耳箔 15 分别通过弯折焊接而电连接在一起即可。

[0055] 在根据本实用新型的叠片式电芯 1 的一实施例中，参照图 1，隔离膜 17 可为单片形式。在另一实施例中，隔离膜 17 为折叠在第一极片 11 和第二极片 14 之间的整片。

[0056] 在根据本实用新型的叠片式电芯 1 的一实施例中，保护胶可为绿胶。

[0057] 根据本实用新型所述的电芯可以为电池的电芯或电容器的电芯。电池可以为但不限于锂离子电池，电容器可以为但不限于锂离子超级电容器。

[0058] 下面说明根据本实用新型第二方面的锂离子电池。

[0059] 根据本实用新型第二方面的锂离子电池包括：根据本实用新型第一方面所述的叠片式电芯 1；电解液（未示出）；以及包装袋 2，封装叠片式电芯 1 并容纳电解液以使电解液浸润叠片式电芯 1 的多个第一极片 11 以及多个第二极片 14。

[0060] 在根据本实用新型的锂离子电池的一实施例中，参照图 4，与第一极耳 13 电连接的第一极片 11 设置在最外层且紧靠包装袋 2 的未冲坑面 21。由此可使极耳与包装袋封装边平齐，紧靠未冲坑面 21，从而电芯与包装袋完好匹配。

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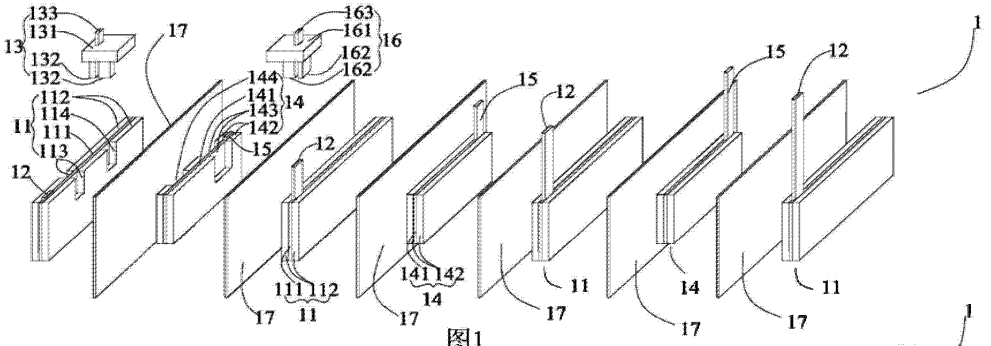


图1

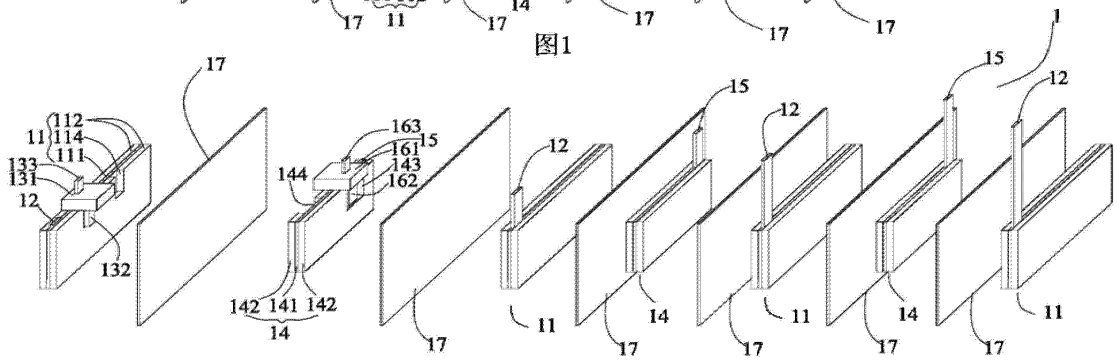


图2

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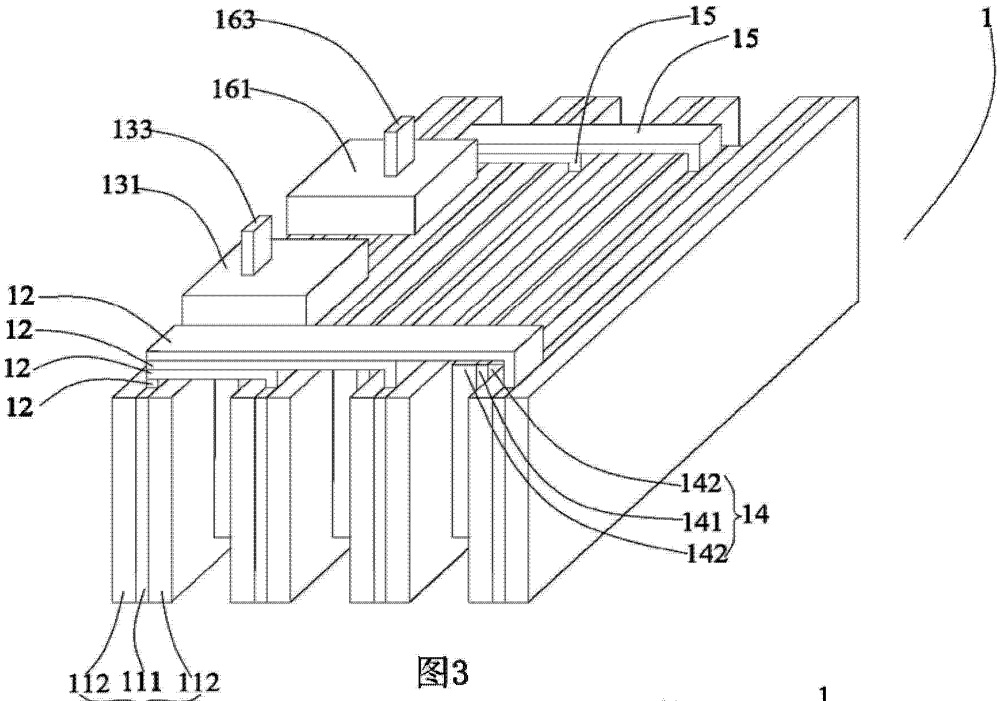


图3

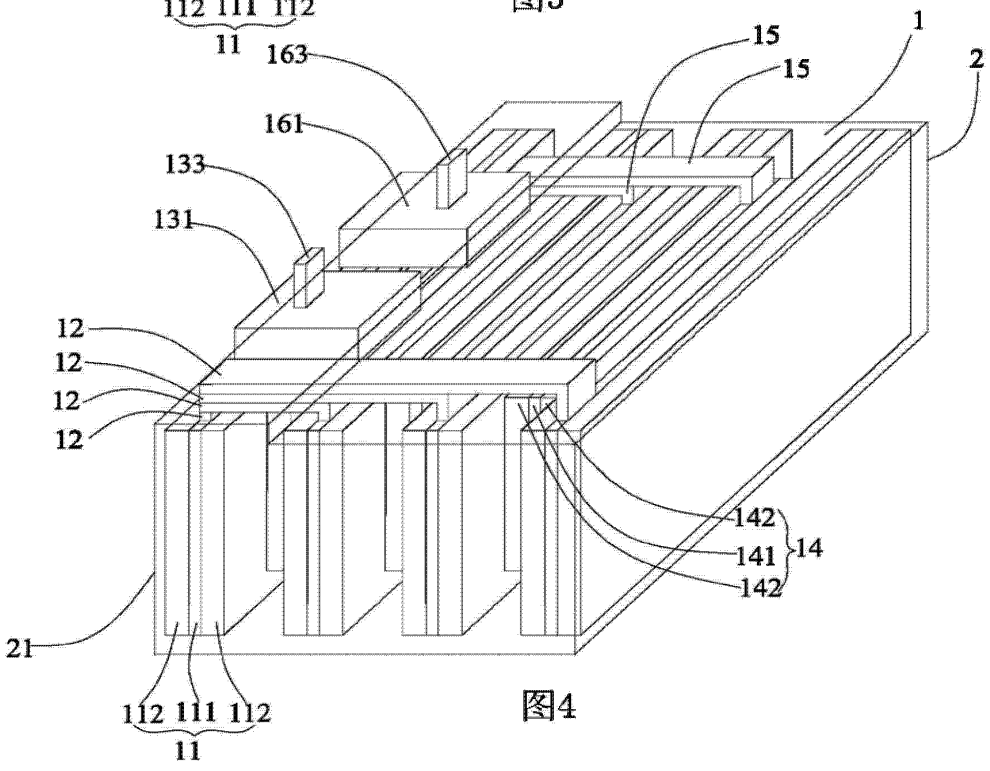


图4

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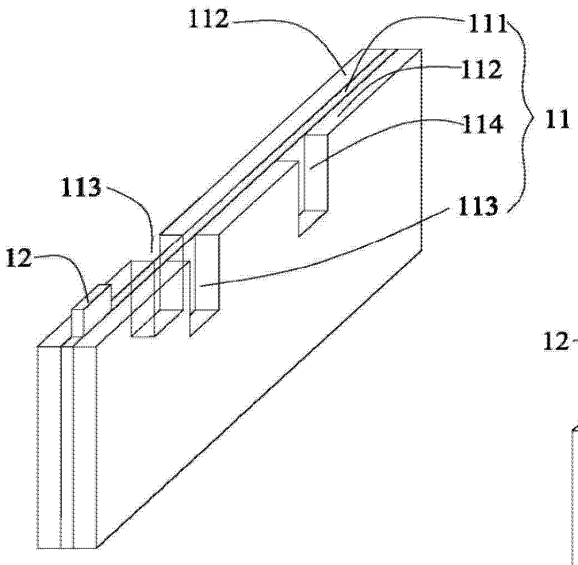


图5

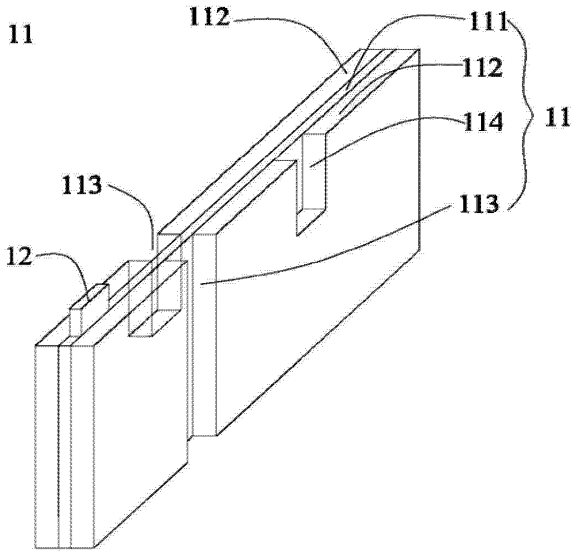


图6

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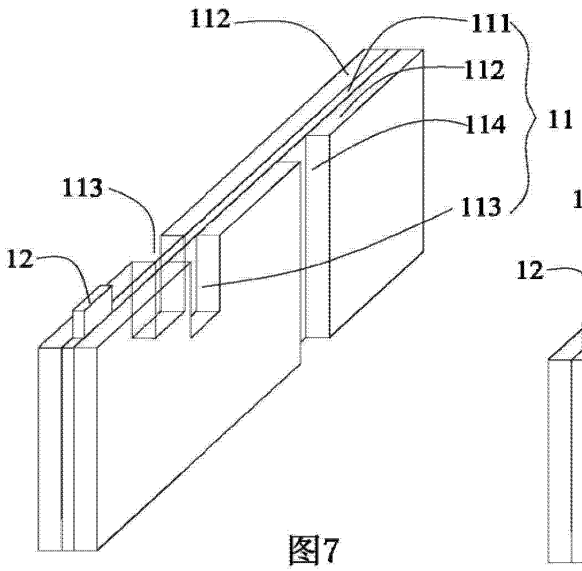


图7

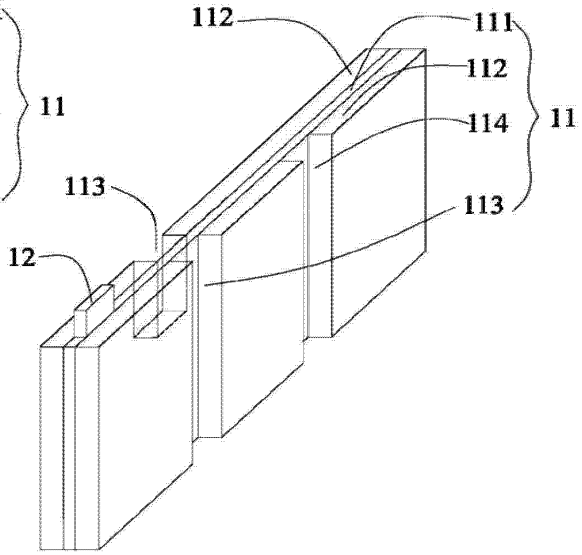


图8

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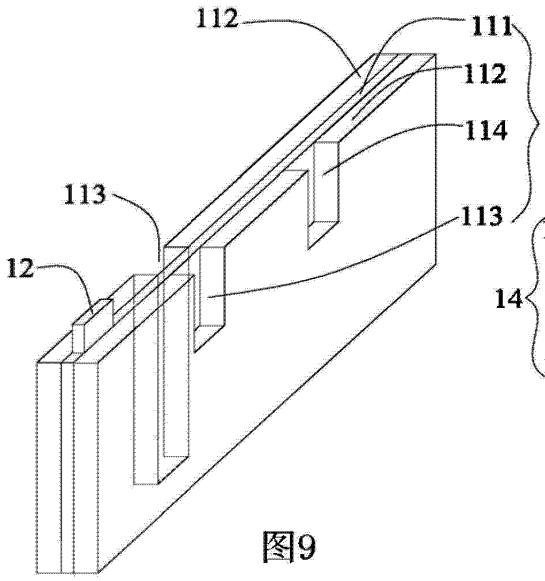


图9

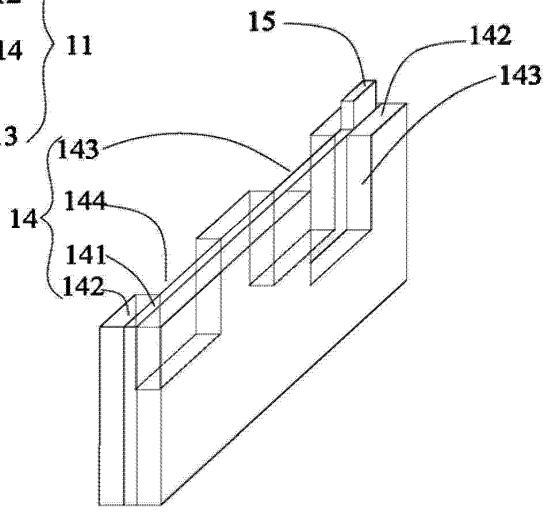


图10

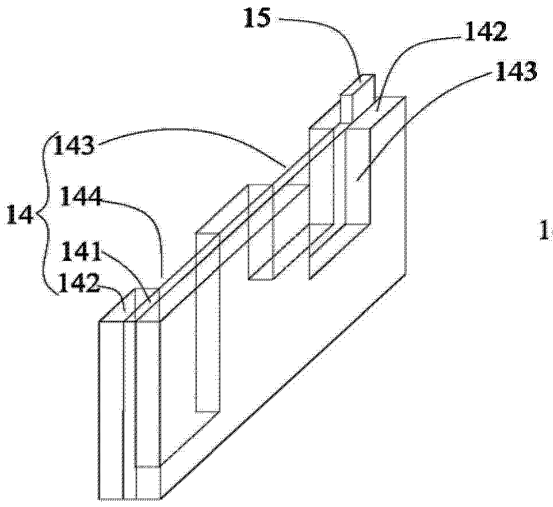


图11

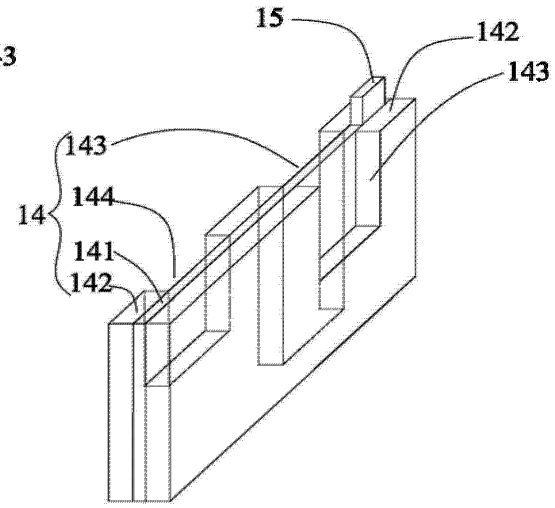


图12

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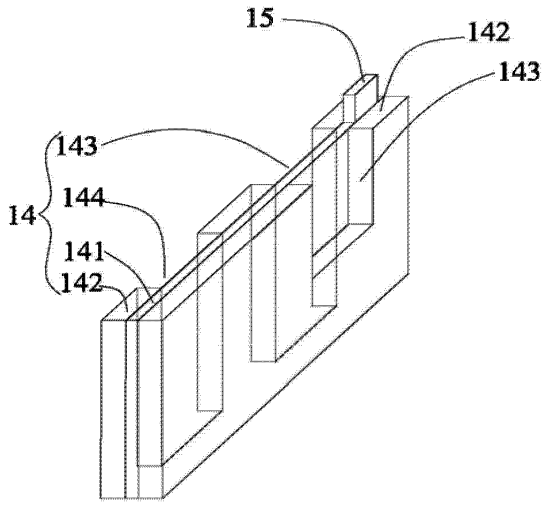


图 13

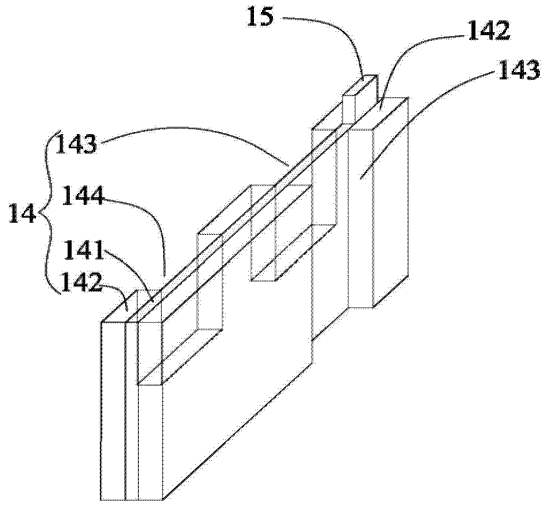


图 14

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Espacenet

Bibliographic data: CN204538109 (U) — 2015-08-05

Improvement structure of power lithium ion battery welding utmost point ear

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Applicant(s): SHIDA BATTERY TECHNOLOGY CO LTD ± (SHIDA BATTERY TECHNOLOGY CO., LTD)

Classification: **- international:** ***H01M10/058; H01M2/26***
- cooperative: Y02E60/10 (EP)

Application number: CN201520107820U 20150212

Priority number (s): CN201520107820U 20150212

Abstract of CN204538109 (U)

The utility model discloses an improvement structure of power lithium ion battery welding utmost point ear, including lithium ion cell, head utmost point ear and afterbody utmost point ear, its characterized in that: head utmost point ear and afterbody utmost point ear overlap joint, head utmost point ear and the cladding of afterbody utmost point ear lap-joint have compound PP to glue, and the lap-joint passes through high temperature glue and fixes the top at lithium ion cell, head utmost point ear has riveting, ultrasonic bonding or resistance weld with afterbody utmost point ear overlap joint fixed connection's connected mode. The utility model discloses following beneficial effect has: simple structure, production efficiency is high, and compound PP glues in lap-joint's cladding, prevents that yin maoci from piercing through high temperature and gluing, adopts the overlap joint mode, buckles when becoming upright at afterbody utmost point ear 90, and the pole piece dislocation appears in the process that prevents to buckle pulling utmost point ear, and product security nature is high.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 204538109 U
(45)授权公告日 2015.08.05

(21)申请号 201520107820.0

(22)申请日 2015.02.12

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代理人 李宪宾

(51)Int.Cl.
H01M 2/26(2006.01)
H01M 10/058(2010.01)

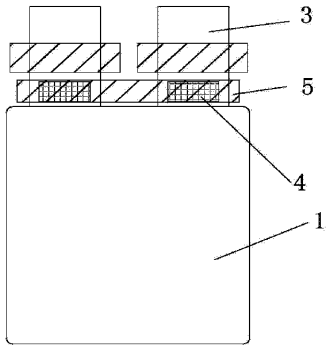
权利要求书1页 说明书2页 附图3页

(54)实用新型名称

一种动力锂离子电池焊接极耳的改良结构

(57)摘要

本实用新型公开了一种动力锂离子电池焊接极耳的改良结构，包括锂离子电芯、头部极耳和尾部极耳，其特征在于：所述头部极耳与尾部极耳搭接，头部极耳与尾部极耳搭接处包覆有复合PP胶，搭接处通过高温胶固定在锂离子电芯的顶部；所述头部极耳与尾部极耳搭接固定连接的连接方式有铆接、超声波焊接或者电阻焊接。本实用新型具有以下有益效果：结构简单，生产效率高，在搭接处包覆复合PP胶，防止因毛刺刺穿高温胶，采用搭接方式，在尾部极耳90°弯折成直立时，防止弯折过程拉动极耳出现极片错位，产品安全性高。



CN 204538109 U

1. 一种动力锂离子电池焊接极耳的改良结构，包括锂离子电芯、头部极耳和尾部极耳，其特征在于：所述头部极耳与尾部极耳搭接，头部极耳与尾部极耳搭接处包覆有复合 PP 胶，搭接处通过高温胶固定在锂离子电芯的顶部。

2. 根据权利要求 1 所述的一种动力锂离子电池焊接极耳的改良结构，其特征在于：所述头部极耳与尾部极耳搭接固定连接的连接方式有铆接、超声波焊接或者电阻焊接。

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一种动力锂离子电池焊接极耳的改良结构

技术领域

[0001] 本实用新型涉及一种锂离子电池，具体涉及一种动力锂离子电池焊接极耳的改良结构。

背景技术

[0002] 锂离子电池属于二次可充电池，具有重量轻、储能大、功率大、无污染、寿命长、自放电系数小、温度适用范围宽等突出优点。被广泛应用于各种移动数码产品、电动工具、电动玩具、笔记本电脑、电动汽车等，并在二次电池市场占有很大的市场份额。

[0003] 锂离子电池根据内部结构，可以分为层叠式、卷绕式及多极耳式卷绕，根据外包装材料分为钢壳、铝壳、铝塑膜。目前，大型动力锂离子电池主要采用层叠式结构，但层叠式电池需要超声波背焊焊接极耳，即把头部极耳 2’ 与尾部极耳 3’ 叠放一起，使头部极耳 2’ 的伸出端部与尾部极耳 3’ 的一端部对齐后，进行焊接，裁切极耳，把焊接点 4’ 通过包高温胶 6’ 固定在锂离子电芯 1’ 顶部（如图 1 至图 4）。当背焊焊接极耳时，极耳紧挨着隔膜，会出现烫隔膜现象；在裁切极耳时，会出现毛刺，包胶后仍会刺穿高温胶纸，导致刺穿隔膜，或电解液浸泡后高温胶纸脱落；在弯折极耳时是为了将尾部极耳 90° 弯折成直立，弯折过程会拉动极片出现极片错位，使得电池存在一定的安全隐患。此种工艺条件下，会存在安全隐患及工艺复杂，在当前安全性能要求高的市场环境下，缺乏市场竞争力。

实用新型内容

[0004] 本实用新型所要解决的技术问题是提供一种结构简单、操作性强、安全性能好的动力锂离子电池焊接极耳的改良结构。

[0005] 实现本实用新型目的的技术解决方案为：一种动力锂离子电池焊接极耳的改良结构，包括锂离子电芯、头部极耳和尾部极耳，其特征在于：所述头部极耳与尾部极耳搭接，头部极耳与尾部极耳搭接处包覆有复合 PP 胶，搭接处通过高温胶固定在锂离子电芯的顶部。

[0006] 所述头部极耳与尾部极耳搭接固定连接的连接方式有铆接、超声波焊接或者电阻焊接。

[0007] 本实用新型一种动力锂离子电池焊接极耳的改良结构具有以下有益效果：结构简单，生产效率高，在搭接处包覆复合 PP 胶，防止因毛刺刺穿高温胶，采用搭接方式，在尾部极耳 90° 弯折成直立时，防止弯折过程拉动极耳出现极片错位，产品安全性高。

附图说明

[0008] 下面结合附图与实施例对本实用新型作详细说明；

[0009] 图 1 是现有技术的动力锂离子电池极耳的焊接结构示意图；

[0010] 图 2 是把图 1 中的极耳的裁切后的左侧结构示意图；

[0011] 图 3 是把图 2 中的尾部极耳 90° 弯折成直立；

[0012] 图 4 是把图 3 中极耳焊接处固定在锂离子电芯顶部的结构示意图；

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[0013] 图 5 是本实用新型动力锂离子电池焊接极耳的改良结构的焊接结构示意图；

[0014] 图 6 是图 5 的左视示意图；

[0015] 图 7 是本实用新型头部极耳与尾部极耳搭接固定连接所形成的搭接处上包覆有复合 PP 胶的结构示意图；

[0016] 图 8 是本实用新型搭接处固定在锂离子电芯顶部的结构示意图；

[0017] 图 9 是本实用新型立体图。

具体实施方式

[0018] 如图 5 至图 9 所示，一种动力锂离子电池焊接极耳的改良结构，包括锂离子电芯 1、头部极耳 2 和尾部极耳 3，所述头部极耳 2 与尾部极耳 3 搭接，所述搭接即头部极耳 2 与尾部极耳 3 错开 180° 重合固定连接在一起；所述搭接固定连接方式可以是超声波焊接、电阻焊接或者铆接；在搭接处 4 包覆有复合 PP 胶 5，搭接处 4 通过高温胶 6 固定在锂离子电芯 1 的顶部。

[0019] 通过上述搭接方式及包搭接处结构，极耳离隔膜较远，可预防点焊时隔膜烫伤，搭接后不用再次裁切极耳，可减少裁切极耳的工步及由于裁切极耳产生的毛刺，复合 PP 胶可以起到绝缘的功能，且电解液浸泡后不会脱落，极耳采用回折的方式不会导致拉动极片，可预防极片拉动错位，能有效提高电芯的安全性能，防止因焊接、裁切及包搭接处不良引起的性能及安全隐患，确保本实用新型的锂离子电池结构的安全可靠。

