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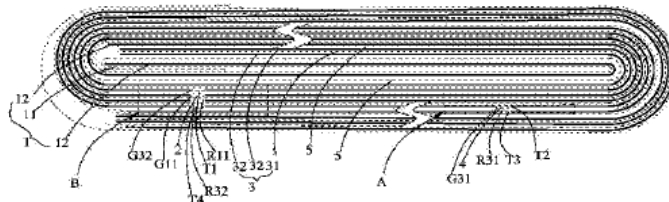
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Secondary Battery Cell

The present utility model provides a secondary battery cell, which comprises an anode sheet, an anode tab, a cathode sheet, a cathode tab, and a separator. The anode sheet comprises an anode current collector and an anode membrane. The cathode sheet comprises a cathode current collector and a cathode membrane. The separator is placed between the anode sheet and the cathode sheet. The anode sheet is formed with an anode tab accommodating groove, the bottom of which is an anode current collector and the peripheral side of which is an anode membrane, and the anode tab is accommodated within the anode tab accommodating groove and is electrically connected to the anode current collector at the anode tab accommodating groove. The cathode sheet is formed with a cathode tab accommodating groove, the bottom of which is a cathode current collector and the peripheral side of which is a cathode membrane, and the cathode tab is accommodated within the cathode tab accommodating groove and is electrically connected to the cathode current collector at the cathode tab accommodating groove. The cathode sheet is further formed with a cathode sheet alignment groove located in a region of the cathode sheet corresponding to the anode tab accommodating groove, the bottom of the cathode sheet alignment groove being a cathode current collector and the peripheral side thereof being a cathode membrane.



1. A secondary battery cell, comprising:
an anode sheet (1), comprising:
an anode current collector (11); and
an anode membrane (12) disposed on the surface of the anode current collector (11);
an anode tab (2);
a cathode sheet (3), comprising:
a cathode current collector (31); and
a cathode membrane (32) disposed on the surface of the cathode current collector (31);
a cathode tab (4); and
a separator (5) disposed between the anode sheet (1) and the cathode sheet (3);
wherein
the anode sheet (1) is formed with:
an anode tab accommodating groove (G11), the bottom of which is an anode current collector (11) and the peripheral side of which is an anode membrane (12), and the anode tab (2) is accommodated within the anode tab accommodating groove (G11) and is electrically connected to the anode current collector (11) at the anode tab accommodating groove (G11);
the cathode sheet (3) is formed with:
a cathode tab accommodating groove (G31), the bottom of which is a cathode current collector (31) and the peripheral side of which is a cathode membrane (32), and the cathode tab (4) is accommodated within the cathode tab accommodating groove (G31) and is electrically connected to the cathode current collector (31) at the cathode tab accommodating groove (G31);
characterized in that
the cathode sheet (3) is further formed with:
a cathode sheet alignment groove (G32) located in a region of the cathode sheet (3) corresponding to the anode tab accommodating groove (G11), the bottom of the cathode sheet alignment groove being a cathode current collector (31) and the peripheral side thereof being a cathode membrane (32).
2. The secondary battery cell according to claim 1, characterized in that the cathode sheet alignment groove (G32) is larger in both length and width than the anode tab accommodating groove (G11).
3. The secondary battery cell according to claim 1, characterized in that the secondary battery cell further comprises:
a double-sided insulating adhesive tape for the cathode sheet alignment groove (T1), which covers the entire cathode sheet alignment groove (G32), and bonds the separator (5) and the cathode membrane (32) surrounding the cathode sheet alignment groove (G32) respectively to the two sides thereof.
4. The secondary battery cell according to claim 1, characterized in that the secondary battery cell further comprises:
a double-sided insulating adhesive tape for the cathode tab accommodating groove (T2), which covers the entire cathode tab accommodating groove (G31), and bonds the separator (5) and the cathode membrane (32) surrounding the cathode tab accommodating groove (G31) respectively to the two sides thereof.
5. The secondary battery cell according to claim 1, characterized in that the cathode sheet (3) is further formed with:
a cathode matching recess (R31) located on the opposite back side of the cathode tab accommodating groove (G31), the bottom of the cathode matching recess being a cathode current collector (31), and the peripheral side thereof being a cathode membrane (32).
6. The secondary battery cell according to claim 5, characterized in that the secondary battery cell further comprises:
a double-sided insulating adhesive tape for the cathode matching recess (T3), which covers the entire cathode matching recess (R31), and bonds the separator (5) and the cathode membrane (32) surrounding the cathode matching recess (R31) respectively to the two sides thereof.
7. The secondary battery cell according to claim 1, characterized in that
the anode sheet (1) is further formed with:

an anode matching recess (R11) located on the opposite back side of the anode tab accommodating groove (G11), the bottom of the anode matching recess being an anode current collector (11), and the peripheral side thereof being an anode membrane (12);

the cathode sheet (3) is further formed with:

a cathode sheet alignment recess (R32) that is located in a region of the cathode sheet (3) aligned with the anode matching recess (R11), the bottom of the cathode sheet alignment recess being a cathode current collector (31) and the peripheral side thereof being a cathode membrane (32), and that is larger in both length and width than the anode matching recess (R11).

8. The secondary battery cell according to claim 7, characterized in that the secondary battery cell further comprises:

a double-sided insulating adhesive tape for the cathode sheet alignment recess (T4), which covers the entire cathode sheet alignment recess (R32), and bonds the separator (5) and the cathode membrane (32) surrounding the cathode sheet alignment recess (R32) respectively to the two sides thereof.

9. The secondary battery cell according to claim 1, characterized in that

the anode sheet (1) is a single integral sheet, and the secondary battery cell is a wound-type cell; in the unfolded state of the anode sheet (1), the distance from the head to the tail of the anode sheet (1) is defined as D1, the distance between the center line of the anode tab accommodating groove (G11) and the head of the anode sheet (1) is defined as d1, d1 being within the range of $1/10 D1$ to $7/10 D1$ calculated from the head of the anode sheet (1).

10. The secondary battery cell according to claim 1, characterized in that

the cathode sheet (3) is a single integral sheet, and the secondary battery cell is a wound-type cell; in the unfolded state of the cathode sheet (3), the distance from the head to the tail of the cathode sheet (3) is defined as D2, the distance between the center line of the cathode tab accommodating groove (G31) and the head of the cathode sheet (3) is defined as d2, d2 being within the range of $1/10 D2$ to $7/10 D2$ calculated from the head of the cathode sheet (3).

Secondary Battery Cell

Technical Field

[0001] The present utility model relates to electrochemical energy storage devices, and more particularly to a secondary battery cell.

Background Art

[0002] Lithium-ion batteries (a type of secondary battery) are widely used in various electronic products. As electronic products become smaller and more intelligent, higher demands are being placed on the energy density of lithium-ion batteries. Existing technologies mainly aim to increase energy density by creating grooves on the electrode sheet and welding the tabs into the grooves.

[0003] Chinese patent document CN203733894U, which was authorized and published on July 23, 2014, discloses a lithium-ion battery, wherein a first groove is provided on a cathode membrane, a second groove is provided on an anode membrane, a cathode tab