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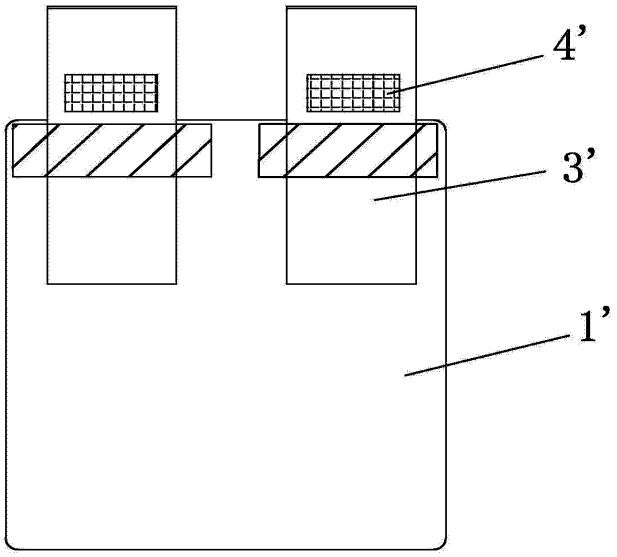


图 1

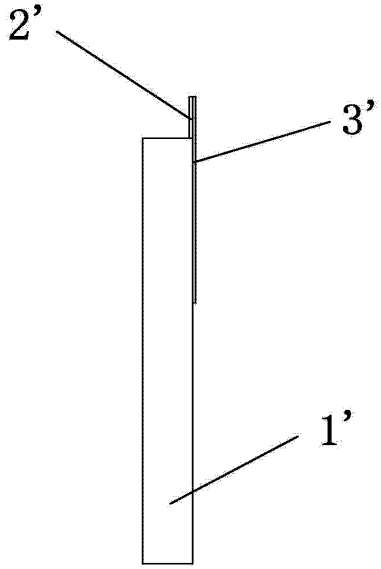


图 2

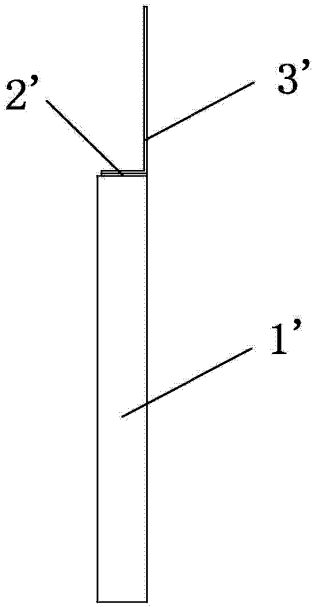


图 3

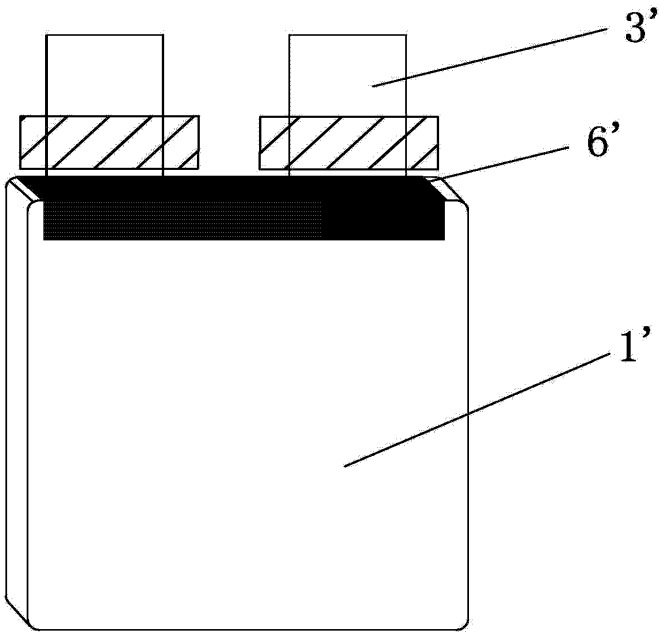


图 4

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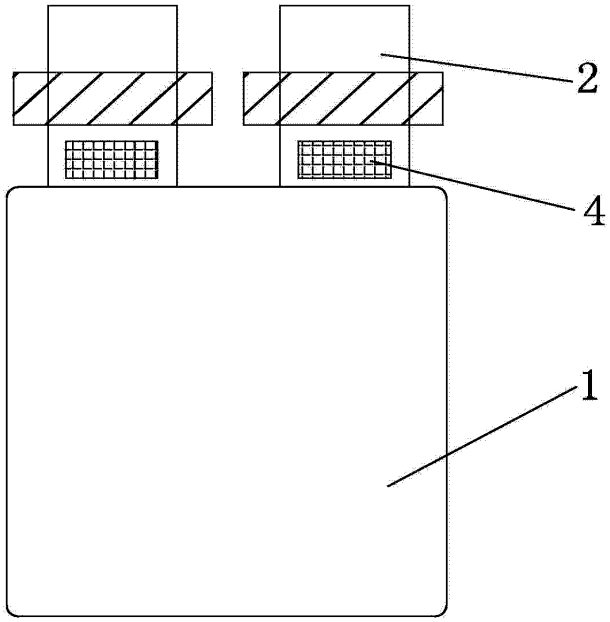


图 5

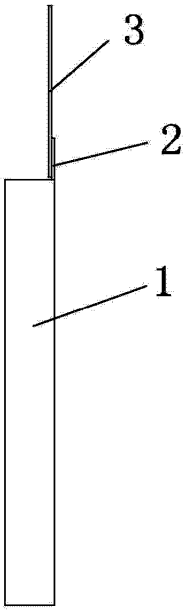


图 6

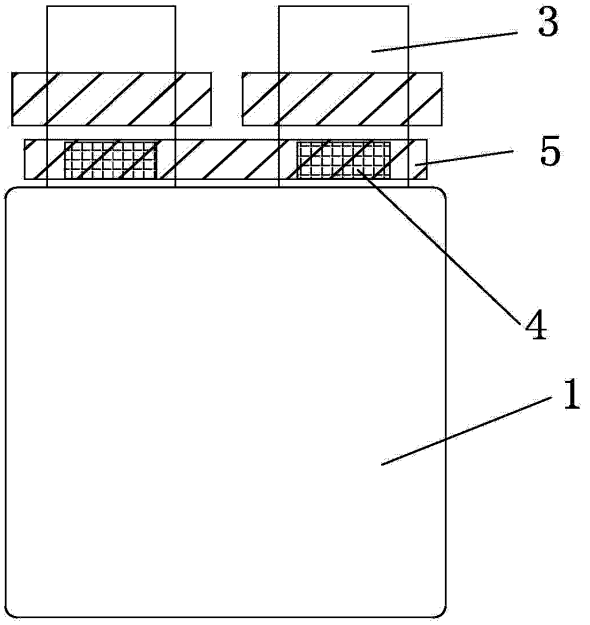


图 7

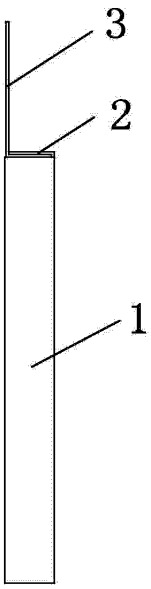


图 8

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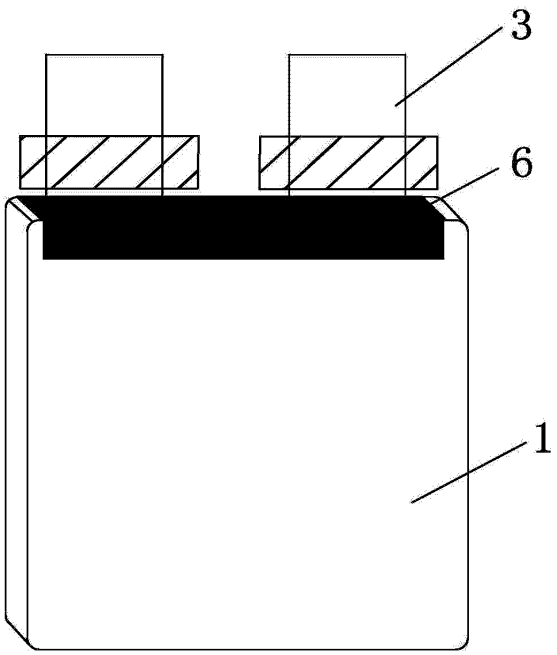


图 9

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Espacenet

Bibliographic data: CN204946995 (U) — 2016-01-06

Secondary cell electricity core and winding formation system thereof

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Applicant(s):	NINGDE AMPEREX TECHNOLOGY LTD ± (NINGDE AMPEREX TECHNOLOGY LTD)
Classification:	**- international:** ***H01M10/0587; H01M2/20; H01M2/30; H01M4/64*** **- cooperative:** Y02E60/10 (EP)
Application number:	CN201520667767U 20150831
Priority number (s):	CN201520667767U 20150831

Abstract of CN204946995 (U)

The utility model provides a secondary cell electricity core and winding formation system thereof. Secondary cell electricity core includes positive pole pole piece, positive pole utmost point ear, negative pole pole piece, negative pole utmost point ear and barrier film. Secondary cell electricity core winding formation system includes work platform, the winding mechanism, the positive pole pole piece unreels the roller, positive pole pole piece wiper mechanism, positive pole pole piece cross cutting mechanism, positive pole utmost point ear feed mechanism, positive pole utmost point ear coupling mechanism, positive pole pole piece transmission device, the negative pole pole piece unreels the roller, negative pole pole piece wiper mechanism, negative pole pole piece cross cutting mechanism, negative pole utmost point ear feed mechanism, negative pole utmost point ear coupling mechanism, negative pole pole piece transmission device, first barrier film unreels the roller, the second barrier film unreels the roller, first barrier film transmission device and second barrier film transmission device. The utility model discloses a secondary cell electricity core that secondary cell electricity core winding formation system prepared can effectually prevent that secondary cell electricity core from taking place interior short circuit, improves the security performance of secondary cell electricity core when guaranteeing high energy density.

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(12)实用新型专利

(10)授权公告号 CN 204946995 U
(45)授权公告日 2016.01.06

(21)申请号 201520667767.X

(22)申请日 2015.08.31

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代理人 张向琨

(51)Int.Cl.
H01M 2/30(2006.01)
H01M 2/20(2006.01)
H01M 4/64(2006.01)
H01M 10/0587(2010.01)

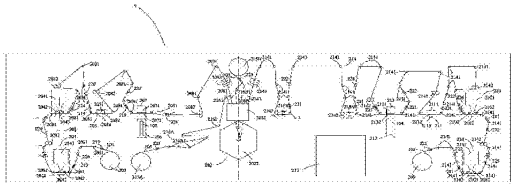
权利要求书4页 说明书13页 附图6页

(54)实用新型名称

二次电池电芯及其卷绕成型系统

(57)摘要

本实用新型提供了一种二次电池电芯及其卷绕成型系统。二次电池电芯包括阳极极片、阳极极耳、阴极极片、阴极极耳以及隔离膜。二次电池电芯卷绕成型系统包括工作平台、卷绕机构、阳极极片放卷辊、阳极极片清洗机构、阳极极片模切机构、阳极极耳供给机构、阳极极耳连接机构、阳极极片传输机构、阴极极片放卷辊、阴极极片清洗机构、阴极极片模切机构、阴极极耳供给机构、阴极极耳连接机构、阴极极片传输机构、第一隔离膜放卷辊、第二隔离膜放卷辊、第一隔离膜传输机构以及第二隔离膜传输机构。本实用新型的二次电池电芯卷绕成型系统制备的二次电池电芯，能有效的防止二次电池电芯发生内短路，在保证高的能量密度的同时提高二次电池电芯的安全性能。



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1. 一种二次电池电芯 (1)，包括：

阳极极片 (101)，包括：

阳极集流体 (1011)；以及

阳极膜片 (1012)，设置在阳极集流体 (1011) 的表面；

阳极极耳 (102)；

阴极极片 (103)，包括：

阴极集流体 (1031)；以及

阴极膜片 (1032)，设置在阴极集流体 (1031) 的表面；

阴极极耳 (104)；以及

隔离膜 (105)，设置于阳极极片 (101) 和阴极极片 (103) 之间；

其中，

阳极极片 (101) 形成有：

阳极极耳收容凹槽 (1013)，底部为阳极集流体 (1011) 而周侧为阳极膜片 (1012)，阳极极耳 (102) 收容于阳极极耳收容凹槽 (1013) 内并电连接于阳极极耳收容凹槽 (1013) 处的阳极集流体 (1011)；

阴极极片 (103) 形成有：

阴极极耳收容凹槽 (1033)，底部为阴极集流体 (1031) 而周侧为阴极膜片 (1032)，阴极极耳 (104) 收容于阴极极耳收容凹槽 (1033) 内并电连接于阴极极耳收容凹槽 (1033) 处的阴极集流体 (1031)；

其特征在于，

阳极极片 (101) 还形成有：

阳极极片模切缺口 (1014)，位于阳极极耳收容凹槽 (1013) 的侧缘且贯穿阳极极片 (101)；

阴极极片 (103) 还形成有：

阴极极片模切缺口 (1034)，位于阴极极耳收容凹槽 (1033) 的侧缘且贯穿阴极极片 (103)。

2. 根据权利要求 1 所述的二次电池电芯 (1)，其特征在于，

阳极极片模切缺口 (1014) 在长度方向 (L) 的长度为阳极极耳收容凹槽 (1013) 长度的 0.9 ～ 1.2 倍；

阳极极片模切缺口 (1014) 在宽度方向 (W) 的宽度为阳极极耳收容凹槽 (1013) 宽度的 0.2 ～ 0.8 倍；

阴极极片模切缺口 (1034) 在长度方向 (L) 的长度为阴极极耳收容凹槽 (1033) 长度的 0.9 ～ 1.2 倍；

阴极极片模切缺口 (1034) 在宽度方向 (W) 的宽度为阴极极耳收容凹槽 (1033) 宽度的 0.2 ～ 0.8 倍。

3. 根据权利要求 1 所述的二次电池电芯 (1)，其特征在于，所述二次电池电芯 (1) 还包括：

第一绝缘胶带 (T1)，粘贴在已收容阴极极耳 (104) 的阴极极耳收容凹槽 (1033) 处；以及

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第二绝缘胶带（T2），粘贴在二次电池电芯（1）卷绕成型后阴极膜片（1032）的与阳极极耳收容凹槽（1013）对位的部位。

4. 根据权利要求 3 所述的二次电池电芯（1），其特征在于，

阳极极片（101）还形成有：阳极配对凹部（1015），底部为阳极集流体（1011）而周侧为阳极膜片（1012），位于阳极极耳收容凹槽（1013）的正对背侧；

阴极极片（103）还形成有：阴极配对凹部（1035），底部为阴极集流体（1031）而周侧为阴极膜片（1032），位于阴极极耳收容凹槽（1033）的正对背侧；

所述二次电池电芯（1）还包括：第三绝缘胶带（T3），粘贴在二次电池电芯（1）卷绕成型后阴极膜片（1032）的与阳极配对凹部（1015）对位的部位；以及

第四绝缘胶带（T4），粘贴在阴极配对凹部（1035）。

5. 一种二次电池电芯卷绕成型系统（2），其特征在于，包括：

工作平台（201），固定不动；

卷绕机构（202），设置于工作平台（201）；

阳极极片放卷辊（203），设置于工作平台（201），卷绕有阳极极片（101），阳极极片（101）包括：阳极集流体（1011）；以及阳极膜片（1012），设置在阳极集流体（1011）的表面；

阳极极片清洗机构（204），设置于工作平台（201），位于阳极极片放卷辊（203）下游，用于在阳极极片（101）上清洗出底部为阳极集流体（1011）而周侧为阳极膜片（1012）的阳极极耳收容凹槽（1013）；

阳极极片模切机构（205），设置于工作平台（201），位于阳极极片清洗机构（204）下游，用于在阳极极耳收容凹槽（1013）的侧缘处模切阳极极片（101）而形成贯穿阳极极片（101）的阳极极片模切缺口（1014）；

阳极极耳供给机构（206），设置于工作平台（201），位于阳极极片模切机构（205）下游，卷绕有阳极极耳（102），用于向模切出阳极极片模切缺口（1014）的阳极极片（101）的阳极极耳收容凹槽（1013）提供阳极极耳（102），以使阳极极耳（102）收容于阳极极耳收容凹槽（1013）内；

阳极极耳连接机构（207），设置于工作平台（201），位于阳极极片模切机构（205）下游，用于将收容于阳极极耳收容凹槽（1013）的阳极极耳（102）与阳极极耳收容凹槽（1013）处的阳极集流体（1011）电连接固定；

阳极极片传输机构（208），设置于工作平台（201），用于将从阳极极片放卷辊（203）放卷的阳极极片（101）依次通过阳极极片清洗机构（204）、阳极极片模切机构（205）、阳极极耳连接机构（207）而输送至卷绕机构（202）；

阴极极片放卷辊（209），设置于工作平台（201），卷绕有阴极极片（103），阴极极片（103）包括：阴极集流体（1031）；以及阴极膜片（1032），设置在阴极集流体（1031）的表面；

阴极极片清洗机构（210），设置于工作平台（201），位于阴极极片放卷辊（209）下游，用于在阴极极片（103）上清洗出底部为阴极集流体（1031）而周侧为阴极膜片（1032）的阴极极耳收容凹槽（1033）；

阴极极片模切机构（211），设置于工作平台（201），位于阴极极片清洗机构（210）下游，用于在阴极极耳收容凹槽（1033）侧缘处模切阴极极片（103）而形成贯穿阴极极片（103）的阴极极片模切缺口（1034）；

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阴极极耳供给机构（212），设置于工作平台（201），位于阴极极片模切机构（211）下游，卷绕有阴极极耳（104），用于向模切出阴极极片模切缺口（1034）的阴极极片（103）的阴极极耳收容凹槽（1033）提供阴极极耳（104），以使阴极极耳（104）收容于阴极极耳收容凹槽（1033）内；

阴极极耳连接机构（213），设置于工作平台（201），位于阴极极片模切机构（211）下游，用于将收容于阴极极耳收容凹槽（1033）的阴极极耳（104）与阴极极耳收容凹槽（1033）处的阴极集流体（1031）电连接固定；

阴极极片传输机构（214），设置于工作平台（201），用于将从阴极极片放卷辊（209）放卷的阴极极片（103）依次通过阴极极片清洗机构（210）、阴极极片模切机构（211）、阴极极耳连接机构（213）而输送至卷绕机构（202）；

第一隔离膜放卷辊（215A），设置于工作平台（201），卷绕有一隔离膜（105）；

第二隔离膜放卷辊（215B），设置于工作平台（201），卷绕有另一隔离膜（105）；

第一隔离膜传输机构（216A），设置于工作平台（201），用于将第一隔离膜放卷辊（215A）放卷的对应隔离膜（105）输送至卷绕机构（202），以使二次电池电芯卷绕成型后对应隔离膜（105）间隔在阳极极片（101）和阴极极片（103）之间；以及

第二隔离膜传输机构（216B），设置于工作平台（201），用于将第二隔离膜放卷辊（215B）放卷的对应隔离膜（105）输送至卷绕机构（202），以使二次电池电芯卷绕成型后对应隔离膜（105）间隔在阳极极片（101）和阴极极片（103）之间。

6. 根据权利要求 5 所述的二次电池电芯卷绕成型系统（2），其特征在于，所述二次电池电芯卷绕成型系统（2）还包括：

第一阴极极片贴胶机构（218A），设置于工作平台（201），位于阴极极耳连接机构（213）下游，用于在已收容阴极极耳（104）的阴极极耳收容凹槽（1033）粘贴第一绝缘胶带（T1）；以及

第二阴极极片贴胶机构（218B），设置于工作平台（201），位于第一阴极极片贴胶机构（218A）与卷绕机构（202）之间，用于在二次电池电芯（1）卷绕成型后阴极膜片（1032）与阳极极耳收容凹槽（1013）对位的部位粘贴第二绝缘胶带（T2）。

7. 根据权利要求 6 所述的二次电池电芯卷绕成型系统（2），其特征在于，

阳极极片清洗机构（204）为两个，一个阳极极片清洗机构（204）用于在阳极极片（101）上清洗出底部为阳极集流体（1011）而周侧为阳极膜片（1012）的阳极极耳收容凹槽（1013），而另一个阳极极片清洗机构（204）用于在阳极极片（101）上清洗出底部为阳极集流体（1011）而周侧为阳极膜片（1012）且位于阳极极耳收容凹槽（1013）的正对背侧的阳极配对凹部（1015）；

阴极极片清洗机构（210）为两个，一个阴极极片清洗机构（210）用于在阴极极片（103）上清洗出底部为阴极集流体（1031）而周侧为阴极膜片（1032）的阴极极耳收容凹槽（1033），而另一个阴极极片清洗机构（210）用于在阴极极片（103）上清洗出底部为阴极集流体（1031）而周侧为阴极膜片（1032）且位于阴极极耳收容凹槽（1033）的正对背侧的阴极配对凹部（1035）；

第一阴极极片贴胶机构（218A）还用于在阴极配对凹部（1035）粘贴第四绝缘胶带（T4）；

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第二阴极极片贴胶机构（218B）还用于在阴极膜片（1032）与阳极配对凹部（1015）对位的部位粘贴第三绝缘胶带（T3）。

8. 根据权利要求 5 所述的二次电池电芯卷绕成型系统（2），其特征在于，阳极极片模切机构（205）包括：

阳极极片模切凸模机构（2051）；以及

阳极极片模切凹模机构（2052），与阳极极片模切凸模机构（2051）配合，以在阳极极片（101）经过阳极极片模切机构（205）时在阳极极耳收容凹槽（1013）的侧缘处模切阳极极片（101）而形成贯穿阳极极片（101）的阳极极片模切缺口（1014）。

9. 根据权利要求 5 所述的二次电池电芯卷绕成型系统（2），其特征在于，阴极极片模切机构（211）包括：

阴极极片模切凸模机构（2111）；以及

阴极极片模切凹模机构（2112），与阴极极片模切凸模机构（2111）配合，以在阴极极片（103）经过阴极极片模切机构（211）时在阴极极耳收容凹槽（1033）的侧缘处模切阴极极片（103）而形成贯穿阴极极片（103）的阴极极片模切缺口（1034）。

10. 根据权利要求 5 或 7 所述的二次电池电芯卷绕成型系统（2），其特征在于，

阳极极片清洗机构（204）包括：

阳极极片激光清洗系统（2041），用于对经过的阳极极片（101）的阳极膜片（1012）对应进行清洗；

阳极极片除尘机构（2042），用于去除阳极极片激光清洗系统（2041）进行清洗时产生的阳极膜片（1012）颗粒；以及

阳极极片吸附冷却辅助平台（2043），将吸附固定并冷却经过阳极极片激光清洗系统（2041）的阳极极片（101）；

阴极极片清洗机构（210）包括：

阴极极片激光清洗系统（2101），用于对经过的阴极极片（103）的阴极膜片（1032）对应进行清洗；

阴极极片除尘机构（2102），用于去除阴极极片激光清洗系统（2101）进行清洗时产生的阴极膜片（1032）颗粒；以及

阴极极片吸附冷却辅助平台（2103），将吸附固定并冷却经过阴极极片激光清洗系统（2101）的阴极极片（103）。

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二次电池电芯及其卷绕成型系统

技术领域

[0001] 本实用新型涉及二次电池领域，尤其涉及一种二次电池电芯及其卷绕成型系统。

背景技术

[0002] 锂离子电池（为二次电池的一种）在电子产品、汽车和电动车、航空航天、微型机电以及储能等领域均有广泛的应用。随着应用环境及条件趋向复杂化及苛刻化，对锂离子电池的使用安全性能、能量密度以及生产成本提出了更高的要求。

[0003] 目前已有技术通过在极片上开设凹槽，将极耳焊接在凹槽内，从而达到提升能量密度的目的，但现阶段该工艺是分别由独立的激光清洗设备和焊接卷绕设备实现的，这些设备的综合成本及厂房占用空间较大，导致整体锂电池的生产成本比较高；并且在极片上由激光清洗出的凹槽边缘因存在焦距波动偏差引发的过热穿孔或烧损，造成该凹槽边缘的集流体上形成较多毛刺，如不经处理直接将此带有毛刺的极片制备成电芯则会存在毛刺刺穿隔离膜发生内短路甚至着火等严重的安全隐患，现有技术中通过在凹槽中贴盖厚胶纸来防止毛刺刺穿隔离膜，然而这势必会增加电芯厚度从而导致能量密度的损失。

实用新型内容

[0004] 鉴于背景技术中存在的问题，本实用新型的目的在于提供一种二次电池电芯，其能在提高二次电池电芯的能量密度的同时防止二次电池电芯发生内短路，提高二次电池电芯的安全性能。

[0005] 本实用新型的另一目的在于提供一种二次电池电芯卷绕成形系统，其能减小二次电池电芯卷绕成型系统的体积，节省厂房的占用空间，降低二次电池电芯的生产成本，并提高制备的二次电池电芯的能量密度和安全性能。

[0006] 为了实现上述目的，在第一方面，本实用新型提供了一种二次电池电芯，其包括阳极极片、阳极极耳、阴极极片、阴极极耳以及隔离膜。

[0007] 阳极极片包括：阳极集流体；以及阳极膜片，设置在阳极集流体的表面。

[0008] 阴极极片包括：阴极集流体；以及阴极膜片，设置在阴极集流体的表面。

[0009] 隔离膜设置于阳极极片和阴极极片之间。

[0010] 阳极极片形成有：阳极极耳收容凹槽，底部为阳极集流体而周侧为阳极膜片，阳极极耳收容于阳极极耳收容凹槽内并电连接于阳极极耳收容凹槽处的阳极集流体。

[0011] 阴极极片形成有：阴极极耳收容凹槽，底部为阴极集流体而周侧为阴极膜片，阴极极耳收容于阴极极耳收容凹槽内并电连接于阴极极耳收容凹槽处的阴极集流体。

[0012] 阳极极片还形成有：阳极极片模切缺口，位于阳极极耳收容凹槽的侧缘且贯穿阳极极片。

[0013] 阴极极片还形成有：阴极极片模切缺口，位于阴极极耳收容凹槽的侧缘且贯穿阴极极片。

[0014] 为了实现上述目的，在第二方面，本实用新型提供了一种二次电池电芯卷绕成型

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系统，其包括工作平台、卷绕机构、阳极极片放卷辊、阳极极片清洗机构、阳极极片模切机构、阳极极耳供给机构、阳极极耳连接机构、阳极极片传输机构、阴极极片放卷辊、阴极极片清洗机构、阴极极片模切机构、阴极极耳供给机构、阴极极耳连接机构、阴极极片传输机构、第一隔离膜放卷辊、第二隔离膜放卷辊、第一隔离膜传输机构以及第二隔离膜传输机构。

[0015] 工作平台固定不动。

[0016] 卷绕机构设置于工作平台。

[0017] 阳极极片放卷辊设置于工作平台，卷绕有阳极极片，阳极极片包括：阳极集流体；以及阳极膜片，设置在阳极集流体的表面。

[0018] 阳极极片清洗机构设置于工作平台，位于阳极极片放卷辊下游，用于在阳极极片上清洗出底部为阳极集流体而周侧为阳极膜片的阳极极耳收容凹槽。

[0019] 阳极极片模切机构设置于工作平台，位于阳极极片清洗机构下游，用于在阳极极耳收容凹槽的侧缘处模切阳极极片而形成贯穿阳极极片的阳极极片模切缺口。

[0020] 阳极极耳供给机构设置于工作平台，位于阳极极片模切机构下游，卷绕有阳极极耳，用于向阳极极片模切缺口的阳极极片的阳极极耳收容凹槽提供阳极极耳，以使阳极极耳收容于阳极极耳收容凹槽内。

[0021] 阳极极耳连接机构设置于工作平台，位于阳极极片模切机构下游，用于将收容于阳极极耳收容凹槽的阳极极耳与阳极极耳收容凹槽处的阳极集流体电连接固定。

[0022] 阳极极片传输机构设置于工作平台，用于将从阳极极片放卷辊放卷的阳极极片依次通过阳极极片清洗机构、阳极极片模切机构、阳极极耳连接机构而输送至卷绕机构。

[0023] 阴极极片放卷辊设置于工作平台，卷绕有阴极极片，阴极极片包括：阴极集流体；以及阴极膜片，设置在阴极集流体的表面。

[0024] 阴极极片清洗机构设置于工作平台，位于阴极极片放卷辊下游，用于在阴极极片上清洗出底部为阴极集流体而周侧为阴极膜片的阴极极耳收容凹槽。

[0025] 阴极极片模切机构设置于工作平台，位于阴极极片清洗机构下游，用于在阴极极耳收容凹槽侧缘处模切阴极极片而形成贯穿阴极极片的阴极极片模切缺口。

[0026] 阴极极耳供给机构设置于工作平台，位于阴极极片模切机构下游，卷绕有阴极极耳，用于向模切出阴极极片模切缺口的阴极极片的阴极极耳收容凹槽提供阴极极耳，以使阴极极耳收容于阴极极耳收容凹槽内。

[0027] 阴极极耳连接机构设置于工作平台，位于阴极极片模切机构下游，用于将收容于阴极极耳收容凹槽的阴极极耳与阴极极耳收容凹槽处的阴极集流体电连接固定。

[0028] 阴极极片传输机构设置于工作平台，用于将从阴极极片放卷辊放卷的阴极极片依次通过阴极极片清洗机构、阴极极片模切机构、阴极极耳连接机构而输送至卷绕机构。

[0029] 第一隔离膜放卷辊设置于工作平台，卷绕有一隔离膜。

[0030] 第二隔离膜放卷辊设置于工作平台，卷绕有另一隔离膜。

[0031] 第一隔离膜传输机构设置于工作平台，用于将第一隔离膜放卷辊放卷的对应隔离膜输送至卷绕机构，以使二次电池电芯卷绕成型后对应隔离膜间隔在阳极极片和阴极极片之间。

[0032] 第二隔离膜传输机构设置于工作平台，用于将从第二隔离膜放卷辊放卷的对应隔离膜输送至卷绕机构，以使二次电池电芯卷绕成型后对应隔离膜间隔在阳极极片和阴极极

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片之间。

[0033] 本实用新型的有益效果如下：

[0034] 在根据本实用新型的二次电池电芯中，阳极极耳收容于阳极极耳收容凹槽，阴极极耳收容于阴极极耳收容凹槽，有效提高了二次电池电芯的能量密度，而阳极极片模切缺口能够去除阳极极耳收容凹槽在形成过程中边缘部分的集流体上形成的毛刺，同时阴极极片模切缺口能有效去除阴极极耳收容凹槽在形成过程中边缘部分的集流体上形成的毛刺，有效地防止二次电池电芯发生内短路，从而在保证高的能量密度的同时提高二次电池电芯的安全性能。

[0035] 在根据本实用新型的二次电池电芯卷绕成型系统中，卷绕机构、阳极极片放卷辊、阳极极片清洗机构、阳极极片模切机构、阳极极耳供给机构、阳极极耳连接机构、阳极极片传输机构、阴极极片放卷辊、阴极极片清洗机构、阴极极片模切机构、阴极极耳给机构、阴极极耳连接接机构、阴极极片传输机构、第一隔离膜放卷辊、第二隔离膜放卷辊、第一隔离膜传输机构以及第一隔离膜传输机构集成在一个工作台上，减小二次电池电芯卷绕成型系统的体积，节省厂房的占用空间，降低二次电池电芯的生产成本；阳极极片模切机构能够去除阳极极片清洗机构清洗出的阳极极耳收容凹槽边缘部分的集流体上的毛刺，阴极极片模切机构能够去除阴极极片清洗机构清洗出的阴极极耳收容凹槽边缘部分的集流体上的毛刺，有效地防止制备出的二次电池电芯发生内短路，提高生产的二次电池电芯的安全性能。

附图说明

[0036] 图 1 为本实用新型的二次电池电芯卷绕成型系统的结构示意图。

[0037] 图 2 为本实用新型的二次电池电芯的阳极极片与极耳焊接后的示意图，其中图 (a) 为阳极极片与极耳焊接后的剖视图，图 (b) 为图 (a) 所示阳极极片的俯视图。

[0038] 图 3 为本实用新型的二次电池电芯的阴极极片与极耳焊接后的示意图，其中图 (a) 为阴极极片与极耳焊接后的剖视图，图 (b) 为图 (a) 所示阴极极片的仰视图。

[0039] 图 4 为本实用新型的二次电池电芯的极片模切过程示意图，其中图 (a) 为阳极极片模切过程示意图，图 (b) 为阴极极片模切过程示意图。

[0040] 图 5 为本实用新型的二次电池电芯的极片示意图，其中图 (a) 为阳极极片示意图，图 (b) 为阴极极片示意图。

[0041] 图 6 为现有技术二次电池电芯极片的示意图，其中图 (a) 为阳极极片的示意图，图 (b) 为阴极极片的示意图。

[0042] 其中，附图标记说明如下：

[0043] 1 二次电池电芯

[0044] 101 阳极极片

[0045] 1011 阳极集流体

[0046] 1012 阳极膜片

[0047] 1013 阳极极耳收容凹槽

[0048] 1014 阳极极片模切缺口

[0049] 1015 阳极配对凹部

[0050] 102 阳极极耳

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[0051] 103 阴极极片

[0052] 1031 阴极集流体

[0053] 1032 阴极膜片

[0054] 1033 阴极极耳收容凹槽

[0055] 1034 阴极极片模切缺口

[0056] 1035 阴极配对凹部

[0057] 104 阴极极耳

[0058] 105 隔离膜

[0059] 2 二次电池电芯卷绕成型系统

[0060] 201 工作平台

[0061] 202 卷绕机构

[0062] 2021 除尘器

[0063] 2022 卷绕装置

[0064] 203 阳极极片放卷辊

[0065] 204 阳极极片清洗机构

[0066] 2041 阳极极片激光清洗系统

[0067] 2042 阳极极片除尘机构

[0068] 2043 阳极极片吸附冷却辅助平台

[0069] 205 阳极极片模切机构

[0070] 2051 阳极极片模切凸模机构

[0071] 2052 阳极极片模切凹模机构

[0072] 2053 阳极极片模切废料收集机构

[0073] 206 阳极极耳供给机构

[0074] 207 阳极极耳连接机构

[0075] 2071 阳极极耳焊头机构

[0076] 2072 阳极极耳焊座机构

[0077] 208 阳极极片传输机构

[0078] 2081 固定辊

[0079] 2082 主驱动机构

[0080] 2083 主驱动纠偏机构

[0081] 209 阴极极片放卷辊

[0082] 210 阴极极片清洗机构

[0083] 2101 阴极极片激光清洗系统

[0084] 2102 阴极极片除尘机构

[0085] 2103 阴极极片吸附冷却辅助平台

[0086] 211 阴极极片模切机构

[0087] 2111 阴极极片模切凸模机构

[0088] 2112 阴极极片模切凹模机构

[0089] 2113 阴极极片模切废料收集机构

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[0090] 212 阴极极耳供给机构

[0091] 213 阴极极耳连接机构

[0092] 2131 阴极极耳焊头机构

[0093] 2132 阴极极耳焊座机构

[0094] 214 阴极极片传输机构

[0095] 2141 固定辊

[0096] 2142 主驱动机构

[0097] 2143 主驱动纠偏机构

[0098] 215A 第一隔离膜放卷辊

[0099] 215B 第二隔离膜放卷辊

[0100] 216A 第一隔离膜传输机构

[0101] 216A1 固定辊

[0102] 216B 第二隔离膜传输机构

[0103] 216B1 固定辊

[0104] 217 中心控制机构

[0105] 218A 第一阴极极片贴胶机构

[0106] 218B 第二阴极极片贴胶机构

[0107] 219 阳极极片感应机构

[0108] 220 阳极极片纠偏机构

[0109] 221 阴极极片感应机构

[0110] 222 阴极极片纠偏机构

[0111] 223 隔离膜感应机构

[0112] 224 阳极极片除尘部

[0113] 225 阴极极片除尘部

[0114] T1 第一绝缘胶带

[0115] T2 第二绝缘胶带

[0116] T3 第三绝缘胶带

[0117] T4 第四绝缘胶带

[0118] L 长度方向

[0119] W 宽度方向

具体实施方式

[0120] 下面参照附图来详细说明根据本实用新型的二次电池电芯及其卷绕成型系统。

[0121] 首先说明根据本实用新型第一方面的二次电池电芯。

[0122] 参照图 2 至图 5，根据本实用新型的二次电池电芯 1 包括阳极极片 101、阳极极耳 102、阴极极片 103、阴极极耳 104 以及隔离膜 105。

[0123] 阳极极片 101 包括：阳极集流体 1011；以及阳极膜片 1012，设置在阳极集流体 1011 的表面。

[0124] 阴极极片 103 包括：阴极集流体 1031；以及阴极膜片 1032，设置在阴极集流体

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1031 的表面。

[0125] 隔离膜 105 设置于阳极极片 101 和阴极极片 103 之间。

[0126] 阳极极片 101 形成有 :阳极极耳收容凹槽 1013,底部为阳极集流体 1011 而周侧为阳极膜片 1012,阳极极耳 102 收容于阳极极耳收容凹槽 1013 内并电连接于阳极极耳收容凹槽 1013 处的阳极集流体 1011。

[0127] 阴极极片 103 形成有 :阴极极耳收容凹槽 1033,底部为阴极集流体 1031 而周侧为阴极膜片 1032,阴极极耳 104 收容于阴极极耳收容凹槽 1033 内并电连接于阴极极耳收容凹槽 1033 处的阴极集流体 1031。

[0128] 阳极极片 101 还形成有 :阳极极片模切缺口 1014,位于阳极极耳收容凹槽 1013 的侧缘且贯穿阳极极片 101。

[0129] 阴极极片 103 还形成有 :阴极极片模切缺口 1034,位于阴极极耳收容凹槽 1033 的侧缘且贯穿阴极极片 103。

[0130] 在根据本实用新型的二次电池电芯 1 中,阳极极耳 102 收容于阳极极耳收容凹槽 1013,阴极极耳 104 收容于阴极极耳收容凹槽 1033,有效提高了二次电池电芯 1 的能量密度 ;阳极极片模切缺口 1014 能够去除阳极极耳收容凹槽 1013 在形成过程中边缘部分的集流体 1011 上形成的毛刺,阴极极片模切缺口 1034 能有效去除阴极极耳收容凹槽 1033 在形成过程中边缘部分的集流体 1031 上形成的毛刺,从而有效地防止二次电池电芯 1 发生内短路,进而在保证高的能量密度的同时提高二次电池电芯 1 的安全性能。

[0131] 在根据本实用新型的二次电池电芯 1 中,二次电池电芯 1 为卷绕式电芯。

[0132] 在根据本实用新型的二次电池电芯 1 中,参照图 5(a),在一实施例中,阳极极片模切缺口 1014 在长度方向 L 的长度可为阳极极耳收容凹槽 1013 长度的 0.9 ～ 1.2 倍 ;阳极极片模切缺口 1014 在宽度方向 W 的宽度可为阳极极耳收容凹槽 1013 宽度的 0.2 ～ 0.8 倍。

[0133] 在根据本实用新型的二次电池电芯 1 中,参照图 5(b),在一实施例中,阴极极片模切缺口 1034 在长度方向 L 的长度可为阴极极耳收容凹槽 1033 长度的 0.9 ～ 1.2 倍 ;阴极极片模切缺口 1034 在宽度方向 W 的宽度可为阴极极耳收容凹槽 1033 宽度的 0.2 ～ 0.8 倍。

[0134] 在根据本实用新型的二次电池电芯 1 中,参照图 2,在一实施例中,阳极极片 101 上可不粘贴绝缘胶带 T。在阳极极片 101 上粘贴绝缘胶带 T 并不能提高二次电池电芯 1,反而可能会增加二次电池电芯 1 厚度,降低二次电池电芯 1 的能量密度。

[0135] 在根据本实用新型的二次电池电芯 1 中,参照图 3,在一实施例中,二次电池电芯 1 还包括 :第一绝缘胶带 T1,粘贴在已收容阴极极耳 104 的阴极极耳收容凹槽 1033 处 ;以及第二绝缘胶带 T2,粘贴在二次电池电芯 1 卷绕成型后阴极膜片 1032 的与阳极极耳收容凹槽 1013 对位的部位。由于粘贴了第二绝缘胶带 T2,减少了向阳极极耳 102 游离的阴极膜片 1032 的阴极活性物质,减少了阴极膜片 1032 的阴极活性物质游离扩散至对位的阳极极耳 102 处,进而能减轻在二次电池充放电过程中阴极膜片 1032 的阴极活性物质富集在阳极极耳 102 处,最终减轻了阳极极耳 102 处出现析出阴极活性物质的问题,同时避免阳极极耳 102 处的毛刺刺穿隔离膜 105 时阳极极耳 102 与阴极极片 103 接触发生内短路。

[0136] 在根据本实用新型的二次电池电芯 1 中,参照图 2(a),在一实施例中,阳极极片 101 还形成有阳极配对凹部 1015,底部为阳极集流体 1011 而周侧为阳极膜片 1012,位于阳极极耳收容凹槽 1013 的正对背侧 ;参照图 3(a) 和图 3(b),在本实施例中二次电池电芯 1 还

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包括：第三绝缘胶带 T3，粘贴在二次电池电芯 1 卷绕成型后阴极膜片 1032 的与阳极配对凹部 1015 对位的部位。

[0137] 在根据本实用新型的二次电池电芯 1 中，参照图 3(a)，在一实施例中，阴极极片 103 还形成有阴极配对凹部 1035，底部为阴极集流体 1031 而周侧为阴极膜片 1032，位于阴极极耳收容凹槽 1033 的正对背侧；参照图 3(a) 和图 3(b)，在本实施例中，二次电池电芯 1 还包括：第四绝缘胶带 T4，粘贴在阴极配对凹部 1035。

[0138] 在根据本实用新型的二次电池电芯 1 中，在一实施例中，阳极极片 101 还形成有阳极配对凹部 1015，底部为阳极集流体 1011 而周侧为阳极膜片 1012，位于阳极极耳收容凹槽 1013 的正对背侧，如图 2(a) 所示；阴极极片 103 还形成有阴极配对凹部 1035，底部为阴极集流体 1031 而周侧为阴极膜片 1032，位于阴极极耳收容凹槽 1033 的正对背侧，如图 3(a) 所示。参照图 3(a) 和图 3(b)，在本实施例中，二次电池电芯 1 还包括：第三绝缘胶带 T3，粘贴在二次电池电芯 1 卷绕成型后阴极膜片 1032 的与阳极配对凹部 1015 对位的部位；以及第四绝缘胶带 T4，粘贴在阴极配对凹部 1035。

[0139] 在根据本实用新型的二次电池电芯 1 中，第一绝缘胶带 T1、第二绝缘胶带 T2、第三绝缘胶带 T3 以及第四绝缘胶带 T4 为单面绝缘胶带或双面绝缘胶带。当采用双面绝缘胶带，双面绝缘胶带粘接区域比采用单面绝缘胶带时更紧密，从而使得二次电池电芯的整体性加强，从而避免二次电池电芯在整形工序以及二次电池充放电膨胀后该区域隆起成为最大变形区。

[0140] 其次说明根据本实用新型第二方面的二次电池电芯卷绕成型系统。

[0141] 参照图 1，根据本实用新型的二次电池电芯卷绕成型系统包括工作平台 201、卷绕机构 202、阳极极片放卷辊 203、阳极极片清洗机构 204、阳极极片模切机构 205、阳极极耳供给机构 206、阳极极耳连接机构 207、阳极极片传输机构 208、阴极极片放卷辊 209、阴极极片清洗机构 210、阴极极片模切机构 211、阴极极耳供给机构 212、阴极极耳连接机构 213、阴极极片传输机构 214、第一隔离膜放卷辊 215A、第二隔离膜放卷辊 215B、第一隔离膜传输机构 216A 以及第二隔离膜传输机构 216B。

[0142] 工作平台 201 固定不动。

[0143] 卷绕机构 202 设置于工作平台 201。

[0144] 阳极极片放卷辊 203 设置于工作平台 201，卷绕有阳极极片 101，阳极极片 101 包括：阳极集流体 1011；以及阳极膜片 1012，设置在阳极集流体 1011 的表面。

[0145] 阳极极片清洗机构 204 设置于工作平台 201，位于阳极极片放卷辊 203 下游，用于在阳极极片 101 上清洗出底部为阳极集流体 1011 而周侧为阳极膜片 1012 的阳极极耳收容凹槽 1013。

[0146] 阳极极片模切机构 205 设置于工作平台 201，位于阳极极片清洗机构 204 下游，用于在阳极极耳收容凹槽 1013 的侧缘处模切阳极极片 101 而形成贯穿阳极极片 101 的阳极极片模切缺口 1014；

[0147] 阳极极耳供给机构 206 设置于工作平台 201，位于阳极极片模切机构 205 下游，卷绕有阳极极耳 102，用于向阳极极片模切缺口 1014 的阳极极片 101 的阳极极耳收容凹槽 1013 提供阳极极耳 102，以使阳极极耳 102 收容于阳极极耳收容凹槽 1013 内。

[0148] 阳极极耳连接机构 207 设置于工作平台 201，位于阳极极片模切机构 205 下游，用

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于将收容于阳极极耳收容凹槽 1013 的阳极极耳 102 与阳极极耳收容凹槽 1013 处的阳极集流体 1011 电连接固定。

[0149] 阳极极片传输机构 208 设置于工作平台 201，用于将从阳极极片放卷辊 203 放卷的阳极极片 101 依次通过阳极极片清洗机构 204、阳极极片模切机构 205、阳极极耳连接机构 207 而输送至卷绕机构 202。阴极极片放卷辊 209 设置于工作平台 201，卷绕有阴极极片 103，阴极极片 103 包括：阴极集流体 1031；以及阴极膜片 1032，设置在阴极集流体 1031 的表面。

[0150] 阴极极片清洗机构 210 设置于工作平台 201，位于阴极极片放卷辊 209 下游，用于在阴极极片 103 上清洗出底部为阴极集流体 1031 而周侧为阴极膜片 1032 的阴极极耳收容凹槽 1033。

[0151] 阴极极片模切机构 211 设置于工作平台 201，位于阴极极片清洗机构 210 下游，用于在阴极极耳收容凹槽 1033 侧缘处模切阴极极片 103 而形成贯穿阴极极片 103 的阴极极片模切缺口 1034。

[0152] 阴极极耳供给机构 212 设置于工作平台 201，位于阴极极片模切机构 211 下游，卷绕有阴极极耳 104，用于向模切出阴极极片模切缺口 1034 的阴极极片 103 的阴极极耳收容凹槽 1033 提供阴极极耳 104，以使阴极极耳 104 收容于阴极极耳收容凹槽 1033 内。

[0153] 阴极极耳连接机构 213 设置于工作平台 201，位于阴极极片模切机构 211 下游，用于将收容于阴极极耳收容凹槽 1033 的阴极极耳 104 与阴极极耳收容凹槽 1033 处的阴极集流体 1031 电连接固定。

[0154] 阴极极片传输机构 214 设置于工作平台 201，用于将从阴极极片放卷辊 209 放卷的阴极极片 103 依次通过阴极极片清洗机构 210、阴极极片模切机构 211、阴极极耳连接机构 213 而输送至卷绕机构 202。

[0155] 第一隔离膜放卷辊 215A 设置于工作平台 201，卷绕有一隔离膜 105。

[0156] 第二隔离膜放卷辊 215B 设置于工作平台 201，卷绕有另一隔离膜 105。

[0157] 第一隔离膜传输机构 216A 设置于工作平台 201，用于将第一隔离膜放卷辊 215A 放卷的对应隔离膜 105 输送至卷绕机构 202，以使二次电池电芯卷绕成型后对应隔离膜 105 间隔在阳极极片 101 和阴极极片 103 之间。

[0158] 第二隔离膜传输机构 216B 设置于工作平台 201，用于将从第二隔离膜放卷辊 215B 放卷的对应隔离膜 105 输送至卷绕机构 202，以使二次电池电芯卷绕成型后对应隔离膜 105 间隔在阳极极片 101 和阴极极片 103 之间。

[0159] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，卷绕机构 202、阳极极片放卷辊 203、阳极极片清洗机构 204、阳极极片模切机构 205、阳极极耳供给机构 206、阳极极耳连接机构 207、阳极极片传输机构 208、阴极极片放卷辊 209、阴极极片清洗机构 210、阴极极片模切机构 211、阴极极耳给机构 212、阴极极耳连接接机构 213、阴极极片传输机构 214、第一隔离膜放卷辊 215A、第二隔离膜放卷辊 215B、第一隔离膜传输机构 216A 以及第一隔离膜传输机构 216B 集成在一个工作台 201 上，减小二次电池电芯卷绕成型系统 2 的体积，节省厂房的占用空间，降低二次电池电芯 1 的生产成本；阳极极片模切机构 205 能够去除阳极极片清洗机构 204 清洗出的阳极极耳收容凹槽 1013 边缘部分的集流体 1011 上的毛刺，阴极极片模切机构 211 能够去除阴极极片清洗机构 210 清洗出的阴极极耳收容凹槽 1033 边缘

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部分的集流体 1031 上的毛刺，有效的防止制备出的二次电池电芯 1 发生内短路，提高生产的二次电池电芯 1 的安全性能。

[0160] 在一实施例中，要在阳极极片 101 的两面分别清洗出阳极极耳收容凹槽 1013 和阳极配对凹部 1015，而阳极极片传输机构 208 通过导向能够改变阳极极片 101 的传输方位，实现双面清洗的效果。

[0161] 在一实施例中，要在阴极极片 103 的两面分别清洗出阴极极耳收容凹槽 1033 和阴极配对凹部 1035，而阴极极片传输机构 214 能够通过导向改变阴极极片 103 的传输方位，实现双面清洗的效果。

[0162] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，二次电池电芯卷绕成型系统 2 还包括中心控制机构 217，通信连接并控制选自阳极极片放卷辊 203、阳极极片清洗机构 204、阳极极片模切机构 205、阳极极耳供给机构 206、阳极极耳连接机构 207、阴极极片放卷辊 209、阴极极片清洗机构 210、阴极极片模切机构 211、阴极极耳供给机构 212、阴极极耳连接机构 213 及卷绕机构 202 中的至少一种。

[0163] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1 和图 3，在一实施例中，二次电池电芯卷绕成型系统 2 还包括：第一阴极极片贴胶机构 218A，设置于工作平台 201，位于阴极极耳连接机构 213 下游，用于在已收容阴极极耳 104 的阴极极耳收容凹槽 1033 粘贴第一绝缘胶带 T1；以及第二阴极极片贴胶机构 218B，设置于工作平台 201，位于第一阴极极片贴胶机构 218A 与卷绕机构 202 之间，用于在二次电池电芯 1 卷绕成型后阴极膜片 1032 与阳极极耳收容凹槽 1013 对位的部位粘贴第二绝缘胶带 T2。

[0164] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片清洗机构 204 为两个，一个阳极极片清洗机构 204 用于在阳极极片 101 上清洗出底部为阳极集流体 1011 而周侧为阳极膜片 1012 的阳极极耳收容凹槽 1013，而另一个阳极极片清洗机构 204 用于在阳极极片 101 上清洗出底部为阳极集流体 1011 而周侧为阳极膜片 1012 且位于阳极极耳收容凹槽 1013 的正对背侧的阳极配对凹部 1015；参照图 1 和图 3，在本实施例中，第二阴极极片贴胶机构 218B 还用于在阴极膜片 1032 的与阳极配对凹部 1015 对位的部位粘贴第三绝缘胶带 T3。

[0165] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阴极极片清洗机构 210 为两个，一个阴极极片清洗机构 210 用于在阴极极片 103 上清洗出底部为阴极集流体 1031 而周侧为阴极膜片 1032 的阴极极耳收容凹槽 1033，而另一个阴极极片清洗机构 210 用于在阴极极片 103 上清洗出底部为阴极集流体 1031 而周侧为阴极膜片 1032 且位于阴极极耳收容凹槽 1033 的正对背侧的阴极配对凹部 1035；参照图 1 和图 3，在本实施例中，第一阴极极片贴胶机构 218A 还用于在阴极配对凹部 1035 粘贴第四绝缘胶带 T4。

[0166] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片清洗机构 204 为两个，一个阳极极片清洗机构 204 用于在阳极极片 101 上清洗出底部为阳极集流体 1011 而周侧为阳极膜片 1012 的阳极极耳收容凹槽 1013，而另一个阳极极片清洗机构 204 用于在阳极极片 101 上清洗出底部为阳极集流体 1011 而周侧为阳极膜片 1012 且位于阳极极耳收容凹槽 1013 的正对背侧的阳极配对凹部 1015；参照图 1，在本实施例中，阴极极片清洗机构 210 为两个，一个阴极极片清洗机构 210 用于在阴极极片 103 上

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清洗出底部为阴极集流体 1031 而周侧为阴极膜片 1032 的阴极极耳收容凹槽 1033，而另一个阴极极片清洗机构 210 用于在阴极极片 103 上清洗出底部为阴极集流体 1031 而周侧为阴极膜片 1032 且位于阴极极耳收容凹槽 1033 的正对背侧的阴极配对凹部 1035；参照图 1 和图 3，在本实施例中，第一阴极极片贴胶机构 218A 还用于在阴极配对凹部 1035 粘贴第四绝缘胶带 T4；第二阴极极片贴胶机构 218B 还用于在阴极膜片 1032 与阳极配对凹部 1015 对位的部位粘贴第三绝缘胶带 T3。

[0167] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，二次电池电芯卷绕成型系统 2 还包括：多个阳极极片感应机构 219，设置于工作平台 201，且通信连接于中心控制机构 217，并处于阳极极片 101 的从阳极极片放卷辊 203 起始经由阳极极片清洗机构 204、阳极极片模切机构 205、阳极极耳连接机构 207 而到卷绕机构 202 的输送路径上，以感测阳极极片 101 在输送路径上的位置；多个阳极极片纠偏机构 220，设置于工作平台 201，且通信连接于中心控制机构 217，并处于阳极极片 101 的从阳极极片放卷辊 203 起始经由阳极极片清洗机构 204、阳极极片模切机构 205、阳极极耳连接机构 207 而到卷绕机构 202 的输送路径上，以对阳极极片 101 进行纠偏。

[0168] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，二次电池电芯卷绕成型系统 2 还包括：多个阴极极片感应机构 221，设置于工作平台 201，且通信连接于中心控制机构 217，并处于阴极极片 103 的从阴极极片放卷辊 209 起始经由阴极极片清洗机构 210、阴极极片模切机构 211、阴极极耳连接机构 213 而到卷绕机构 202 的输送路径上，以感测阴极极片 103 在输送路径上的位置；多个阴极极片纠偏机构 222，设置于工作平台 201，且通信连接于中心控制机构 217，并处于阴极极片 103 的从阴极极片放卷辊 209 起始经由阴极极片清洗机构 210、阴极极片模切机构 211、阴极极耳连接机构 213 而到卷绕机构 202 的输送路径上，以对阴极极片 103 进行纠偏。

[0169] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，二次电池电芯卷绕成型系统 2 还包括：多个隔离膜感应机构 223，设置于工作平台 201，且通信连接于中心控制机构 217，分别处于对应隔离膜 105 的从第一隔离膜放卷辊 215A 到卷绕机构 202 的输送路径以及从第二隔离膜放卷辊 215B 到卷绕机构 202 的输送路径上，以感测对应隔离膜 105 在输送路径上的位置。

[0170] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片放卷辊 203、阴极极片放卷辊 209、第一隔离膜放卷辊 215A 以及第二隔离膜放卷辊 215B 均能够沿垂直于工作平台 201 方向伸缩。第一隔离膜放卷辊 215A 以及第二隔离膜放卷辊 215B 沿垂直于工作平台 201 方向伸缩可以配合隔离膜感应机构 223 实现纠偏，所以隔离膜的放料没有增加单独的隔离膜纠偏机构。

[0171] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片清洗机构 204 包括：阳极极片激光清洗系统 2041，用于对经过的阳极极片 101 的阳极膜片 1012 对应进行清洗；阳极极片除尘机构 2042，用于去除阳极极片激光清洗系统 2041 进行清洗时产生的阳极膜片 1012 颗粒；以及阳极极片吸附冷却辅助平台 2043，将吸附固定并冷却经过阳极极片激光清洗系统 2041 的阳极极片 101。

[0172] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片吸附冷却辅助平台 2043 可为抽真空吸附。

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[0173] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阴极极片清洗机构 210 包括：阴极极片激光清洗系统 2101，用于对经过的阴极极片 103 的阴极膜片 1032 对应进行清洗；阴极极片除尘机构 2102，用于去除阴极极片激光清洗系统 2101 进行清洗时产生的阴极膜片 1032 颗粒；以及阴极极片吸附冷却辅助平台 2103，将吸附固定并冷却经过阴极极片激光清洗系统 2101 的阴极极片 103。

[0174] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阴极极片吸附冷却辅助平台 2103 可为抽真空吸附。

[0175] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片模切机构 205 包括：阳极极片模切凸模机构 2051；阳极极片模切凹模机构 2052，与阳极极片模切凸模机构 2051 配合，以在阳极极片 101 经过阳极极片模切机构 205 时在阳极极耳收容凹槽 1013 的侧缘处模切阳极极片 101 而形成贯穿阳极极片 101 的阳极极片模切缺口 1014；以及阳极极片模切废料收集机构 2053，用于收集模切下来的阳极极片 101 的废料。

[0176] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阴极极片模切机构 211 包括：阴极极片模切凸模机构 2111；阴极极片模切凹模机构 2112，与阴极极片模切凸模机构 2111 配合，以在阴极极片 103 经过阴极极片模切机构 211 时在阴极极耳收容凹槽 1033 的侧缘处模切阴极极片 103 而形成贯穿阴极极片 103 的阴极极片模切缺口 1034；以及阴极极片模切废料收集机构 2113，用于收集模切下来的阴极极片 103 的废料。

[0177] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极耳连接机构 207 包括：阳极极耳焊头机构 2071；以及阳极极耳焊座机构 2072，与阳极极耳焊头机构 2071 配合，以将阳极极耳 102 焊接于阳极极耳收容凹槽 1013 处的阳极集流体 1011。

[0178] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阴极极耳连接机构 213 包括：阴极极耳焊头机构 2131；以及阴极极耳焊座机构 2132，与阴极极耳焊头机构 2131 配合，以将阴极极耳 104 焊接于阴极极耳收容凹槽 1033 处的阴极集流体 1031。

[0179] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，卷绕机构 202 包括：除尘器 2021，对输送至卷绕机构 202 的阳极极片 101、阴极极片 103 和两个隔离膜 105 进行除尘；以及卷绕装置 2022，使输送至卷绕机构 202 的阳极极片 101、阴极极片 103 和两个隔离膜 105 层叠为使卷绕机构 202 卷绕成型二次电池电芯后对应隔离膜 105 间隔在阳极极片 101 和阴极极片 103 之间。

[0180] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阳极极片传输机构 208 包括：固定辊 2081，从动地使阳极极片 101 从其上通过；主驱动机构 2082，主动地带动并输送阳极极片 101；以及主驱动纠偏机构 2083，位于卷绕机构 202 上游并对进入卷绕机构 202 的阳极极片 101 进行纠偏。

[0181] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，阴极极片传输机构 214 包括：固定辊 2141，从动地使阴极极片 103 从其上通过；主驱动机构 2142，主动地带动并输送阴极极片 103；以及主驱动纠偏机构 2143，位于卷绕机构 202 上游

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并对进入卷绕机构 202 的阴极极片 103 进行纠偏。

[0182] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，第一隔离膜传输机构 216A 包括固定辊 216A1，从动地使对应隔离膜 105 从其上通过并向卷绕机构 202 输送；第二隔离膜传输机构 216B 包括：固定辊 216B1，从动地使对应隔离膜 105 从其上通过并向卷绕机构 202 输送。

[0183] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，二次电池电芯卷绕成型系统 2 还包括：多个阳极极片除尘部 224，设置于工作平台 201，且通信连接于中心控制机构 217，并处于阳极极片 101 的从阳极极片清洗机构 204 经由阳极极片模切机构 205、阳极极耳连接机构 207 而到卷绕机构 202 的输送路径上，以去除阳极极片经过清洗、极耳焊接后产生的阳极膜片 1012 颗粒。

[0184] 在根据本实用新型的二次电池电芯卷绕成型系统 2 中，参照图 1，在一实施例中，二次电池电芯卷绕成型系统 2 还包括：多个阴极极片除尘部 225，设置于工作平台 201，且通信连接于中心控制机构 217，并处于阴极极片 103 的从阴极极片清洗机构 210 经由阴极极片模切机构 211、阴极极耳连接机构 213 而到卷绕机构 202 的输送路径上，以去除阴极极片经过清洗、极耳焊接后产生的阴极膜片 1032 颗粒。

[0185] 下面对使用本实用新型的二次电池电芯卷绕成型系统 2 制备出的二次电池电芯的性能与现有技术中制备出的二次电池电芯的性能进行比较。

[0186] 实施例 1 以制备 335272 型号电芯（成品电池厚度为 3.3mm、宽度为 52mm、长度为 72mm）为例，根据本实用新型的二次电池电芯卷绕成型系统 2 制备出二次电池电芯 1，参照图 2 至图 5，阳极极片 101 和阴极极片 103 预设位置上使用阳极极片清洗机构 204 和阴极极片清洗机构 210 分别清洗出长度 12mm（沿长度方向 L）、宽度 8mm（宽度方向 W）的阳极极耳收容凹槽 1013 和阴极极耳收容凹槽 1033，并将阳极极耳收容凹槽 1013 和阴极极耳收容凹槽 1033 侧缘的毛刺区经由阳极极片模切机构 205 和阴极极片模切机构 211 模切切除形成长度 12mm、宽度 3mm 的阳极极片模切缺口 1014 和阴极极片模切缺口 1034，阳极极片模切缺口 1014 和阴极极片模切缺口的长边与对应的阳极极耳收容凹槽 1013 和阴极极耳收容凹槽 1033 的长边重合，宽度为 6mm 的阳极极耳 102 和阴极极耳 104 分别被焊接于阳极极耳收容凹槽 1013 和阴极极耳收容凹槽 1033 中。在已收容阴极极耳 104 的阴极极耳收容凹槽 1033 上粘贴第一绝缘胶带 T1、在二次电池电芯 1 卷绕成型后阴极膜片 1032 的与阳极极耳收容凹槽 1013 对位的部位粘贴第二绝缘胶带 T2、在二次电池电芯 1 卷绕成型后阴极膜片 1032 的与阳极配对凹部 1015 对位的部位对应粘贴第三绝缘胶带 T3 以及在阴极配对凹部 1035 粘贴第四绝缘胶带 T4，绝缘胶带 T1 至 T4 的厚度为 10μm，其中 T1、T2、T3 和 T4 长度为 15mm、宽度为 24mm。阳极极片 101 不贴绝缘胶带。由此制备成本实用新型的一种实施例二次电池电芯结构。

[0187] 对比例 1 同样以制备 335272 型号电芯（成品电池厚度为 3.3mm、宽度为 52mm、长度为 72mm）为例，使用现有技术中常规独立的激光清洗设备和焊接卷绕设备制备出二次电池电芯，参照图 6，除阳极极耳收容凹槽 1013 和阴极极耳收容凹槽 1033 侧缘的毛刺区没有被模切去除，T1、T2、T3 以及 T4 采用 35μm 厚绝缘胶带之外，其他同实施例 1。

[0188] 对比例 2 同样以制备 335272 型号电芯（成品电池厚度为 3.3mm、宽度为 52mm、长度为 72mm）为例，其中除 T1、T2、T3 以及 T4 采用 10μm 厚绝缘胶带之外，其他同对比例 1。

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[0189] 在实施例 1、对比例 1 及对比例 2 中分别选取 20 个软包装锂离子电池样品进行容量测试，厚度测量，并且对测试后的软包装锂离子电池样品进行拆解观察清洗槽位区内短路的情况，所得结果示如表 1 所示。

[0190] 表 1 实施例 1 与对比例 1-2 的测试结果

[0191]

	平均容量 mAh	平均体积能量密度 Wh/L	平均厚度 mm	发生内短路的样品个数
实施例 1	3027.5	937	3.28	0

[0192]

对比例 1	3027.3	925	3.32	0
对比例 2	3027.4	937	3.28	12

[0193] 从表 1 看出，采用本实用新型二次电池电芯卷绕成型系统 2 制备的实施例 1 的二次电池电芯在保证较高的平均体积能量密度的同时没有电芯发生内短路；而对比例 1 虽同样没有电芯出现内短路问题，但因其粘贴较厚的绝缘胶导致平均体积能量密度明显降低；对比例 2 虽同样保证了较高的平均体积能量密度，但发生了高比率的内短路电芯。

[0194] 由此可见，实施例 1 中，采用模切切除阳极极耳容纳凹槽 1013 和阳极极耳容纳凹槽 1033 侧缘毛刺区的极片结构能完全解决毛刺引发的内短路问题，提升电芯的使用安全性能，且采用二次电池电芯卷绕成型系统 2 可降低电芯的综合制作成本。

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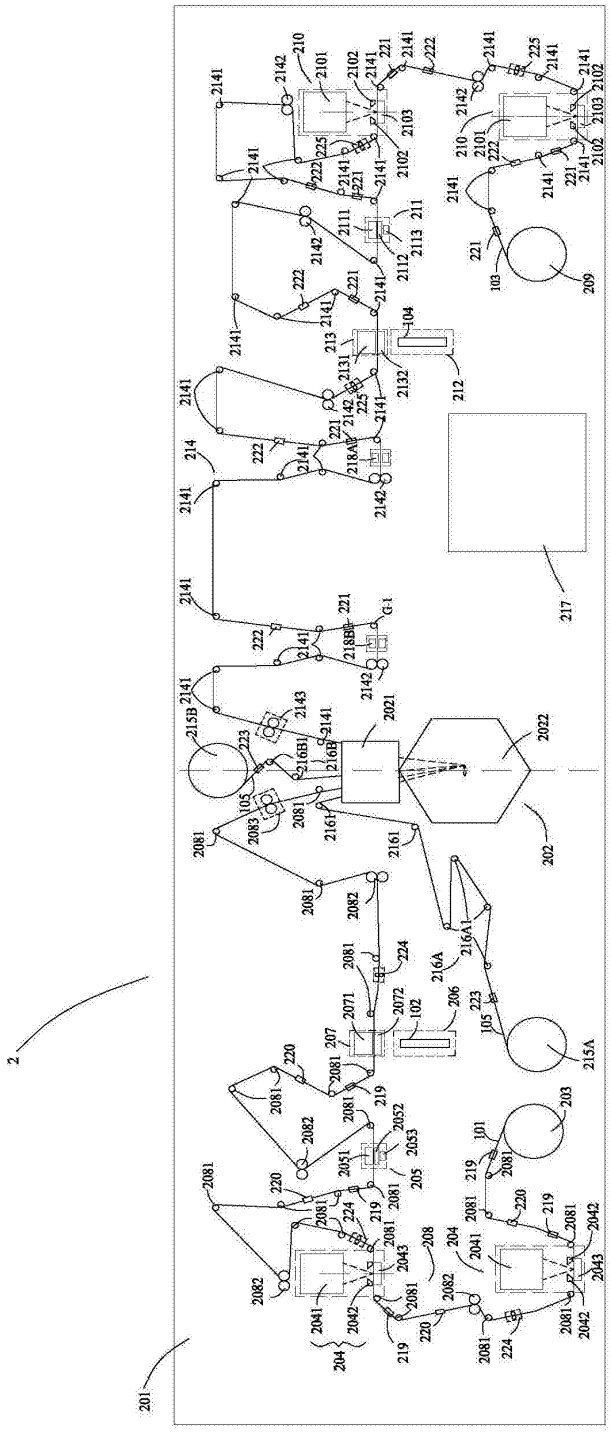


图 1

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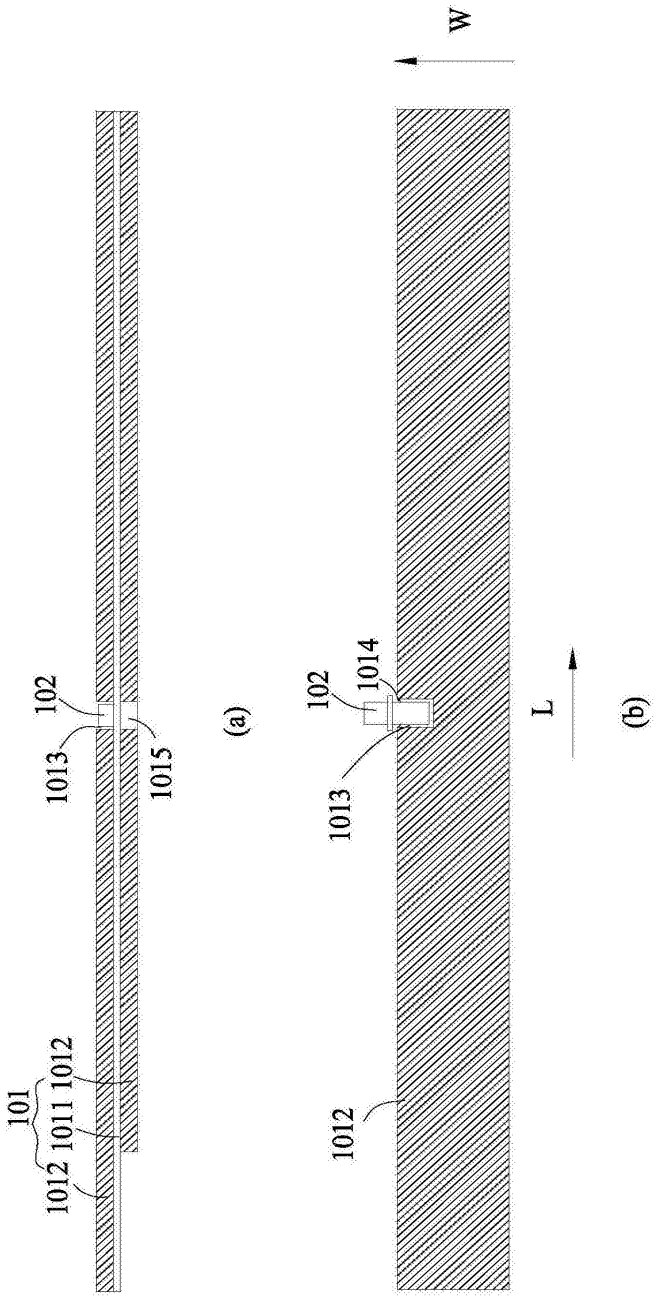


图 2

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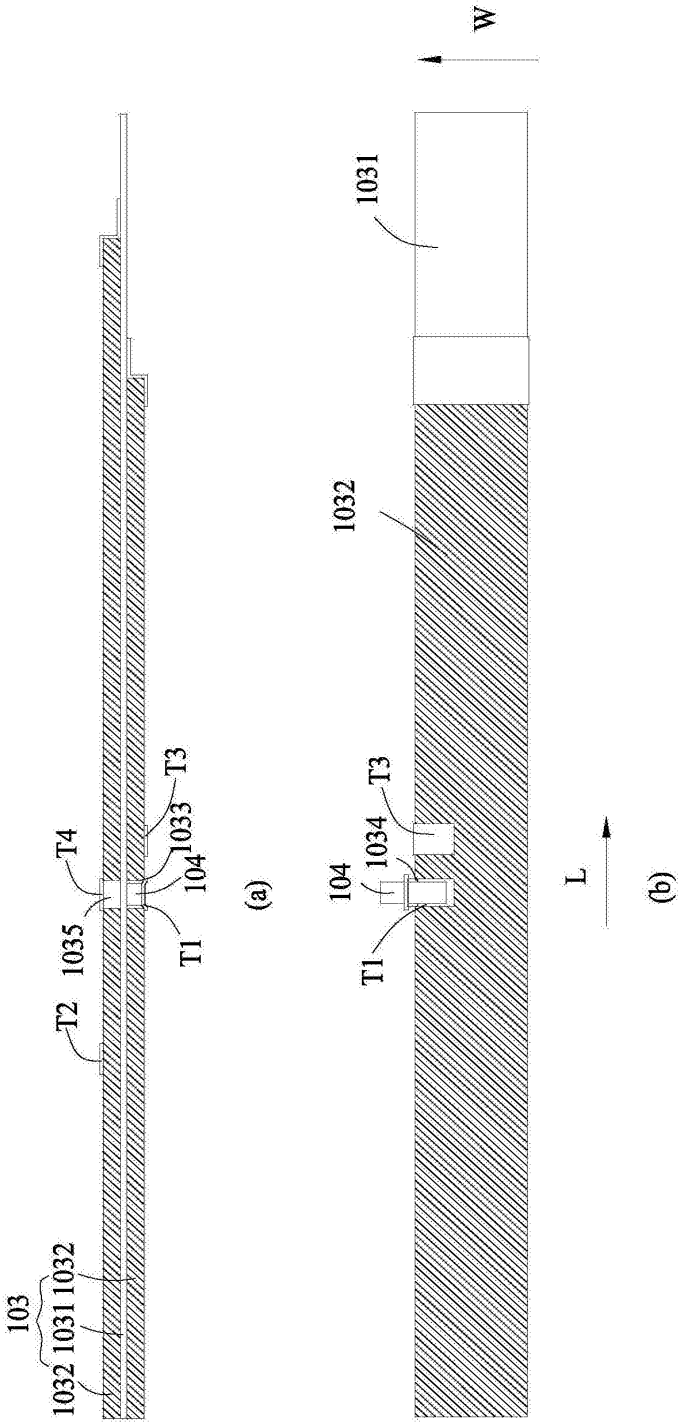


图 3

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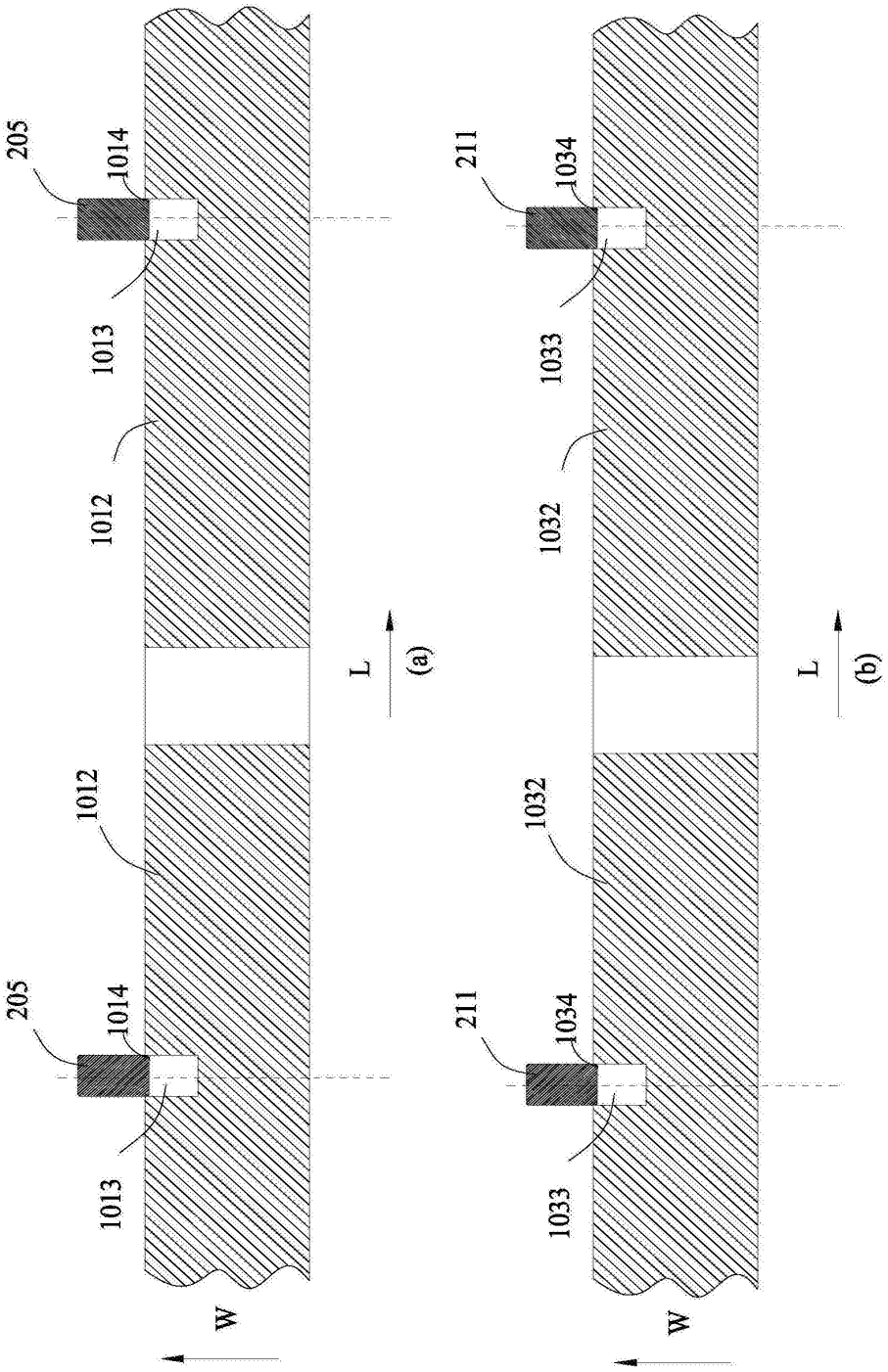


图 4

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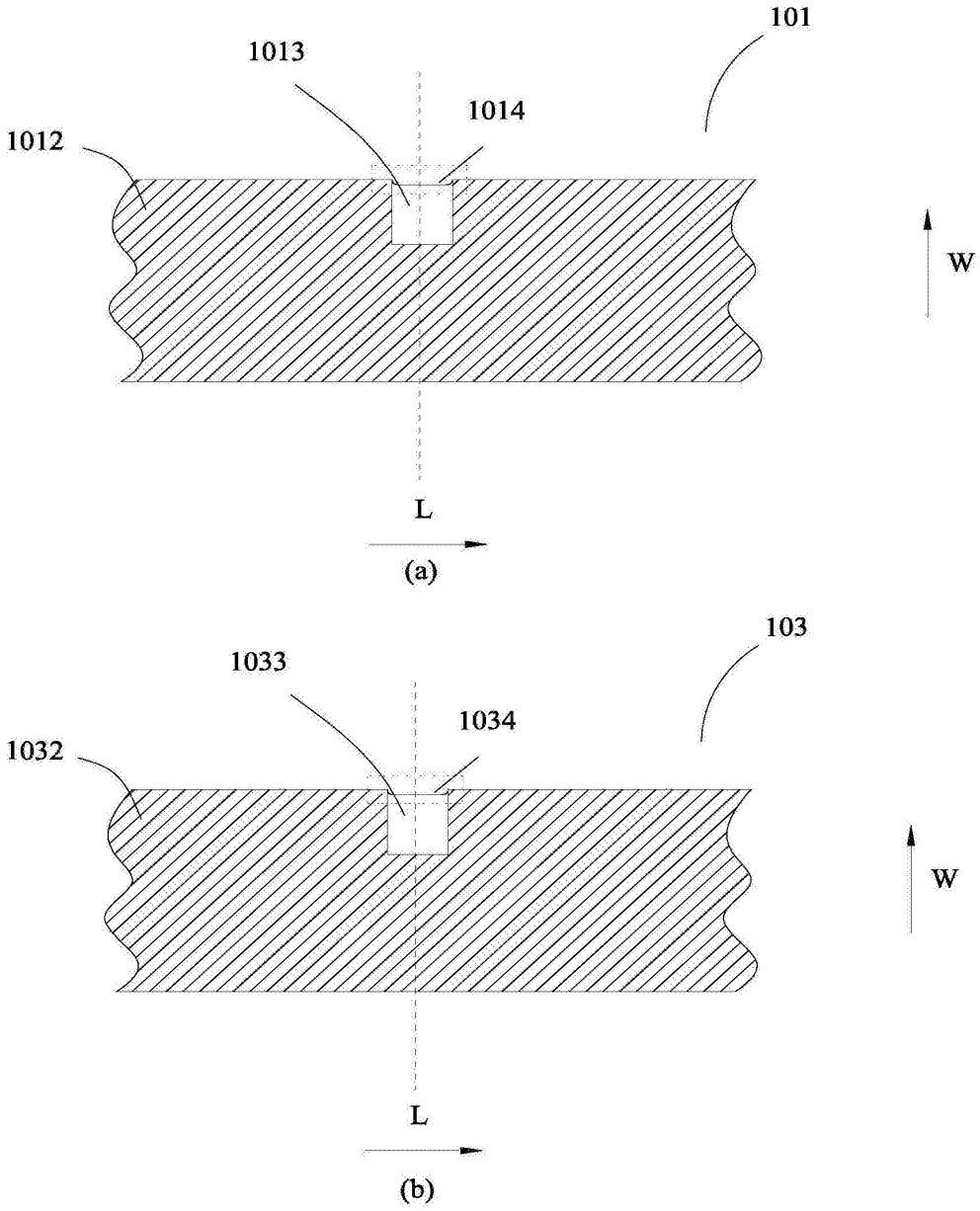


图 5

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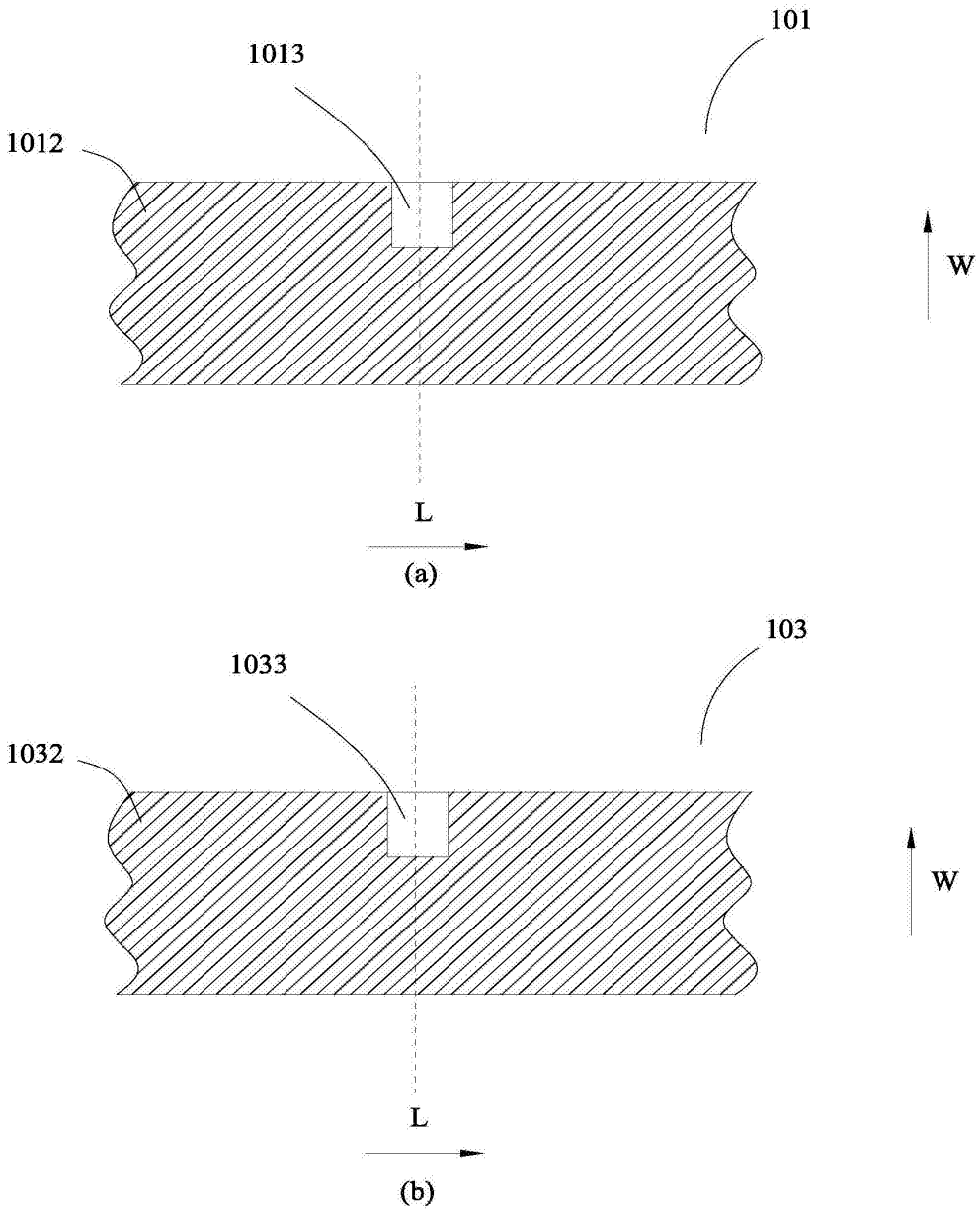


图 6

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Espacenet

Bibliographic data: JP2000323135 (A) — 2000-11-24

METHOD AND DEVICE FOR WORKING ELECTRODE FOR ALKALINE BATTERY

Inventor(s): HOJO HIDEMI ± (HOJO HIDEMI)

Applicant(s): TOSHIBA BATTERY ± (TOSHIBA BATTERY CO LTD)

Classification: **- international:** ***H01M4/26;*** (IPC1-7): H01M4/26
- cooperative: Y02E60/10 (EP)

Application number: JP19990133213 19990513

Priority number(s): JP19990133213 19990513

Abstract of JP2000323135 (A)

PROBLEM TO BE SOLVED: To easily eliminate the metal fiber projected (extruded) from a cut surface of an electrode for battery without lowering the quality. SOLUTION: This working method has a process for cutting and separating sheet-like electrodes for alkaline battery including metal fiber or metal foil as a collector, a process for pressurizing the cut and separated electrodes 2 for alkaline battery in the thickness direction, and a process for eliminating the burr generated in the cut and separated surfaces 2c, 2d while polishing the cut and separated surfaces 2c, 2d of the electrode for alkaline battery, to which pressurization is already performed, with polishing tools 3, 3'.

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号
特開2000－323135
（P2000－323135A）
(43)公開日　平成12年11月24日(2000.11.24)

(51)Int.Cl.[7]	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｈ０１Ｍ　4/26		Ｈ０１Ｍ　4/26	Ｚ　５Ｈ０１６

審査請求　未請求　請求項の数２　ＯＬ　（全　４　頁）

(21)出願番号　特願平11－133213

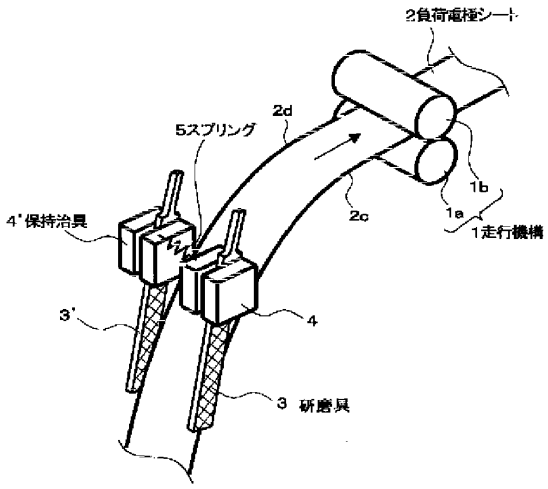
(22)出願日　平成11年５月13日(1999.5.13)

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Ｆターム(参考)　5H016 AA05 BB03 BB04 BB05 BB19 BB20 EE01

(54)【発明の名称】　アルカリ電池用電極の加工方法、および加工装置

(57)【要約】
【課題】　電池用電極の切断面に突出して（食みだして）いる金属繊維などを容易に、かつ品質低下の恐れもなく除去することが可能な電池用電極の加工方法および加工装置の提供。
【解決手段】　加工方法の発明は、金属繊維もしくは金属箔を集電体として含むシート状のアルカリ電池用電極を切断・分離する工程と、前記切断、分離したアルカリ電池用電極２を厚さ方向に加圧する工程と、前記加圧処理したアルカリ電池用電極２の切断・分離面2c，2dを、たとえば研磨具３，３′研磨し、切断・分離面2c，2dに発生したバリを除去する工程と、を有することを特徴とする。



【特許請求の範囲】
【請求項１】　金属繊維もしくは金属箔を集電体として含むシート状のアルカリ電池用電極を切断・分離する工程と、
前記切断、分離したアルカリ電池用電極を厚さ方向に加圧する工程と、
前記加圧処理したアルカリ電池用電極の切断・分離面を研磨し、切断・分離面に発生したバリを除去する工程と、を有することを特徴とするアルカリ電池用電極の加工方法。
【請求項２】　金属繊維もしくは金属箔を集電体として含み、かつ切断・分離したシート状のアルカリ電池用電極を走行させる走行機構と、
前記走行機構の側面に沿わせて対向・配置され、走行機構を走行するアルカリ電池用電極の切断・分離面を研磨する研磨具と、
前記研磨具をアルカリ電池用電極の切断・分離面に対して進退させる研磨具進退機構と、
前記研磨具をアルカリ電池用電極の切断・分離面に対する押圧を調整する押圧調整機構と、を具備して成ることを特徴とするアルカリ電池用電極の加工装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、金属繊維もしくは金属箔を集電体として含むアルカリ電池用電極（電池用電極板）の切断面に突出している集電体を成す金属繊維などを除去する加工手段に関する。
【０００２】
【従来の技術】シート状正極、シート状絶縁体、シート状負極およびシート状絶縁体の積層体をスパイラル状に巻装して成る電極要素を、外装容器内に液密に封装した構成のニッケル水素電池、もしくはニッケルカドミウム電池などが広く実用に供されている。ところで、前記アルカリ電池の電極要素の構成においては、たとえば径10～30μｍ程度の微細なニッケル繊維（ニッケルフェルト系繊維）などの金属繊維、あるいは厚さ20～ 100μｍ程度の金属箔を集電体とするシート状（テープ状）電極が使用されている。特に、金属繊維を集電体とすると、微細な多孔質体が電極活物質を多量に担持し易い。また、担持した電極活物質の脱落も起こり難いので、アルカリ電池の高性能化もしくは長寿命化への寄与が期待されるからである。
【０００３】そして、この種のアルカリ電池用電極は、担持する活物質はもとより、集電体として含む金属繊維もしくは金属箔を、たとえばカッターによる切断・分離で、所定寸法もしくは所要形状に加工されている。すなわち、シート状の電池用電極は、その量産性などを考慮し、たとえば４～10条の所定幅ら切断分離し、所要の電池用電極を得ることができる帯状の集電体面に、(a) ニッケル化合物を含む正極活物質層を設けたもの、(b) $CaCu_5$ 型の結晶構造を有する水素吸蔵合金を含む負極活物質層を設けたものを製造する。
【０００４】ここで、シート状の電池用電極は、電池容量の向上ないし電池のコンパクト化のため、その厚さを成るべく薄くし、捲装の緊迫度を上げられるようにしている。
【０００５】次いで、これらのシート状の電池用電極を所定の幅、長さに切断・分離するという加工が施される。その後に、前記切断・分離したシート状の電池用電極間に、電解液（質）担持層を介在させて捲回して作製した電極要素部を、電池外装容器内に液密に封装してアルカリ電池を構成している。
【０００６】
【発明が解決しようとする課題】しかしながら、前記切断加工されたアルカリ電池用電極は、実用上、次ぎのような問題がある。すなわち、アルカリ電池用電極の加工が、カッター切断で行われた場合、電池用電極の切断面に、ニッケル繊維などの集電体の切断面が部分的に突出し（食みだし、バリ）・残存して、電池機能を損なう恐れが認められる。この点、さらに言及すると、たとえばニッケルフェルト系繊維などの金属繊維は、一般的に径が10～30μｍ程度と細く、かつ柔らかいので、また、金属箔の場合も厚さが薄いので、切断面に金属繊維が食みださない状態に、切断加工することが事実上至難である。そして、結果的には、スパイラル状に巻装して電極要素を構成するとき、切断加工された電池用電極の切断面に突出し（食みだし）している金属繊維などが、隣接配置される絶縁シートを突き抜け、他の電極に接触するなど、電池内部で絶縁不良を起こす恐れがある。
【０００７】こうした懸念から、電池用電極の切断面に食みだす金属繊維などを、たとえば放電処理などで除去することも試みられている。すなわち、切断・分離した電池用電極に一定の電位を与える一方、対応する電極を切断・分離面に近接し放電を起こさせ、この放電によって食みだす金属繊維などを溶断・除去する手段が知られている。
【０００８】しかし、この放電処理手段は限界があり、実用上、十分満足し得る手段といえない。たとえばニッケル水素電池用の負極は、集電体に水素吸蔵合金を含む活物質層を担持しているため、放電処理の過程で発火する危険性がある。ここで、発火の危険性は、作業性ないし作業環境を悪化するだけでなく、品質ないし歩留まりの低下を招来する。
【０００９】本発明は上記事情に対処してなされたもので、電池用電極の切断面に突出して（食みだして）いる金属繊維などを容易に、かつ品質低下の恐れもなく除去することが可能な電池用電極の加工方法および加工装置の提供を目的とする。
【００１０】
【課題を解決するための手段】請求項１の発明は、金属

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繊維もしくは金属箔を集電体として含むシート状のアルカリ電池用電極を切断・分離する工程と、前記切断、分離したアルカリ電池用電極を厚さ方向に加圧する工程と、前記加圧処理したアルカリ電池用電極の切断・分離面を研磨し、切断・分離面に発生したバリを除去する工程と、を有することを特徴とするアルカリ電池用電極の加工方法である。

【００１１】請求項２の発明は、金属繊維もしくは金属箔を集電体として含み、かつ切断・分離したシート状のアルカリ電池用電極を走行させる走行機構と、前記走行機構の側面に沿わせて対向・配置され、走行機構を走行するアルカリ電池用電極の切断・分離面を研磨する研磨具と、前記研磨具をアルカリ電池用電極の切断・分離面に対して進退させる研磨具進退機構と、前記研磨具をアルカリ電池用電極の切断・分離面に対する押圧を調整する押圧調整機構と、を具備して成ることを特徴とするアルカリ電池用電極の加工装置である。

【００１２】請求項１および２の発明において、被加工体となる電池用電極は、１枚のシート状の電池用電極、たとえばニッケル水素電池用の正・負極シート、ニッケルカドミウム電池用の正・負極シートなどを、複数条に切断・分離して複数化された電池用電極で、集電体が電極活物質層を担持した構成のものである。

【００１３】請求項１および２の発明において、切断・分離された電池用電極の切断・分離面を研磨して、その切断・分離面に突出した集電体系のバリを除去する研磨手段は、たとえば目の細かい綾目の工具用ヤスリ（たとえば呼び寸法 200，上目数56，JIS B 4703）、目の細かい（＃ 200～＃1000程度）ダイヤモンド砥石ないしダイヤモンドベルトなどを研磨具としたものである。

【００１４】ここで、研磨手段による研磨は、被加工体である電池用電極の材質、厚さ、構成などによっても異なるが、一般的に、500g～2000g 程度の押圧力に設定すれば十分である。

【００１５】請求項１の発明では、被加工体（電池用電極）の切断面に突出・食みだした微細な金属繊維などが、その切断面に適切に押圧される研磨具で研磨・除去される。すなわち、微細な金属繊維などが突出・食みだした切断面は、適正な機械的処理条件で研磨されるため、突出・食みだした金属繊維など容易に、かつ確実に除去される。しかも、この処理は、純機械的であって、発火などの危険性がない状態で行われるので、良好な作業性、歩留まりも確保される。

【００１６】請求項２の発明では、請求項１の発明に係る加工方法を定常的に実施することが可能で、信頼性の高い電池用電極を量産的に、かつ歩留まりよく加工できる。

【００１７】

【発明の実施の形態】以下、図１および図２を参照して実施例を説明する。

【００１８】図１は実施例に係る加工装置の要部構成を示す斜視図、図２は被加工体とした電池用負電極の要部構成を示す断面図である。図１において、１は金属繊維もしくは金属箔を集電体として含み、かつ切断・分離したシート状のアルカリ電池用負電極２を走行させる走行機構である。

【００１９】ここで、走行機構１は回転ローラ1a，1b対であり、ほぼ一定の間隔をおいて複数対が設置され、アルカリ電池用負電極２をガイドを兼ねながら一定の方向に走行させる。なお、アルカリ電池用負電極２は、図２に示すように、厚さ45μm のニッケルメッキ鋼板（金属箔）2aの両主面に、$CaCu_5$ 型の結晶構造を有する水素吸蔵合金を含む負極活物質層2bを設けて成る厚さ 0.3㎜程度、幅60㎜程度のテープ状に切断されたものである。

【００２０】また、３，３′は前記走行機構１の側面に沿わせて対向・配置され、走行機構１を走行するアルカリ電池用負電極２の切断・分離面2c，2dを研磨する研磨具、４，４′は前記研磨具３，３′をそれぞれ保持する保持具である。

【００２１】ここで、研磨具３，３′は、研磨面が細か目の綾目に形成された工具用ヤスリであり、この工具用ヤスリ３，３′は、挟着的な保持具４，４′によって、それぞれ保持され、かつ所定の間隔をおいて対向配置されている。なお、保持具４，４′は、図示を省略してある研磨具進退機構によって、適宜、方向・位置を変更調節できるようになっている。

【００２２】さらに、５は前記保持具４，４′間に架張され、保持具４，４′に保持された研磨具３，３′が、アルカリ電池用負電極２の切断・分離面2c，2dを押圧する力を調節する押圧調整機構である。ここで、押圧調整機構５は、たとえばスプリング、その他の弾発手段、エアーシリンダーなどであるが、構造ないしコストなどの点で、スプリング方式が望ましい。

【００２３】次に、前記構成の加工装置による加工例を説明する。

【００２４】先ず、図示していない裁断・分離機構において、厚さ45μm のニッケルメッキ鋼板（金属箔）2aの両主面に、$CaCu_5$ 型の結晶構造を有する水素吸蔵合金を含む負極活物質層2bを設けて成る厚さ 0.3㎜程度、幅 500㎜程度のシート状のニッケル水素電池用負電極を切断・分離して、幅60㎜程度のテープ状電極を作製する。その後、幅60㎜程度に切断・分離したテープ状電極は、圧着ローラ間を通過させられ圧着処理が行われた。このとき、テープ状電極２の切断・分離面2c，2dには、前記切断・分離によって生じた金属箔2a系の細かいバリなどが認められた。

【００２５】次いで、前記加圧処理したアルカリ電池用負電極２を走行機構１に移載し、所定の方向に、たとえば約10 m／min.の速度走行させる。この段階で、工具用ヤスリ３，３′を挟着的に保持している保持具４，４′

のスプリング５によって、走行するアルカリ電池用負電極２の両切断面2c，2dに、前記工具用ヤスリ３，３′が約1000 gの力で押圧・対接するように調製する。

【００２６】このような条件設定で、アルカリ電池用負電極２の両切断面2c，2dを研磨したところ、前記切断・分離面に発生・残存していたバリが確実に除去され、切断面2c，2dは、いずれも良好な平坦面を成していた。つまり、こうし上記加工処理したテープ状のアルカリ電池用負電極２を、テープ状のアルカリ電池用正電極およびテープ状のセパレーターとを緊迫に捲装し、電極要素を作製した場合、電極間の短絡発生の恐れがない信頼性の高い電極要素、強いてはアルカリ電池を歩留まりよく製造できる。

【００２７】なお、本発明は、上記実施例に限定されるものでなく、発明の趣旨を逸脱しない範囲でいろいろの変形を採り得る。たとえば、アルカリ電池用電極はニッケル水素電池に限らず、ニッケルカドミウム電池の場合でもよく、また、シート状の負極に限らず、シート状の正極などの場合にも適用し得るし、集電体が金属繊維ないしニッケルフェルト系の場合であっても同様に行い得る。

【００２８】

【発明の効果】請求項１の発明によれば、適正な機械的処理条件により、研磨被加工体（電池用電極）の切断面に突出・食みだした微細な金属繊維などが容易に、かつ確実に除去される。しかも、その処理は、発火などの危険性がない状態で行われるので、良好な作業性、歩留まりも確保される。

【００２９】請求項２の発明によれば、上記作用効果を呈する加工方法が、定常的に実施できるので、信頼性の高い電池用電極を量産的に、かつ歩留まりよく提供できる。

【図面の簡単な説明】

【図１】実施例に係るシート状のアルカリ電池用電極の加工装置の要部構成例を示す斜視図。

【図２】シート状のアルカリ電池用負電極の要部構成を示す断面図。

【符号の説明】

１(1a,1b)……走行機構

２……テープ状のアルカリ電池用負電極

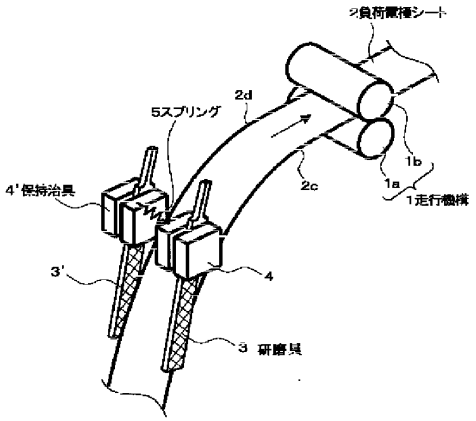
2c，2d……切断・分離面

３，３′……研磨具

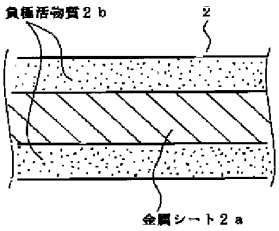
４，４′……保持具

５……押圧調整機構

【図１】



【図２】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/088638

A. CLASSIFICATION OF SUBJECT MATTER

H01M 2/30 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, WPI, EPODOC, GOOGLE: cell, battery, core, current w collect+, ear, tab, film, layer, anode, negative, cathode, positive, separator, groove, contain+, accommodat+, connect+, gap, jag, mould w cut+, burr, short w circuit, platform, roller, clean+, supply+, transmission, transmit+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 204946995 U (NINGDE AMPEREX TECH LTD.) 06 January 2016 (06.01.2016) description, paragraphs [0122]-[0184], and claims 1-10	1-35
X	CN 203574050 U (AMPEREX TECHNOLOGY LTD. et al.) 30 April 2014 (30.04.2014) description, paragraphs [0005]-[0060], and figures 1 and 2	1-9
Y	CN 203574050 U (AMPEREX TECHNOLOGY LTD. et al.) 30 April 2014 (30.04.2014) description, paragraphs [0005]-[0060], and figures 1 and 2	10-35
Y	CN 102315477 A (SHENZHEN YAKANG PREC MACHINERY CO., LTD.) 11 January 2012 (11.01.2012) description, paragraphs [0025]-[0051], and figures 1-10	10-35

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 May 2016	27 May 2016
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer ZHAO, Zhongqin Telephone No. (86-10) 62413968

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/088638

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 202495523 U (NINGDE AMPEREX TECH LTD. et al.) 17 October 2012 (17.10.2012) the whole document	1-35
A	CN 101783402 A (AMPEREX TECHNOLOGY LTD.) 21 July 2010 (21.07.2010) the whole document	1-35
A	US 2011020694 A1 (GM GLOBAL TECHNOLOGY OPERATIONS, INC.) 27 October 2011 (27.10.2011) the whole document	1-35

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/088638

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 204946995 U	06 January 2016	None	
CN 203574050 U	30 April 2014	None	
CN 102315477 A	11 January 2012	CN 102315477 B	02 April 2014
CN 202495523 U	17 October 2012	None	
CN 101783402 A	21 July 2010	None	
US 2011020694 A1	27 January 2011	US 8551638 B2	08 October 2013

Form PCT/ISA /210 (patent family annex) (July 2009)

专 利 合 作 条 约

PCT

国际检索报告

(PCT 第 18 条和细则 43 和 44)

申请人或代理人的档案号 M7CNCN155115	关于后续行为	见 PCT/ISA/220 表和 适用时，见下面第 5 项
国际申请号 PCT/CN2015/088638	国际申请日 *(日/月/年)* 31.8 月 2015(31.08.2015)	(最早的)优先权日 *(日/月/年)*

申请人

宁德新能源科技有限公司

按照条约第 18 条，本国际检索报告由本国际检索单位做出并送交申请人。报告副本送交国际局。

本国际检索报告总计 5 页。

☐ 它还附有本报告所引用的各现有技术文件的副本。

1. **报告的基础**

a.关于语言，进行国际检索基于：

☒ 国际申请提交时使用的语言。

☐ 该国际申请的_____语言译文，为了国际检索的目的提供该种语言的译文(细则 12.3(a)和 23.1(b))。

b.☐ 本国际检索报告考虑了本单位许可或被通知的根据细则91所做出的明显错误更正。(细则43.6之二(a))。

c.☐ 关于国际申请中公开的任何核苷酸和/或氨基酸序列(见第 I 栏)。

2. ☐ 某些权利要求被认为是不能检索的(见第 II 栏)。

3. ☐ 缺乏发明的单一性(见第 III 栏)。

4. **关于发明名称，**

☒ 同意申请人提出的发明名称。

☐ 发明名称由本单位确定如下：

5. **关于摘要，**

☐ 同意申请人提出的摘要。

☒ 根据细则 38.2(b)，摘要由本单位制定，如第 IV 栏中所示。自本国际检索报告发文日起一个月内，申请人可以向本单位提出意见。

6. **关于附图，**

a.随摘要一起公布的**附图**是：图 2

☐ 按照申请人建议的。

☒ 由本单位选择的，因为申请人没有建议一幅图。

☐ 由本单位选择的，因为该图能更好地表示发明的特征。

b. ☐ 没有与摘要一起公布的附图。

中华人民共和国国家知识产权局 专利审查业务章

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国际检索报告

第 IV 栏 摘要正文(续第 1 页第 5 项)

一种二次电池电芯（1）及其卷绕成型系统（2）。该二次电池电芯（1）包括阳极极片（101）、阳极极耳（102）、阴极极片（103）、阴极极耳（104）以及隔离膜（105）。该二次电池电芯卷绕成型系统（2）包括工作平台（201）、卷绕机构（202）、阳极极片放卷辊（203）、阳极极片清洗机构（204）、阳极极片模切机构（205）、阳极极耳供给机构（206）、阳极极耳连接机构（207）、阳极极片传输机构（208）、阴极极片放卷辊（209）、阴极极片清洗机构（210），阴极极片模切机构（211）、阴极极耳供给机构（212）、阴极极耳连接机构（213）、阴极极片传输机构（214）、第一隔离膜放卷辊（215A）、第二隔离膜放卷辊（215B）、第一隔离膜传输机构（216A）以及第二隔离膜传输机构（216B）。该二次电池电芯卷绕成型系统（2）制备的二次电池电芯（1），能有效的防止二次电池电芯（1）发生内短路，在保证高的能量密度的同时提高二次电池电芯（1）的安全性能。

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国际申请号
PCT/CN2015/088638

国际检索报告

A. 主题的分类

H01M 2/30(2006.01)i

按照国际专利分类（IPC）或者同时按照国家分类和 IPC 两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

IPC: H01M

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词（如使用）)

CNPAT, CNKI, WPI, EPODOC, GOOGLE: 电池，电芯，集流体，集电体，集电器，极耳，膜，片，负极，阳极，正极，阴极，隔膜，隔离膜，隔板，槽，凹，容纳，收容，连接，口，模切，毛刺，凸，短路，平台，辊，清洗，洗，供应，供给，传输，cell, battery, core, current w collect+, ear, tab, film, layer, anode, negative, cathode, positive, separator, groove, contain+, accommodat+, connect+, gap, jag, mould w cut+, burr, short w circuit, platform, roller, clean+, supply+, transmission, transmit+

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
E	CN 204946995U (宁德新能源科技有限公司) 06.1 月 2016(06.01.2016) 说明书第[0122]-[0184]段，权利要求 1-10	1-35
X	CN 203574050U (东莞新能源科技有限公司 等) 30.4 月 2014(30.04.2014) 说明书第[0005]-[0060]段，图 1-2	1-9
Y	CN 203574050U (东莞新能源科技有限公司 等) 30.4 月 2014(30.04.2014) 说明书第[0005]-[0060]段，图 1-2	10-35
Y	CN 102315477A (深圳市雅康精密机械有限公司) 11.1 月 2012(11.01.2012) 说明书第[0025]-[0051]段，图 1-10	10-35
A	CN 202495523U (宁德新能源科技有限公司 等) 17.10 月 2012(17.10.2012) 全文	1-35
A	CN 101783402A (东莞新能源科技有限公司) 21.7 月 2010(21.07.2010) 全文	1-35
A	US 2011020694A1 (GM GLOBAL TECHNOLOGY OPERATIONS, INC.) 27.1 月 2011(27.01.2011) 全文	1-35

☐其余文件在 C 栏的续页中列出。　　☒见同族专利附件

PCT/ISA/210 表（第 2 页）(2009 年 7 月)

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国际申请号 PCT/CN2015/088638

国际检索报告

* 引用文件的具体类型： "A" 认为不特别相关的表示了现有技术一般状态的文件 "E" 在国际申请日的当天或之后公布的在先申请或专利 "L" 可能对优先权要求构成怀疑的文件，或为确定另一篇 引用文件的公布日而引用的或者因其他特殊理由而引 用的文件（如具体说明的） "O" 涉及口头公开，使用，展览或其他方式公开的文件 "P" 公布日先于国际申请日但迟于所要求的优先权日的文件	"T" 在申请日或优先权日之后公布，与申请不相抵触，但为了 理解发明之理论或原理的在后文件 "X" 特别相关的文件，单独考虑该文件，认定要求保护的 发明不是新颖的或不具有创造性 "Y" 特别相关的文件，当该文件与另一篇或者多篇该类文件 结合并且这种结合对于本领域技术人员为显而易见时， 要求保护的发明不具有创造性 "&" 同族专利的文件
国际检索实际完成的日期 04. 5 月 2016(04. 05. 2016)	国际检索报告邮寄日期 27. 5 月 2016(27. 05. 2016)
ISA/CN 的名称和邮寄地址： 中华人民共和国国家知识产权局(ISA/CN) 北京市海淀区蓟门桥西土城路 6 号 100088 传真号：(86-10)62019451	受权官员： 赵中琴 电话号码： (86-10)62413968

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国际检索报告
关于同族专利的信息

国际申请号
PCT/CN2015/088038

检索报告中引用的专利文件	公布日期	同族专利	公布日期
CN204946995U	06.01.2016	无	
CN203574050U	30.04.2014	无	
CN102315477A	11.01.2012	CN102315477B	02.04.2014
CN202495523U	17.10.2012	无	
CN101783402A	21.07.2010	无	
US2011020694A1	27.01.2011	US8551638B2	08.10.2013

中华人民共和国国家知识产权局
专利审查协作

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PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	27.05.2016
Applicant's or agent's file reference: M7CNCN155115	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CN2015/088638	31.08.2015	

International Patent Classification (IPC) or both national classification and IPC
H01M2/30(2006.01)i

Applicant
NINGDE AMPEREX TECHNOLOGY LIMITED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/CN	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CN2015/088638

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

a. (means)

☐ on paper

☐ in electronic form

b. (time)

☐ in the international application as filed

☐ together with the international application in electronic form

☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CN2015/088638

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-35	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-35	NO
Industrial applicability (IA)	Claims	1-35	YES
	Claims	None	NO

2. Citations and explanations:

[1] D1: CN 203574050 U (30 April 2014)

[2] D2: CN 102315477 A (11 January 2012)

[3] 1. D1 (see description, paragraphs [0005]-[0060], and fig. 1 and 2) a laminated battery cell of a lithium ion battery, comprising a first electrode plate and a second electrode plate (corresponding to an anode electrode plate and a cathode electrode plate), and a first electrode tab and a second electrode tab (corresponding to an anode electrode tab and a cathode electrode tab), wherein the first electrode plate has a current collector, and diaphragms formed on the front and back surfaces of the current collector; the first electrode tab has two welding parts and an external connection part electrically connected to the welding parts; the first electrode plate has two first welding recesses (corresponding to electrode tab receiving recesses) that are formed by making the current collector expose from the

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

diaphragms of the electrode plate and respectively receive the two welding parts of the first electrode tab; the two welding parts are welded with the current collector in the two welding recesses; the second electrode plate has the same structure as the first electrode plate, and the second electrode tab has the same structure as the first electrode tab; a separator is provided between the first electrode plate and the second electrode plate. Hence, claim 1 differs from D1 by: having an anode electrode plate die cutting notch and a cathode electrode plate die cutting notch formed at particular positions. Claim 1 complies with PCT Article 33(2), and accordingly, claims 2-9 also comply with PCT Article 33(2).

[4] Regarding the difference, a person skilled in the art knows that burr will be formed at edges of anode and cathode current collectors in the slicing process, which would easily cause an internal short-circuit fault. Forming a notch at an edge having the burr to remove the burr at a required position, and a die cutting manner are common means. Claim 1 does not comply with PCT Article 33(3).

[5] 2. The additional technical features of claims 2-9 are common technical means. Therefore, claims 2-9 do not comply with PCT Article 33(3).

[6] 3. D2 (see description, paragraphs [0025]-[0051], and fig. 1-10) a battery winder, comprising a

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

substrate (i.e., a working platform), and an unwinding mechanism, a winding needle mechanism, and a winding rectification mechanism provided on the substrate. The unwinding mechanism comprises positive and negative unwinding units, and two separator unwinding units; material tapes of coils separately converge at the winding mechanism after passing through rollers (implicitly disclosing that each unwinding unit has an unwinding roller) and a clamping mechanism and are then winded into the battery cell; the winding rectification mechanism comprises rectification units respectively corresponding to the unwinding units; each rectification unit comprises a position detection sensor used for detecting whether a material tape on the corresponding unwinding unit is conveyed to a set position (implicitly disclosing that the unwinding unit has a transmission mechanism). Hence, claim 10 differs from D2: by comprising electrode plate cleaning mechanisms, electrode plate die cutting mechanisms, electrode tab supply mechanism, and electrode tab connection mechanisms of an anode and a cathode; and in respect of the positions between the mechanisms. Claim 10 complies with PCT Article 33(2), and therefore, claims 11-35 also comply with PCT Article 33(2).

[7] Regarding the differences, as stated above, D1 discloses forming the welding recess on the electrode plate for welding and placing the electrode tab; setting an electrode plate die

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

cutting notch could easily be conceived of by a person skilled in the art. D1 provides the technical motivation of sequentially providing the electrode plate cleaning mechanisms, the electrode tab supply mechanisms, and the electrode tab connection mechanisms; in addition, a person skilled in the art would easily conceive of providing electrode plate die cutting mechanisms at appropriate positions. Claim 10 does not comply with PCT Article 33(3).

[8] 4. The "sensing mechanism" and the "rectification mechanism" of claims 16-18 are disclosed by D2; the "winding device" of claim 30 is disclosed by D2; the additional technical features of claims 11-15, 19-29, and 31-35, and the remaining additional technical features of claims 16-18 and 30 are conventional options. Claims 11-35 do not likewise comply with PCT Article 33(3).

[9] 5. The subject matter of claims 1-35 complies with PCT Article 33(4).

专 利 合 作 条 约

发信人：国际检索单位

收信人：
100037
中国北京市西城区阜成门外大街2号A1908张向琨

北京五洲洋和知识产权代理事务所（普通合伙）

PCT

国际检索单位书面意见

(PCT细则43之二 .1)

发文日 (年/月/日)	2016年 5月 27日
申请人或代理人的档案号 M7CNCN155115	关于后续行为 见下面第2段

国际申请号	国际申请日	优先权日
PCT/CN2015/088638	(年/月/日) 2015年 8月 31日	(年/月/日)

国际专利分类（IPC）或国家分类及IPC
H01M 2/30(2006.01)i

申请人
宁德新能源科技有限公司

1. 本意见包括关于下列各项标明的内容：

- [x] 第I栏 意见的基础
- [ ] 第II栏 优先权
- [ ] 第III栏 不做出关于新颖性、创造性和工业实用性的意见
- [ ] 第IV栏 缺乏发明的单一性
- [x] 第V栏 按照细则43之二.1(a)(i)关于新颖性、创造性或工业实用性的推断性声明；支持这种声明的引证和解释
- [ ] 第VI栏 某些引用的文件
- [ ] 第VII栏 国际申请中的某些缺陷
- [ ] 第VIII栏 对国际申请的某些意见

2. 后续行为

如果提出初步审查要求书，本次意见将被视为国际初步审查单位(IPEA)的一次书面意见，除非申请人选择的国际初步审查单位非本机构，而且所选国际初步审查单位已按照细则66.1之二(b)通知国际局将不考虑国际检索单位的书面意见时例外。

如本书面意见被视为国际初步审查单位的书面意见，则请申请人在自PCT/ISA/220表发文日起3个月或自优先权日起22个月内（以后届满者为准）向国际初步审查单位提交书面答复并提交修改（如适用）。

进一步的选择参见PCT/ISA/220表。

ISA/CN的名称和邮寄地址	完成本意见的日期	受权官员
中华人民共和国国家知识产权局 中国北京市海淀区蓟门桥西土城路6号 100088 传真号 （86－10）62019451	2016年 5月 24日	赵中琴 电话号码 (86-10)62413968

表 PCT/ISA/237 （扉页） (2011年7月)

国际检索单位书面意见

国际申请号
PCT/CN2015/088638

第I栏　　意见的基础

1. 关于语言，本意见的制定基于：
   ☑ 国际申请提交时使用的语言。
   ☐ 该国际申请的_____语言译文，为了国际检索的目的提供该种语言的译文(细则12.3(a)和23.1(b))。

2. ☐ 本意见的制定考虑了本单位许可或被通知的根据细则91所做出的明显错误更正（细则 43之二1（a））。

3. 关于国际申请中所公开的任何对要求保护的发明必要的核苷酸和/或氨基酸序列，本意见是在下列基础上制定的：

   a. (提交提供)
      ☐ 纸件形式
      ☐ 电子形式

   b. (提交时间)
      ☐ 含在申请提交时的国际申请中
      ☐ 以电子形式与国际申请一起提交
      ☐ 为检索之用随后提交本单位

4. ☐ 另外，在提交/提供了多个版本或副本的序列表的情况下，提供了随后或附加副本中的信息与申请时提交的申请中的信息相同或未超出申请时提交的申请中的信息范围（如适用）的所需声明。

5. 补充意见：

CosMX Exhibit 1003, Page 580 of 676

国际检索单位书面意见

国际申请号
PCT/CN2015/088638

第V栏　　按细则43之二.1（a）（i）关于新颖性、创造性或工业实用性的推测性声明；支持这种声明的引证和解释

1. 声明

新颖性 (N)	权利要求	1-35	是
	权利要求	无	否
创造性 (IS)	权利要求	无	是
	权利要求	1-35	否
工业实用性 (IA)	权利要求	1-35	是
	权利要求	无	否

2. 引证和解释：

[1] D1：CN203574050U （30.04.2014）

[2] D2：CN102315477A （11.01.2012）

[3] 1. D1（参见说明书第[0005]-[0060]段，图1-2）公开一种锂离子电池叠片式电芯，包括：第一极片和第二极片（对应于阳极极片和阴极极片），第一极耳和第二极耳（对应于阳极极耳和阴极极耳）；其中，第一极片具有集流体、形成于集流体正反面的膜片；第一极耳具有：两个焊接部；以及电连接于焊接部的外接部。第一极片具有两个第一焊接槽（对应于极耳收容凹槽），通过使极片的膜片露出集流体形成，分别容置第一极耳的两个焊接部，两个焊接部与两个焊接槽内的集流体焊接。第二极片与第一极片结构相同，第二极耳与第一极耳结构相同。隔离膜设置在第一极片和第二极片之间。可见，权利要求1与D1的区别是：具有形成在特定位置的阳极极片模切缺口和阴极极片模切缺口。权利要求1符合PCT33(2)，进而权利要求2-9也符合PCT33(2)。

[4] 对于上述区别，本领域技术人员知晓阴极、阳极集流体的边缘在切片过程中会形成毛刺，易引起内部短路。在所需部位通过在具有毛刺的边缘形成缺口来切除毛刺、以及模切方式是常用手段。权利要求1不符合PCT33(3)。

[5] 2. 权利要求2-9的附加技术特征属于常用技术手段。因此，权利要求2-9不符合PCT33(3)。

[6] 3. D2（参见说明书第[0025]-[0051]段，图1-10）公开一种电池卷绕机，包括：基体（即工作平台）、设置在基体上的放卷机构、卷针机构和卷绕纠偏机构；放卷机构包括正极、负极放卷单元及两个隔膜放卷单元；各卷料的料带分别经过各辊（隐含各放卷单元具有放卷辊）及夹持机构汇聚于卷绕机构后被卷成电芯。卷绕纠偏机构包括分别与放卷单元对应的纠偏单元，各纠偏单元包括用以检测放卷单元上的料带是否被输送（隐含各放卷单元具有传输机构）在设定位置上的位置检测传感器。可见，权利要求10与D2的区别是：包括阳极和阴极的极片清洗机构、极片模切机构、极耳供给机构、极耳连接机构；及各机构之间的位置。权利要求10符合PCT33(2)，进而权利要求11-35也符合PCT33(2)。

[7] 对于上述区别，如前述，D1公开了在极片上形成用于焊接放置极耳的焊接槽，设置极片模切缺口是本领域技术人员容易得到的。D1给出了按顺序设置极片清洗机构、极耳供给机构、极耳连接机构的技术启示；另外，本领域技术人员容易想到在适当位置设置极片模切机构。权利要求10不符合PCT33(3)。

[8] 4. 权利要求16-18的“感应机构”、“纠偏机构”被D2公开；权利要求30的“卷绕装置”被D2公开；权利要求11-15、19-29、31-35的附加技术特征以及权利要求16-18、30的其他附加技术特征属于常规选择。权利要求11-35也不符合PCT33(3)。

[9] 5. 权利要求1-35的主题符合PCT33(4)。

CosMX Exhibit 1003, Page 581 of 676

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

24341 7590 07/23/2021

Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
07/23/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

padocketingdepartment@morganlewis.com
vskliba@morganlewis.com

PTOL-90A (Rev. 04/07)

Office Action Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 10 May 2021.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-3,6,8-10,12 and 21-23 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3,6,8-10,12 and 21-23 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 28 February 2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9 March 2021 has been entered.

Response to Arguments

Applicant's arguments with respect to claim 1 have been considered but are not persuasive. Specifically, applicant argues the amended limitation "the first electrode plate notch has a depth in a width direction of the first electrode plate; and the first electrode plate notch has a width in a length direction of the first electrode plate" distinguishes from the prior art of record. However, as the prior art arrestor regions 40 are formed by laser ablation to have any desired shape or arrangement (see paragraph [0043] of Stern et al.) the regions are reasonably assumed to be three dimensional features which extend in length and width direction of the first electrode plate as required by the amendments. The claim does not preclude the depth or width of the notch from extending through the entire surface of the collector plate which appears to be shown by the prior art.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

Claims 1-3, 6 and 21-23 are rejected under 35 U.S.C. 103 as being unpatentable over Stern et al. (WO2012/072222 using US Pub 2013/0302674 as an English equivalent, both of record).

In regard to claim 1, Stern et al. teach a secondary-battery (lithium ion battery - paragraph [0035]) which may be a wound-type battery (paragraph [0008]), comprising:

a first electrode tab (connection lugs 50);

a first electrode plate (anode 10 or cathode 20), comprising:

a first current collector (collector substrate 60) ;

a first active substance (coating films 70), disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite the first surface (see paragraph [0018] - coating film preferably formed on both sides of the collector substrate);

a first electrode tab receiving groove (arrestor regions 40), defined by a portion of the first surface of the first current collector and the first active substance 70 on a periphery of the electrode tab receiving groove 40, the first electrode tab receiving groove 40 receiving the first electrode tab 50, wherein the first electrode tab 50 is electrically connected with the first current collector 60 through the first electrode tab receiving groove 40 (paragraph [0019], figure 6 and 9);

a first recess (additional arrestor region 40) that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess (see figure 3 annotated below);

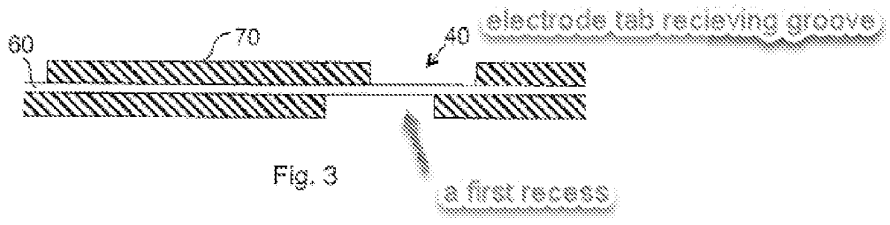


Fig. 3

a first electrode plate notch, disposed on an edge of the first electrode tab receiving groove; and the first electrode tab receiving groove is formed by the first current collector and at least two first active layer substance walls (see figure 9C below which was inadvertently omitted from the US PGPub but can be seen in the WO document and issued US Patent 10,062,897, paragraph [0020, 0044] - portion of collector substrate is also removed).

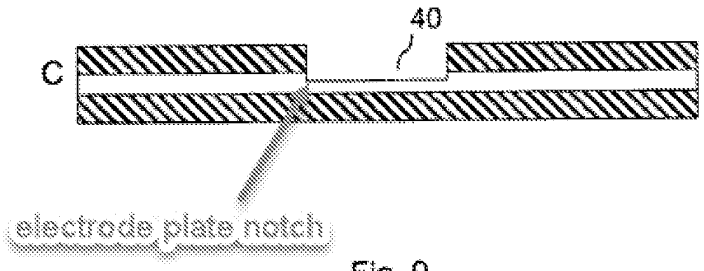


Fig. 9

Therefore, while the prior art does not disclose all of the claimed features in a single embodiment, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to form a wound battery assembly with the claimed electrode plate notches, disposed on an edge of the tab receiving grooves and recessed portion opposite thereof in the device of Stern et al. as all of the claimed features are described by the reference in a manner which could be combined together to obviate the claimed secondary battery.

In regard to **the amendment**, the first electrode plate notch (arrestor regions 40) are formed by laser ablation to have any desired shape or arrangement (see paragraph [0043]) and therefore the regions are reasonably assumed to be three dimensional features which extend in length and width direction of the first electrode plate (i.e. have a depth in a width direction of the first electrode plate, which is the horizontal direction in figure 9 above and a width in a length direction of the first electrode plate which is the direction coming into and out of the paper in figure 9 above, or vice versa) depending on the desired shape of the region (see MPEP 2144.04 Part IV). The Examiner notes the claims do not preclude the notch from extending through the width or the depth of the electrode plate.

In regard to claims 2 and 3, the prior art teach anode and cathode electrodes of the same structure which are interchangeably labeled as first or second electrodes and their respective components (each including tabs, plates, collectors, active material etc. - paragraph [0008]).

In regard to claim 6, a person of ordinary skill in the art would appreciate that the recess in electrode (arrestor regions of Stern et al.) may have different geometry (depending on the size of the electrode tabs which may be any size and shape (paragraphs [0019, 0044]) in a manner which obviates the claimed range absent evidence of criticality (see MPEP 2144.05) as changes to size and shape of the prior art notched groove portions is well with the level of ordinary skill in the art (MPEP 2144.04 Part IV).

In regard to claim 21 and 22, Stern et al. teach the first electrode tab receiving groove 40 is defined in the first active substance 17 and extends to the surface of the first current collector 60 (see figure 3), and the first electrode plate notch extends through the first current collector from the surface of the first current collector (figure 9, notch through entire cross section).

In regard to claim 23, Stern et al. teach a whole of the first electrode tab 50 is parallel with the surface of the first current collector 60 (figure 6).

Claims 8-10 and 12 are rejected under 35 U.S.C. 103 as being unpatentable over Stern et al. as applied to claim 1 above and further in view of Kim et al. (US Pub 2004/0161662 of record).

In regard to claims 8-10 and 12, Stern et al. teach electrode plates with grooves and notches (which are considered concave portions on both sides) which are connected to a lead tabs (connection lugs 50) as applied above but do not disclose insulating tapes on the connection portions. However, Kim et al. teach similar wound (jelly roll) type battery unit and winding method (see title) including an anode and positive electrode plate 35 including a positive electrode current collector 41, a positive active material layer 42, a negative electrode plate 26, negative electrode current collector 410, negative electrode tab welded to a negative electrode uncoated area 411 etc. and the desirability to include at

least four different insulating tapes 491, 492, 480, 481, 490, 890, 880 on various connections between uncoated portions of the current collector and leads tabs and other the components of the battery (see paragraphs [00400-0080], figures 4-8) which prevents short circuits from forming the battery during winding and covers burrs (paragraphs [0085-0086]) which are presumably single sided tapes as no double sided tapes are disclosed.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the instant application was filed to include insulating tapes at various portions of the positive electrode and negative electrode plate windings (including the concave notches and grooves) and lead tabs connections of Stern et al. as such prevents short circuits as taught by Kim et al.

The duplication as well as location and arrangement of those tapes is an obvious modification to the prior art depending on the winding structure and portions which are notched and potentially include burrs (see MPEP 2144.04 Part VI).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Morishima et al. (USP 8,232,008 newly cited) teaches a similar current collector 18 with stepped (notched) portions 26 which accommodate electrode tabs 18c (see figure 3).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached on Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Notice of References Cited	Application/Control No. 15/908,327	Applicant(s)/Patent Under Reexamination Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	Art Unit 1723	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-8232008-B2	07-2012	Morishima; Hideaki	H01M50/538	429/233
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC - Searched*		
Symbol	Date	Examiner
H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20	10/18/2019	NPD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East search with inventor/applicant search and text search of CPC classes H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431 (see attached)	10/18/2019	NPD
update search	01/27/2020	NPD
update with Global Dossier for CN counterpart prosecution	08/27/2020	NPD
update for recess on opposite side	03/04/2021	NPD
update	06/30/2021	NPD

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L10	83	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2021/06/30 08:15
L11	772	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/06/30 08:15
L12	3	(L10 L11) and notch with electrode.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/06/30 08:15
S1	2	cn-203574050-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:17
S2	38	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2019/10/17 13:17
S3	701	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/10/17 13:20
S4	4	(S2 S3) and notch with electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:21
S5	156,868	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/10/17 13:32

			DERWENT; IBM_TDB			
S6	22,720	(H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
S7	289	S6 and (electrode collector) with notch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:33
S8	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 13:39
S9	495	S6 and (electrode collector) with (notch groove) same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S10	423	S6 and (electrode collector) with (notch groove) with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S11	7	S6 and (electrode collector) with (notch groove) near3 edge with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:46
S12	54	S6 and (electrode collector) with (notch groove) near3 edge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:47
S13	57	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" |	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 13:49

		"20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" | "20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.				
S14	1	(13/593213).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:43
S15	5	("20060024572" | "20060063068" | "20070092791" | "20100233521" | "20110200865").PN. OR ("9219267").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2019/10/17 15:44
S16	3	S6 and (electrode collector) with (notch groove) with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:48
S17	3	S6 and notch$4 with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:51
S18	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 15:54
S19	0	(14/596873).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:57
S20	2	S6 and (electrode collector) with (notch groove) with chamfer$5	US-PGPUB; USPAT;	OR	ON	2019/10/17 16:05

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S21	77	S6 and (electrode collector) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:06
S22	15	S6 and (electrode collector) with chamfer$5 same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:08
S23	877	S6 and (electrode collector) same insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S24	40	S6 and (electrode collector) same insulat$5 with tape with (groove notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S25	4	S6 and (electrode collector) same fourth near2 insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:13
S26	206	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc. and notch with bottom	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/27 16:01
S27	2	cn-203733894-$.did.	US-PGPUB; USPAT; USOCR;	OR	ON	2020/08/26 16:03

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
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S29	2	"20150207111".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/08/27 10:29
S30	58	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" | "20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" | "20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/08/31 11:47
S31	0	(14/799345).APP.	USPAT; USOCR	OR	ON	2020/08/31 13:25
S32	1	(14/991686).APP.	USPAT; USOCR	OR	ON	2021/02/11 14:06

S33	58	("20010005561" | "20010019795" | "20020157242" | "20030077509" | "20030148173" | "20030232236" | "20040119442" | "20040127952" | "20050188533" | "20050272479" | "20060024572" | "20060105237" | "20060127762" | "20060154145" | "20060210872" | "20070031733" | "20070105014" | "20070231683" | "20080248386" | "20090029246" | "20090095808" | "20090117462" | "20090197162" | "20090202908" | "20090239133" | "20090248356" | "20100047685" | "20100167111" | "20110064991" | "20110123844" | "20110183183" | "20120015223" | "20120015236" | "20120107654" | "20120121965" | "20120177953" | "20130252053" | "20130302674" | "20140065457" | "20140113184" | "20140170467" | "20140322575" | "20150207111" | "20160013455" | "5478668" | "5910382" | "5916707" | "6040078" | "6224995" | "6432574" | "6991873" | "7092746" | "7364817" | "7432018" | "8440938" | "8592065" | "9276287").PN. OR ("9929393").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2021/02/11 14:06
S34	1	(13/990331).APP.	USPAT; USOCR	OR	ON	2021/03/04 08:41
S35	10	("20030228517" | "20050208354" | "20060035152" | "20070139001" | "20100028767" | "5766798" | "6151338" | "6162264" | "6187473" | "8679677").PN. OR ("10062897").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2021/03/04 08:41
S36	2	wo-2012072222-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/03/04 10:04

EAST Search History (Interference)

<This search history is empty>

6/30/2021 8:24:30 AM
C:\Users\ndaniello\Documents\EAST\Workspaces\15908327.wsp

INFORMATION DISCLOSURE STATEMENT BY APPLICANT Substitute for Form 1449-PTO				*Electronically filed May 10, 2021*	
				Application Number	*15/908,327*
				Filing Date	*February 28, 2018*
				First Named Inventor	*Peipei GUO*
				Art Unit	*1723*
				Examiner Name	*D'Aniello, Nicholas P*
Sheet	1	of	2	Attorney Docket Number	*024607-02-5055-US*

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number Number - Kind Code	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2011/0020694 A1	10-27-2011	Khakhalev et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code – Number - Kind Code *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
		CN101783402A	07-21-2010	AMPEREX TECHNOLOGY LTD		
		CN102315477A	11JAN2012	SHENZHEN YAKANG PREC MACHINERY CO LTD		
		CN103579666A	02-12-2014	WIDO NEW ENERGY CO LTD		
		CN1805183A	07-19-2006	SHENZHEN HAOPENG TECHNOLOGY CO [CN]		
		CN201336332Y	10-28-2009	SHENZHEN BETTERPOWER BATTERY C [CN]		
		CN 202373667U	08-08-2012	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD		
		CN202423456U	09-05-2012	YIYANG KELIYUAN BATTERY CO LTD		
		CN202839841U	03-27-2013	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD		
		CN203574050U	04-30-2014	AMPEREX TECHNOLOGY LTD; NINGDE AMPEREX TECHNOLOGY LTD		
		CN204538109U	08-05-2015	SHIDA BATTERY TECHNOLOGY CO LTD		
		CN204946995U	06JAN2016	NINGDE AMPEREX TECHNOLOGY LTD		
		JP2000323135A	11-24-2000	TOSHIBA BATTERY		

Examiner Signature	/NICHOLAS P D'ANIELLO/	Date Considered	06/29/2021

DB2/ 40844923.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.P.D/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT Substitute for Form 1449-PTO				*Electronically filed May 10, 2021*	
				Application Number	*15/908,327*
				Filing Date	*February 28, 2018*
				First Named Inventor	*Peipei GUO*
				Art Unit	*1723*
				Examiner Name	*D'Aniello, Nicholas P*
Sheet	2	of	2	Attorney Docket Number	*024607-02-5055-US*

NON PATENT LITERATURE DOCUMENTS		
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published
		Ningde Amperex Technology Limited, International Search Report and Written Opinion, PCT/CN2015/088638, 27MAY2016, 17 pgs.
		Chinese Office Action, CN201580082766.1, 27MAY2020, 7 pgs.
		Chinese Office Action, CN201580082766.1, 08JAN2021, 7 pgs.

Examiner Signature	/NICHOLAS P D'ANIELLO/	Date Considered	06/29/2021

DB2/ 40844923.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.P.D/

Electronically filed November 17, 2021

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo, et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Sir:

The enclosed Amendment is in response to the Office Action dated July 23, 2021 for the above identified patent application.

Petition for Extension of Time under 37 CFR 1.136. It is respectfully requested that the time for responding to the Office Action dated July 23, 2021 be extended for a period of 1 month from October 23, 2021 to November 23, 2021.

The Commissioner is hereby authorized to charge any required fee(s) to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 024607-02-5055-US).

Amendments to the Claims

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A secondary battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface;

a first electrode tab receiving groove, defined by a portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess;

a first electrode plate notch disposed on [[an]] a side edge of the first electrode tab receiving groove and extending through the first surface and the second surface of the first current collector; and

~~the first electrode plate notch has a depth in a width direction of the first electrode plate; and~~

~~the first electrode plate notch has a width in a length direction of the first electrode plate; and~~

the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls;

wherein the secondary battery is a wound-type secondary battery.

2. (Currently Amended) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector; and

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a second active substance, disposed on a surface of the second current collector;

a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch disposed on [[an]] a side edge of the second electrode tab receiving groove and extending through the surface of the second current collector.

3. (Previously Presented) The secondary battery according to claim 2, wherein:

the first electrode plate is an anode electrode plate;

the first current collector is an anode current collector;

the first active substance is an anode active substance;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first recess is an anode recess;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active substance is a cathode active substance;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove; and

the second electrode plate notch is a cathode electrode plate notch.

4. (Cancelled)

5. (Cancelled)

6. (Previously Presented) The secondary battery according to claim 3, wherein:

a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and

a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (Cancelled)

8. (Previously Presented) The secondary battery according to claim 3, further comprising:

a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and

a second insulating adhesive tape, disposed on the second active substance and facing the first electrode tab receiving groove.

9. (Previously Presented) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape, disposed on the anode recess.

10. (Previously Presented) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode recess, wherein the cathode recess and the cathode electrode tab receiving groove are disposed on opposite sides of the cathode current collector; and

the fourth insulating adhesive tape is disposed on the cathode recess.

11. (Cancelled)

12. (Previously Presented) The secondary battery according to claim 10, wherein:

each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape, and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (Cancelled)

21. (Previously Presented) The secondary battery according to claim 1, wherein:

the first electrode tab receiving groove is defined by the first active substance and extends to the first surface of the first current collector; and

the first electrode plate notch extends through the first current collector from the first surface of the first current collector.

22. (Previously Presented) The secondary battery according to claim 2, wherein:

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the second electrode tab receiving groove is defined in the second active substance and extends to the surface of the second current collector; and

the second electrode plate notch extends through the second current collector from the surface of the second current collector.

23. (Previously Presented) The secondary battery according to claim 1, wherein a whole of the first electrode tab is parallel with the first surface of the first current collector.

24. (New) The secondary battery according to claim 1, wherein a bottom of the first electrode plate notch is located between the first active substance disposed on two opposite sides of the first electrode tab receiving groove in the length direction of the first electrode plate.

REMARKS

This amendment responds to the office action mailed July 23, 2021. In the office action, the Examiner:

- rejected claims 1-3, 6 and 21-23 under 35 U.S.C. 103 as being unpatentable over Stern et al. (WO 2012/072222), using U.S. Patent Publication No. 2013/0302674 as an English equivalent; and
- rejected claims 8-10 and 12 under 35 U.S.C. 103 as being unpatentable over Stern as applied to claim 1 above, and further in view of Kim et al. (U.S. Patent Publication No. 2004/0161662).

SUBSTANCE OF INTERVIEW

The Applicant thanks Primary Examiner D'aniello for the opportunity to discuss the application during a telephone interview on November 15, 2021 with Yalei Sun (undersigned attorney). During the interview, the Applicant and the Examiner discussed proposed amendments to claim 1. The Examiner agreed that the amended claim 1 overcomes the cited reference but requires a new search.

REMARKS CONCERNING CLAIMS

Claims 1 and 2 have been amended. Claim 24 is a new claim. Support for the amendments can be found in at least paragraphs [0003], [0012], [0013], [0019], [0025], [0034], [0128], and [0129] in connection with FIG. 5 of the published application. No new matter has been added.

With respect to all amendments, Applicant has not dedicated or abandoned any unclaimed subject matter. Moreover, Applicant has not acquiesced to any characterizations of the invention, nor any rejections or objections of the claims, made by the Examiner. Moreover, the Applicant hereby rescinds any prior disclaimer of claim scope, to the extent they exist, made during the prosecution of this application or made during the prosecution of any patent or other related patents/applications, and advises the Examiner that any such previous disclaimers and the cited references that they were made to avoid may need to be revisited.

After entry of this amendment, the pending claims are: claims 1-3, 6, 8-10, 12, and 21-24.

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REMARKS CONCERNING REJECTIONS UNDER 35 U.S.C. 103

I. **REJECTION OF CLAIMS 1-3, 6 AND 21-23 UNDER 35 U.S.C. 103 AS BEING UNPATENTABLE OVER STERN**

Amended claim 1 recites:

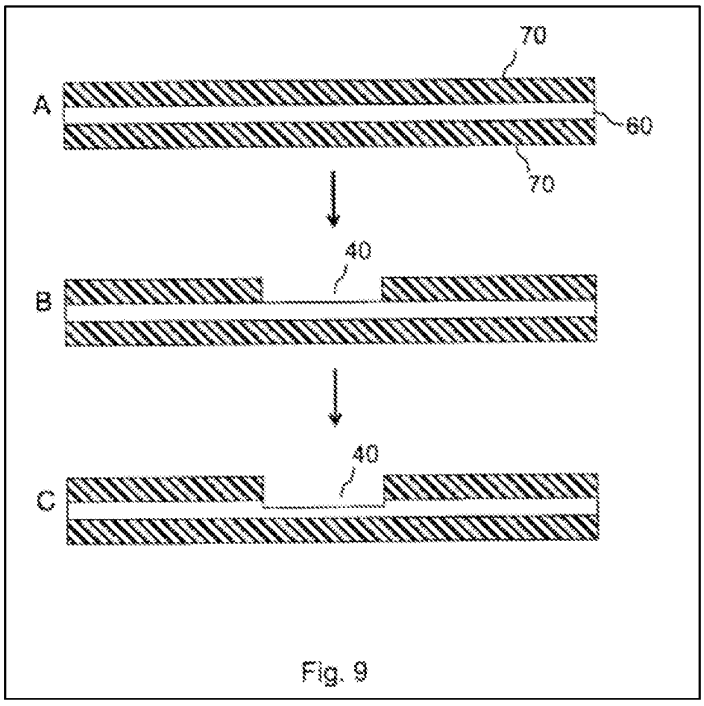
> …
>
> a first electrode plate notch [corresponding to Element 1014 or 1034 in FIG. 5(a) and 5(b)] disposed on a side edge of the first electrode tab receiving groove [Element 1013 or 1033 in FIG. 5(a) and 5(b)] and extending through the first surface and the second surface of the first current collector, wherein:
>
> the first electrode plate notch has a depth [direction W in FIG. 5(a) and 5(b)] in a width direction of the first electrode plate; and
>
> the first electrode plate notch has a width in a length direction [direction L in FIG. 5(a) and 5(b)] of the first electrode plate [Element 101 or 103 in FIG. 5(a) and 5(b)];

(Emphasis added)

The notations in square brackets in the above claim limitation denote the corresponding element numbers in the figures.

The Office Action cites Stern at 8:66 – 9:8 ("a thin layer of the collector substrate 60, to be removed by means of laser … Therefore, a collector substrate 60 in the arrester region 40 can be thinned down in a targeted manner") and FIG. 9C (reproduced below) for allegedly teaching the claimed "first electrode plate notch."

Applicant respectfully disagrees for the reasons explained below.



See FIG. 9 of Stern.

A. Stern does not teach "the first electrode plate notch [is] disposed on a side edge of the first electrode tab receiving groove and extend[s] through the first surface and the second surface of the first current collector"

Amended claim 1 requires that the first electrode plate notch be "disposed on a side edge of the first electrode tab receiving groove and extending through the first surface and the second surface of the first current collector."

The shape and location of the first electrode plate notch is clearly depicted in FIGS. 5(a) and 5(b) of the present application (partially reproduced below), which are plan views of the electrode plates of the secondary battery cell.

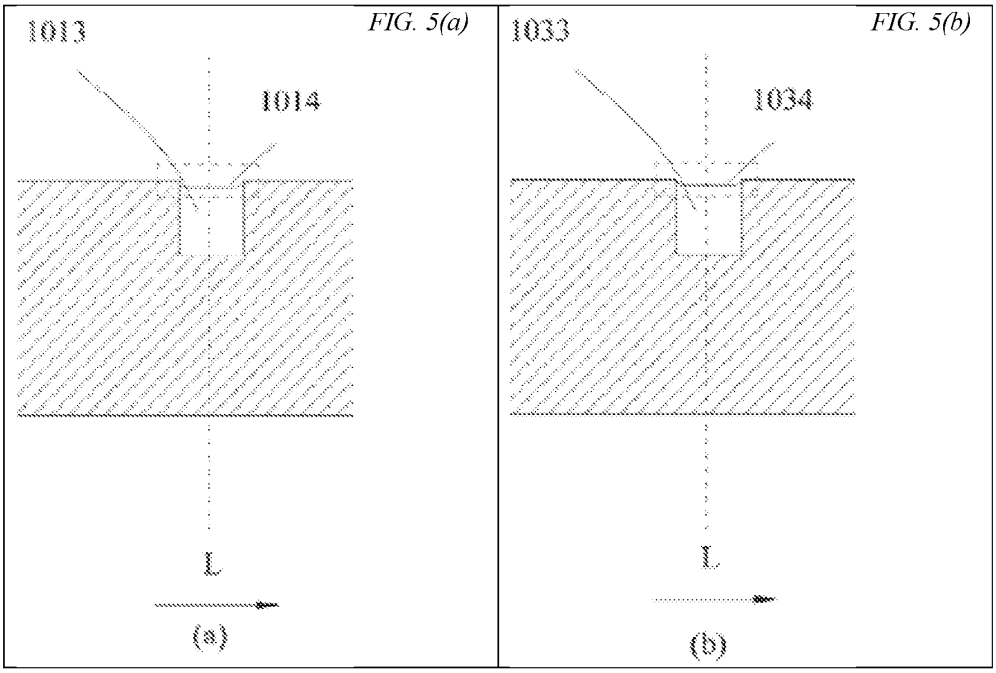
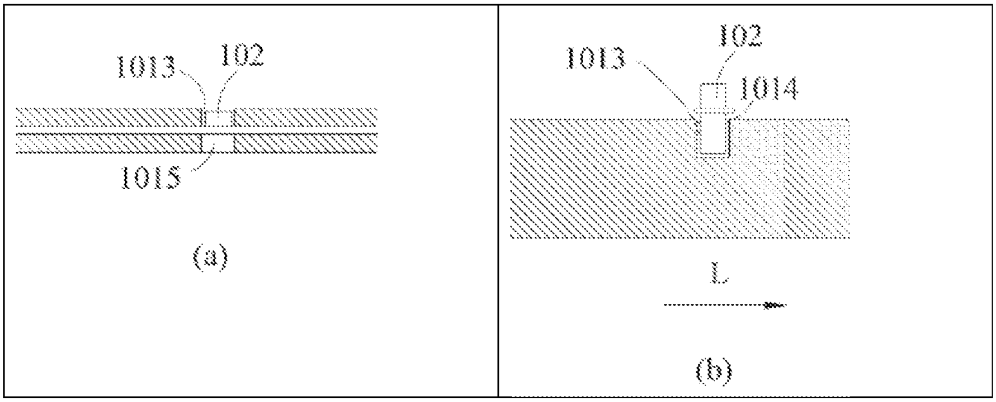
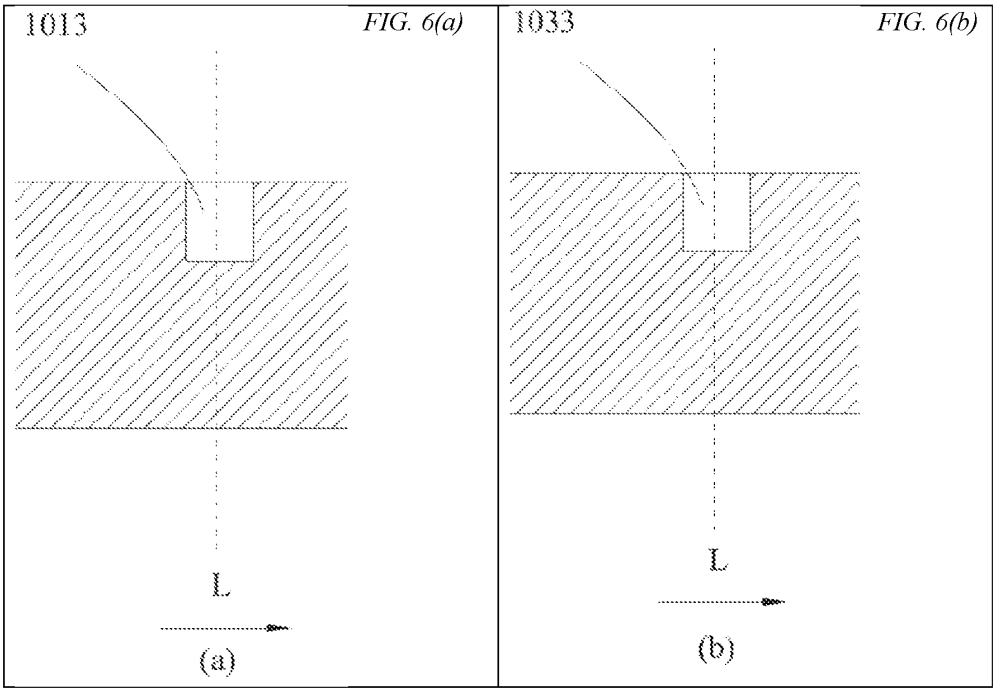


FIG. 5(a) *FIG. 5(b)*

FIGS. 2(a) and 2(b) of the present application (a portion of which being reproduced below) illustrates that the first electrode plate notch 1014 is not visible in the cross-sectional view (a) but visible in the plan view (b).



For comparison, portions of FIGS. 6(a) and 6(b) of the present application, which are plan views of the electrode plates of a secondary battery cell that has no notch at all, are also reproduced below.



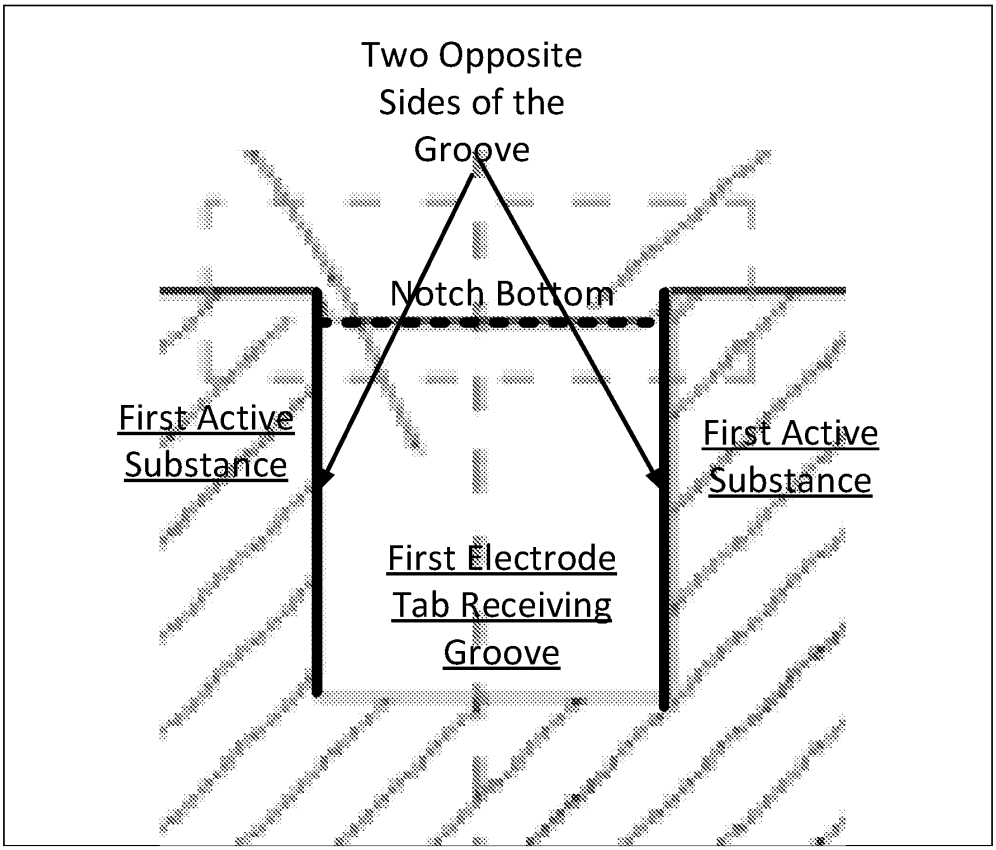
In contrast, FIG. 9A-9C of Stern above are "cross-sectional views through an electrode material during a production process [of an arrester region 40 by laser ablation]" ([0033]). Note that the removal of a thin layer of the collector substrate 60 in the arrester region 40 depicted in FIG. 9C above happens in the thickness direction of the collector substrate 60 (which is therefore visible in cross-sectional view), not in the width direction of the collector substrate 60 (which is only visible in plan view) as required by the amended claim 1.

Thus, for at least the above reasons, claim 1 and its associated dependent claims 2, 3, 6, and 21-23 are patentable over Stern.

Claim 24

New claim 24 further recites that the bottom of the first electrode plate notch (as depicted in the amplified portion of FIG. 5(a) with annotations below) is located between the first active substance disposed on two opposite sides of the first electrode tab receiving groove (the shade regions) in the length direction of the first electrode plate.

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Stern fails to teach or suggest a notch required by the amended claim 1. Therefore, claim 24 is further patentable over Stern.

Applicant respectfully requests that these rejections be withdrawn.

II. **REJECTION OF CLAIMS 8-10 AND 12 UNDER 35 U.S.C. 103 AS BEING UNPATENTABLE OVER STERN AS APPLIED TO CLAIM 1 ABOVE, AND FURTHER IN VIEW OF KIM**

Claims 8-10 and 12 depend from claim 1, and thus include all the limitations of claim 1 as amended. As discussed above, Stern does not disclose each and every limitation of claim 1 as amended. Furthermore, Kim is not cited for, and does not disclose, the limitations that are missing from Stern. Thus, there is no prima facie case of obviousness for claim 1 and its associated dependent claims 8-10 and 12, over the cited combination of Stern and Kim.

Applicant respectfully requests that these rejections be withdrawn.

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CONCLUDING REMARKS

By responding in the foregoing remarks only to particular positions asserted by the examiner, the Applicant does not necessarily acquiesce in other positions that have not been explicitly addressed. In addition, the Applicant's arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

In light of the above amendments and remarks, the Applicant respectfully requests that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney at (650) 843-7558, if a telephone call could help resolve any remaining items.

Respectfully submitted,

Date: November 17, 2021

/Yalei Sun/ 57,765

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1400 Page Mill Road
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E-mail: yalei.sun@morganlewis.com

Electronic Patent Application Fee Transmittal	
Application Number:	15908327
Filing Date:	28-Feb-2018
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Filer:	Yalei Sun/Jacqueline Yu
Attorney Docket Number:	024607-02-5055-US
Filed as Large Entity	
Filing Fees for Utility under 35 USC 111(a)	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	220	220
Miscellaneous:				
		Total in USD ($)		**220**

Electronic Acknowledgement Receipt	
EFS ID:	44309676
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	24341
Filer:	Yalei Sun
Filer Authorized By:	
Attorney Docket Number:	024607-02-5055-US
Receipt Date:	17-NOV-2021
Filing Date:	28-FEB-2018
Time Stamp:	19:02:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$220
RAM confirmation Number	E2021AGJ02450443
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		024607-02-5055-US_P20160383US1_RNFOA.pdf	1914258 c87c50caefb594ae32eb661eff3282862da6b5fc	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	12

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	38809 0f641c02c079400367fa2031056ea5d6bcf46dc5	no	2

Warnings:

Information:

Total Files Size (in bytes):	1953067

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

24341 7590 11/18/2021
Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
11/18/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

padocketingdepartment@morganlewis.com
vskliba@morganlewis.com

PTOL-90A (Rev. 04/07)

Applicant-Initiated Interview Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.		
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 2

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
NICHOLAS P D'ANIELLO	Primary Examiner	Telephonic
Yalei Sun	Attorney of Record	

Date of Interview: 15 November 2021

Issues Discussed:

35 U.S.C. 103

Applicant argues that the prior art includes a notch shown in a cross sectional view in figure 9 as opposed to the notch shown in the instant application figure 5 which is shown in a plan view and include different structures relating to which surfaces the notch extends through. The language below concerning the notch extending through the first surface and the second surface appears to distinguish from the prior art of record. Further search and/or consideration of the more specific structure will be required.

Proposed Amendment(s)

Applicant proposes to amendment "a first electrode plate notch disposed on [[an]] a side edge of the first electrode tab receiving groove and extending through the first surface and the second surface of the first current collector" which appears to distinguish from the prior art which has the notch extending through the first surface and not through the second opposite surface.

☑ Attachment

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general

indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo, et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

PHONE INTERVIEW AGENDA

Amendments to the Claims

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A secondary battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface;

a first electrode tab receiving groove, defined by a portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess;

a first electrode plate notch disposed on [[an]] a side edge of the first electrode tab receiving groove and extending through the first surface and the second surface of the first current collector; and

~~the first electrode plate notch has a depth in a width direction of the first electrode plate; and~~

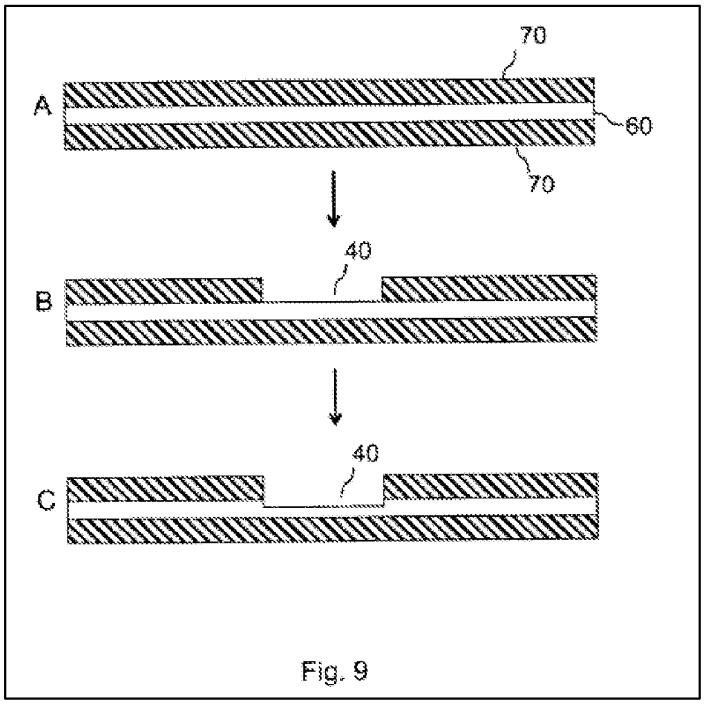
~~the first electrode plate notch has a width in a length direction of the first electrode plate; and~~

the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls;

wherein the secondary battery is a wound-type secondary battery.

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The Office Action cites Stern at 8:66 – 9:8 ("a thin layer of the collector substrate 60, to be removed by means of laser … Therefore, a collector substrate 60 in the arrester region 40 can be thinned down in a targeted manner") and FIG. 9C (reproduced below) for allegedly teaching the claimed "first electrode plate notch." Applicant respectfully disagrees for the reasons explained below.



Stern at FIG. 9.

Amended claim 1 requires that the first electrode plate notch be "disposed on a side edge of the first electrode tab receiving groove and extending through the first surface and the second surface of the first current collector."

The shape and location of the first electrode plate notch is clearly depicted in FIGS. 5(a) and 5(b) of the present application (partially reproduced below), which are plan views of the electrode plates of the secondary battery cell.

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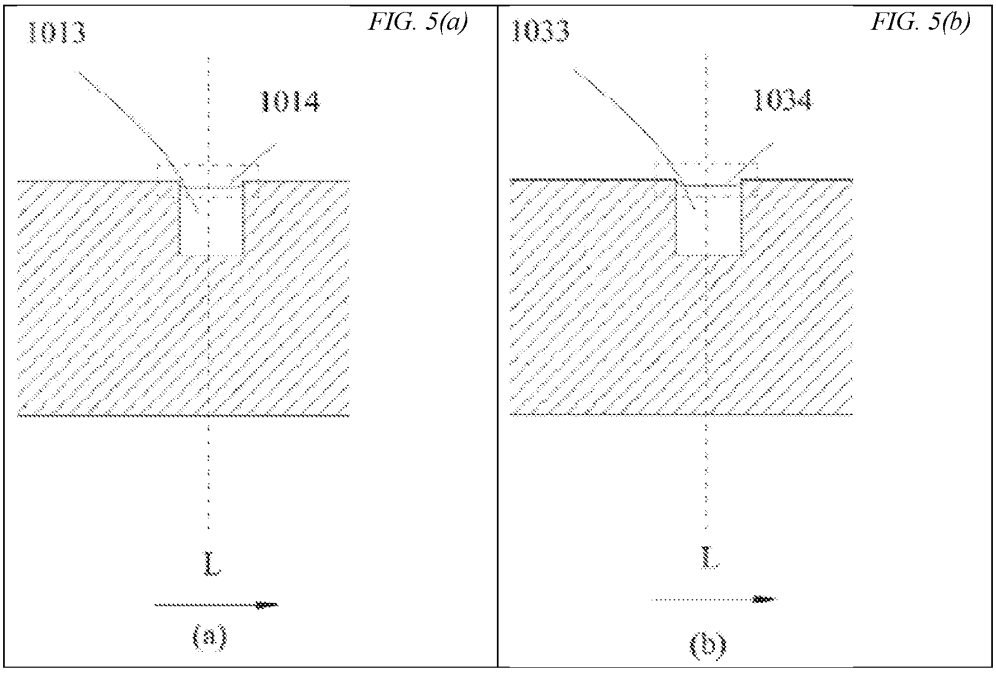


FIG. 5(a) *FIG. 5(b)*

For comparison, portions of FIGS. 6(a) and 6(b) of the present application, which are plan views of the he electrode plates of a secondary battery cell that has no notch at all, are also reproduced below.

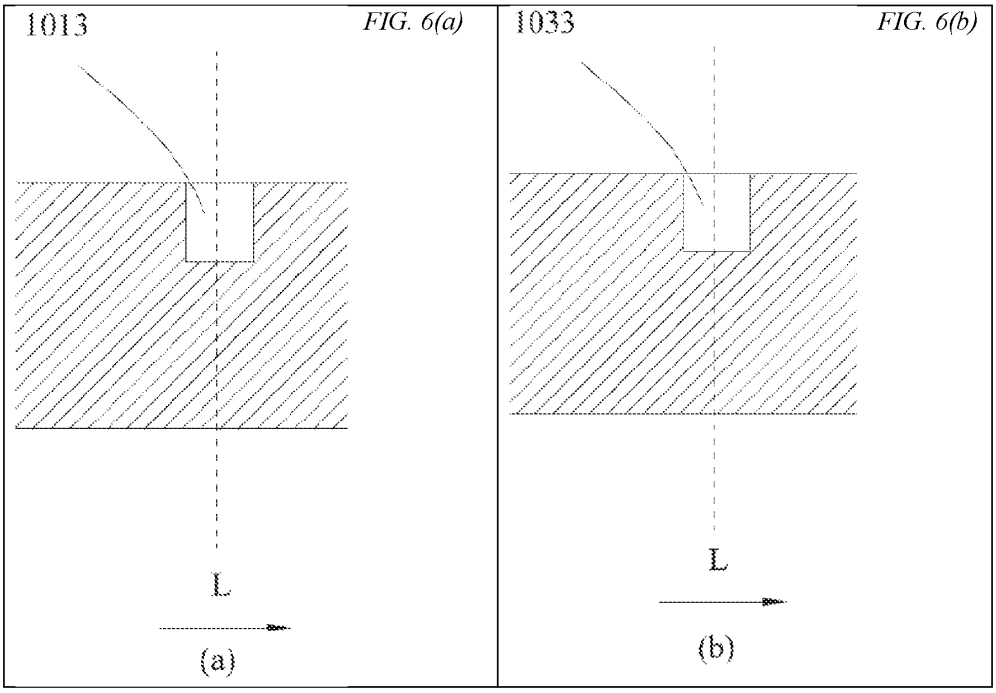


FIG. 6(a) *FIG. 6(b)*

In contrast, FIG. 9A-9C of Stern above are "cross-sectional views through an electrode material during a production process [of an arrester region 40 by laser ablation]" ([0033]). Note that the removal of a thin layer of the collector substrate 60 in the arrester region 40 depicted in FIG. 9C above happens in the thickness direction of the collector substrate 60 (which is therefore visible in cross-sectional view), not in the width direction of the collector substrate 60 (which is only visible in plan view) as required by the amended claim 1.

Thus, for at least the above reasons, claim 1 and its associated dependent claims 2, 3, 6, and 21-23 are patentable over Stern.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

24341 7590 01/12/2022
Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

EXAMINER
D'ANIELLO, NICHOLAS P

ART UNIT	PAPER NUMBER
1723	

DATE MAILED: 01/12/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

TITLE OF INVENTION: SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/12/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24341 7590 01/12/2022
Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

TITLE OF INVENTION: SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/12/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
D'ANIELLO, NICHOLAS P	1723	429-211000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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EXAMINER	
D'ANIELLO, NICHOLAS P	
ART UNIT	**PAPER NUMBER**
1723	

DATE MAILED: 01/12/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/908,327	Applicant(s) Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	Art Unit 1723	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 18 November 2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are See Continuation Sheet . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☑ All b) ☐ Some* c) ☐ None of the:

   1. ☑ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Continuation of 3. The allowed claim(s) is/are: 1-3,6,8-10,12 and 21-24

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Yalei Sun on 6 December 2021.

The application has been amended as follows:

Amend the claims as seen in the attached document.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance: Applicant's arguments filed 17 November 2021 are persuasive.

Specifically, while the closest prior art (including applicant's own work) teaches grooves or notches for receiving an electrode tab on a current collector as previously applied, the prior art fails to teach or render obvious a secondary battery, comprising: a first electrode tab; a first electrode plate, comprising: a first current collector; and a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface; a first electrode tab receiving groove, defined by an exposed portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab,

wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove; a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess; a first electrode plate notch disposed on a side edge of the first electrode tab receiving groove and extending through the second surface and the first surface of the first current collector; and the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls; wherein the secondary battery is a wound-type secondary battery.

Conversely, while the prior art teaches the presence of notches or grooves on various portions of the current collectors, the combination and orientation of the notch and the groove together required by the instant claims would not have been obvious to one of ordinary skill in the art as applicant argues.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Examiner-Initiated Interview Summary	**Application No.** 15/908,327	**Applicant(s)** Guo et al.		
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
NICHOLAS P D'ANIELLO	Primary Examiner	Telephonic
Yalei Sun	Attorney of Record	

Date of Interview: 06 December 2021

Issues Discussed:

Proposed Amendment(s)

An Examiner's amendment to place the application in condition for allowance was proposed and accepted. The amendment includes describing the electrode tab receiving groove as being an "exposed" portion of the first surface of the current collector as shown in the figures of the instant application.

☑ Attachment

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC							
Symbol						Type	Version
H01M	/	50	/	54		F	2021-01-01
H01M	/	10	/	0587		I	2013-01-01
H01M	/	10	/	0409		I	2013-01-01
H01M	/	50	/	528		I	2021-01-01
H01M	/	50	/	538		I	2021-01-01
H01M	/	10	/	0431		I	2013-01-01
H01M	/	10	/	0525		I	2013-01-01
H01M	/	10	/	0585		I	2013-01-01
H01M	/	2220	/	20		A	2013-01-01

CPC Combination Sets								
Symbol						Type	Set	Ranking	Version
	/		/						

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	14 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20211209

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H01M	/	10	/	00	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	14 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20211209

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	22												
2	2	11	23												
3	3	12	24												
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9	21														

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	14 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office Part of Paper No.: 20211209

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC - Searched*		
Symbol	**Date**	**Examiner**
H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20	10/18/2019	NPD
H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50	12/14/2021	NPD

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
East search with inventor/applicant search and text search of CPC classes H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0431 (see attached)	10/18/2019	NPD
update search	01/27/2020	NPD
update with Global Dossier for CN counterpart prosecution	08/27/2020	NPD
update for recess on opposite side	03/04/2021	NPD
update	06/30/2021	NPD
update with interference and new CPC classes	12/14/2021	NPD

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H01M	50/54,528,538; 10/0409,0431,0525,0585,0587	12/14/2021	NPD

/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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S1	2	cn-203574050-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:17
S2	38	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2019/10/17 13:17
S3	701	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/10/17 13:20
S4	4	(S2 S3) and notch with electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:21
S5	156,868	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:32
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S7	289	S6 and (electrode collector) with notch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:33
S8	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 13:39
S9	495	S6 and (electrode collector) with (notch groove) same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S10	423	S6 and (electrode collector) with (notch groove) with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:41
S11	7	S6 and (electrode collector) with (notch groove) near3 edge with (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:46
S12	54	S6 and (electrode collector) with (notch groove) near3 edge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 13:47
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S16	3	S6 and (electrode collector) with (notch groove) with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:48
S17	3	S6 and notch$4 with burr	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 15:51
S18	285	("6300002").URPN.	USPAT	OR	ON	2019/10/17 15:54
S19	0	(14/596873).APP.	USPAT; USOCR	OR	ON	2019/10/17 15:57
S20	2	S6 and (electrode collector) with (notch groove) with chamfer$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:05
S21	77	S6 and (electrode collector) with chamfer$5	US-PGPUB; USPAT; USOCR;	OR	ON	2019/10/17 16:06

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S22	15	S6 and (electrode collector) with chamfer$5 same (tab terminal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:08
S23	877	S6 and (electrode collector) same insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S24	40	S6 and (electrode collector) same insulat$5 with tape with (groove notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:10
S25	4	S6 and (electrode collector) same fourth near2 insulat$5 with tape	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/17 16:13
S26	206	(H01M2/266 or H01M2/22 or H01M2/263 or H01M10/0409 or H01M10/0587 or H01M10/0585 or H01M10/0525 or H01M10/0431 or H01M2220/20).cpc. and notch with bottom	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/27 16:01
S27	2	cn-203733894-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/08/26 16:03
S28	2	cn-202423456-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2020/08/26 16:03

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S32	1	(14/991686).APP.	USPAT; USOCR	OR	ON	2021/02/11 14:06
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S36	2	wo-2012072222-$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/03/04 10:04
S37	83	((("NINGDE") near3 ("AMPEREX") near3 ("TECHNOLOGY") near3 ("LIMITED"))).AS,AANM.	USPAT	OR	ON	2021/06/30 08:15
S38	772	((("GUO") near3 ("Peipei")) OR (("ZHAO") near3 ("Yi")) OR (("HE") near3 ("Ping")) OR (("FANG") near3 ("Hongxin")) OR (("CHENG") near3 ("Wenqiang"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/06/30 08:15
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S43	1,271,546	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/12/03 10:27
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S46	287	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc. and notch$4 with collector and (wound wind$4 jelly)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/12/03 10:28
S47	3	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2021/12/03 10:30

		Y02P70/50).cpc. and notch$4 with expos$4 near3 collector and (wound wind$4 jelly)	DERWENT; IBM_TDB			
S48	0	(14/799345).APP.	USPAT; USOCR	OR	ON	2021/12/03 10:36

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L4	133	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc. and electrode with (lead tab) with (notch groove).clm.	USPAT	OR	ON	2021/12/14 11:59
L5	7	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc. and electrode with active with (lead tab) with (notch groove).clm.	USPAT	OR	ON	2021/12/14 12:00
S49	1	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc. and notch$4 with expos$4 near3 collector and (wound wind$4 jelly)	USPAT	OR	ON	2021/12/03 10:30
S50	1	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc. and notch$4 with expos$4 near3 collector.clm.	USPAT	OR	ON	2021/12/03 10:31
S51	12	(H01M50/54 or H01M10/0409 or H01M10/0431 or H01M10/0525 or H01M10/0585 or	USPAT	OR	ON	2021/12/03 10:33

		H01M10/0587 or H01M50/528 or H01M50/538 or H01M2220/20 or Y02E60/10 or Y02P70/50).cpc. and notch$4 near3 collector.clm.				

12/14/2021 12:01:04 PM
C:\Users\ndaniello\Documents\EAST\Workspaces\15908327.wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo, et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

EXAMINER'S AMENDMENT

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A secondary battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface;

a first electrode tab receiving groove, defined by an exposed portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess;

a first electrode plate notch disposed on a side edge of the first electrode tab receiving groove and extending through the second surface and the first surface of the first current collector; and

the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls;

wherein the secondary battery is a wound-type secondary battery.

2. (Previously Presented) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector; and

a second active substance, disposed on a surface of the second current collector;

a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch disposed on a side edge of the second electrode tab receiving groove and extending through the surface of the second current collector.

3. (Previously Presented) The secondary battery according to claim 2, wherein:

the first electrode plate is an anode electrode plate;

the first current collector is an anode current collector;

the first active substance is an anode active substance;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first recess is an anode recess;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active substance is a cathode active substance;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove; and

the second electrode plate notch is a cathode electrode plate notch.

4. (Cancelled)

5. (Cancelled)

6. (Previously Presented) The secondary battery according to claim 3, wherein:

a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and

a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (Cancelled)

8. (Previously Presented) The secondary battery according to claim 3, further comprising:

a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and

a second insulating adhesive tape, disposed on the second active substance and facing the first electrode tab receiving groove.

9. (Previously Presented) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape, disposed on the anode recess.

10. (Previously Presented) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode recess, wherein the cathode recess and the cathode electrode tab receiving groove are disposed on opposite sides of the cathode current collector; and

the fourth insulating adhesive tape is disposed on the cathode recess.

11. (Cancelled)

12. (Previously Presented) The secondary battery according to claim 10, wherein:

each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape, and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (Cancelled)

21. (Previously Presented) The secondary battery according to claim 1, wherein:

the first electrode tab receiving groove is defined by the first active substance and extends to the first surface of the first current collector; and

the first electrode plate notch extends through the first current collector from the first surface of the first current collector.

22. (Previously Presented) The secondary battery according to claim 2, wherein:

the second electrode tab receiving groove is defined in the second active substance and extends to the surface of the second current collector; and

the second electrode plate notch extends through the second current collector from the surface of the second current collector.

23. (Previously Presented) The secondary battery according to claim 1, wherein a whole of the first electrode tab is parallel with the first surface of the first current collector.

24. (Previously Presented) The secondary battery according to claim 1, wherein a bottom of the first electrode plate notch is located between the first active substance disposed on two opposite sides of the first electrode tab receiving groove in the length direction of the first electrode plate.

Bibliographic Data

Application No: 15/908,327

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /NICHOLAS P D'ANIELLO/ Examiner's Signature | Initials

Title: SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
02/28/2018	429	1723	024607-02-5055-US
RULE			

APPLICANTS

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Ping He, Ningde, CHINA

Hongxin Fang, Ningde, CHINA

Wenqiang Cheng, Ningde, CHINA

CONTINUING DATA

This application is a CON of PCT/CN2015/088638 08/31/2015

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

03/23/2018

STATE OR COUNTRY

CHINA

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Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124
UNITED STATES

FILING FEE RECEIVED

$1,720

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

24341 7590 01/21/2022

Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1723	

NOTIFICATION DATE	DELIVERY MODE
01/21/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

padocketingdepartment@morganlewis.com
vskliba@morganlewis.com

PTOL-90A (Rev. 04/07)

Corrected ***Notice of Allowability***	**Application No.** 15/908,327	**Applicant(s)** Guo et al.	
	Examiner NICHOLAS P D'ANIELLO	**Art Unit** 1723	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 18 November 2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are See Continuation Sheet . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Continuation of 3. The allowed claim(s) is/are: 1-3,6,8-10,12 and 21-24

NOTE - This CORRECTED NOTICE OF ALLOWANCE includes a correction on the PTO-37, the previous notice of allowance mailed 12 January 2022 noted that foreign priority was claimed when in fact this application is a CON of a PCT which does not have a foreign priority claim.

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Yalei Sun on 6 December 2021.

The application has been amended as follows:

Amend the claims as seen in the attached document.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance: Applicant's arguments filed 17 November 2021 are persuasive.

Specifically, while the closest prior art (including applicant's own work) teaches grooves or notches for receiving an electrode tab on a current collector as previously applied, the prior art fails to teach or render obvious a secondary battery, comprising: a first electrode tab; a first electrode plate, comprising: a first current collector; and a first active substance, disposed on a first surface of the first

current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface; a first electrode tab receiving groove, defined by an exposed portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove; a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess; a first electrode plate notch disposed on a side edge of the first electrode tab receiving groove and extending through the second surface and the first surface of the first current collector; and the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls; wherein the secondary battery is a wound-type secondary battery.

Conversely, while the prior art teaches the presence of notches or grooves on various portions of the current collectors, the combination and orientation of the notch and the groove together required by the instant claims would not have been obvious to one of ordinary skill in the art as applicant argues.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS P D'ANIELLO whose telephone number is (571)270-3635. The examiner can normally be reached Monday to Friday 9am to 5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICHOLAS P D'ANIELLO/
Primary Examiner, Art Unit 1723

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

CPC							
Symbol						Type	Version
H01M	/	50	/	54		F	2021-01-01
H01M	/	10	/	0587		I	2013-01-01
H01M	/	10	/	0409		I	2013-01-01
H01M	/	50	/	528		I	2021-01-01
H01M	/	50	/	538		I	2021-01-01
H01M	/	10	/	0431		I	2013-01-01
H01M	/	10	/	0525		I	2013-01-01
H01M	/	10	/	0585		I	2013-01-01
H01M	/	2220	/	20		A	2013-01-01

CPC Combination Sets								
Symbol						Type	Set	Ranking	Version
	/		/						

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	14 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20220114

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H01M	/	10	/	00	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	14 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/908,327	Guo et al.
	Examiner	Art Unit
	NICHOLAS P D'ANIELLO	1723

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	22												
2	2	11	23												
3	3	12	24												
4	6														
5	8														
6	9														
7	10														
8	12														
9	21														

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/NICHOLAS P D'ANIELLO/ Primary Examiner, Art Unit 1723	14 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office Part of Paper No.: 20220114

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Peipei Guo, et al.	Confirmation No.:	2611
Serial No.:	15/908,327	Art Unit:	1723
Filed:	February 28, 2018	Examiner:	D'aniello, Nicholas P.
For:	*Secondary Battery Cell And Winding Formation System Thereof*	Attorney Docket No.:	024607-02-5055-US

EXAMINER'S AMENDMENT

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A secondary battery, comprising:

a first electrode tab;

a first electrode plate, comprising:

a first current collector; and

a first active substance, disposed on a first surface of the first current collector and a second surface of the first current collector, wherein the second surface is opposite to the first surface;

a first electrode tab receiving groove, defined by an exposed portion of the first surface of the first current collector and the first active substance on a periphery of the first electrode tab receiving groove, the first electrode tab receiving groove receiving the first electrode tab, wherein the first electrode tab is electrically connected with the first current collector through the first electrode tab receiving groove;

a first recess that is opposite to the first electrode tab receiving groove, defined by a corresponding portion of the second surface of the first current collector and the first active substance on a periphery of the first recess;

a first electrode plate notch disposed on a side edge of the first electrode tab receiving groove and extending through the second surface and the first surface of the first current collector; and

the first electrode tab receiving groove is formed by the first current collector and at least two first active substance walls;

wherein the secondary battery is a wound-type secondary battery.

2. (Previously Presented) The secondary battery according to claim 1, further comprising:

a second electrode tab;

a second electrode plate, comprising:

a second current collector; and

a second active substance, disposed on a surface of the second current collector;

a second electrode tab receiving groove, configured to receive the second electrode tab, wherein the second electrode tab is electrically connected with the second current collector through the second electrode tab receiving groove; and

a second electrode plate notch disposed on a side edge of the second electrode tab receiving groove and extending through the surface of the second current collector.

3. (Previously Presented) The secondary battery according to claim 2, wherein:

the first electrode plate is an anode electrode plate;

the first current collector is an anode current collector;

the first active substance is an anode active substance;

the first electrode tab is an anode electrode tab;

the first electrode tab receiving groove is an anode electrode tab receiving groove;

the first recess is an anode recess;

the first electrode plate notch is an anode electrode plate notch;

the second electrode plate is a cathode electrode plate;

the second current collector is a cathode current collector;

the second active substance is a cathode active substance;

the second electrode tab is a cathode electrode tab;

the second electrode tab receiving groove is a cathode electrode tab receiving groove; and

the second electrode plate notch is a cathode electrode plate notch.

4. (Cancelled)

5. (Cancelled)

6. (Previously Presented) The secondary battery according to claim 3, wherein:

a length of the first electrode plate notch is 0.9-1.2 times a length of the first electrode tab receiving groove along a length direction of the first electrode plate; and

a width of the first electrode plate notch is 0.2-0.8 times a width of the first electrode tab receiving groove along a width direction of the first electrode plate.

7. (Cancelled)

8. (Previously Presented) The secondary battery according to claim 3, further comprising:

a first insulating adhesive tape, disposed on the second electrode tab receiving groove; and

a second insulating adhesive tape, disposed on the second active substance and facing the first electrode tab receiving groove.

9. (Previously Presented) The secondary battery according to claim 8, further comprising:

a third insulating adhesive tape, disposed on the anode recess.

10. (Previously Presented) The secondary battery according to claim 8, further comprising:

a fourth insulating adhesive tape;

the cathode electrode plate comprising a cathode recess, wherein the cathode recess and the cathode electrode tab receiving groove are disposed on opposite sides of the cathode current collector; and

the fourth insulating adhesive tape is disposed on the cathode recess.

11. (Cancelled)

12. (Previously Presented) The secondary battery according to claim 10, wherein:

each of the first insulating adhesive tape, the second insulating adhesive tape, the third insulating adhesive tape, and the fourth insulating adhesive tape is a single-sided insulating adhesive tape.

13-20. (Cancelled)

21. (Previously Presented) The secondary battery according to claim 1, wherein:

the first electrode tab receiving groove is defined by the first active substance and extends to the first surface of the first current collector; and

the first electrode plate notch extends through the first current collector from the first surface of the first current collector.

22. (Previously Presented) The secondary battery according to claim 2, wherein:

the second electrode tab receiving groove is defined in the second active substance and extends to the surface of the second current collector; and

the second electrode plate notch extends through the second current collector from the surface of the second current collector.

23. (Previously Presented) The secondary battery according to claim 1, wherein a whole of the first electrode tab is parallel with the first surface of the first current collector.

24. (Previously Presented) The secondary battery according to claim 1, wherein a bottom of the first electrode plate notch is located between the first active substance disposed on two opposite sides of the first electrode tab receiving groove in the length direction of the first electrode plate.

Bibliographic Data

Application No: 15/908,327

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /NICHOLAS P D'ANIELLO/ Examiner's Signature | Initials

Title: SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
02/28/2018	429	1723	024607-02-5055-US
RULE			

APPLICANTS

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Yi Zhao, Ningde, CHINA

Ping He, Ningde, CHINA

Hongxin Fang, Ningde, CHINA

Wenqiang Cheng, Ningde, CHINA

CONTINUING DATA

This application is a CON of PCT/CN2015/088638 08/31/2015

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

03/23/2018

STATE OR COUNTRY

CHINA

ADDRESS

Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124
UNITED STATES

FILING FEE RECEIVED

$1,720

PART B - FEE(S) TRANSMITTAL

Electronically filed April 11, 2022

Complete and send this form with applicable fee(s), to: Mail — Mail Stop ISSUE FEE, Commissioner of Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450

or Fax — (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advanced orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS

MORGAN, LEWIS & BOCKIUS LLP
1400 Page Mill Road
Palo Alto, CA 94304

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Certificate of Mailing

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTY'S DOCKET NO.	CONFIRMATION NO.
15/908,327	02/28/2018	Peipei Guo	024607-02-5055-US	2611

TITLE OF INVENTION SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	0	$1200	04/12/2022

EXAMINER	ART UNIT	CLASS-SUB CLASS
D'ANIELLO, NICHOLAS P	1723	429-211000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed

1. **Morgan, Lewis & Bockius LLP**
2.
3.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: NINGDE AMPEREX TECHNOLOGY LIMITED

(B) RESIDENCE: (CITY and STATE OR COUNTRY) (C) NINGDE, FUJIAN, CHINA

Please check the appropriate assignee category or categories (will not be printed on the patent) ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee

☐ Advanced Order - # of Copies ____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above.**)

☐ A check in the amount of the fee(s) enclosed

☐ Payment by credit card. Form PTO-2038 is attached.

☒ The Director is hereby authorized to charge the required fee(s), or credit any overpayment, to Deposit Account Number 50-0310 (order no. 024607-02-5055-US).

5. **Change in Small Entity Status** (from status indicated above)

☐ a. Applicant certifying micro entity status. See 37 CFR 1.29. NOTE: Absent a valid certification of Micro Entity (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27. NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status. NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be sign in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Yalei Sun/ Date: April 11, 2022

Printed Name: Yalei Sun Registration No. 57,765

Electronic Patent Application Fee Transmittal

Application Number:	15908327
Filing Date:	28-Feb-2018
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Filer:	Yalei Sun/Cheryl Rogers
Attorney Docket Number:	024607-02-5055-US

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1200**

Electronic Acknowledgement Receipt	
EFS ID:	45443483
Application Number:	15908327
International Application Number:	
Confirmation Number:	2611
Title of Invention:	SECONDARY BATTERY CELL AND WINDING FORMATION SYSTEM THEREOF
First Named Inventor/Applicant Name:	Peipei Guo
Customer Number:	24341
Filer:	Yalei Sun
Filer Authorized By:	
Attorney Docket Number:	024607-02-5055-US
Receipt Date:	11-APR-2022
Filing Date:	28-FEB-2018
Time Stamp:	19:42:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1200
RAM confirmation Number	E20224AJ42521820
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	024607-02-5055-US_Issue_Fee_Transmittal.pdf	120792 64ec6e5b54d2c35eca7e7bcd2d323d5f12fdb2a5	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38109 8c22d2a22d065a58837072cac1922eb00c86c71c	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	158901		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/908,327	05/10/2022	11329352	024607-02-5055-US	2611

24341 7590 04/20/2022

Morgan, Lewis & Bockius LLP (PA)
1400 Page Mill Road
Palo Alto, CA 94304-1124

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 204 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Peipei Guo, Ningde, CHINA;
Yi Zhao, Ningde, CHINA;
Ping He, Ningde, CHINA;
Hongxin Fang, Ningde, CHINA;
Wenqiang Cheng, Ningde, CHINA;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Ningde Amperex Technology Limited, Ningde, CHINA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IR103 (Rev. 10/09)

AO 120 (Rev. 08/10)

TO:	**Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-232	6/24/2022	Eastern District of Texas

PLAINTIFF	DEFENDANT
Ningde Amperex Technology Limited	Zhuhai CosMX Battery Co., Ltd. Mainland Zhuhai Guanyu Battery Co., Ltd.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	10,971,706	4/6/2021	Ningde Amperex Technology Limited
2	11,329,352	5/10/2022	Ningde Amperex Technology Limited
3			
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

TO:	**Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

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3			
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☑ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
8/4/2022		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 10,833,363	11/10/2020	Ningde Amperex Technology Limited
2 10,964,987	3/30/2021	Ningde Amperex Technology Limited
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**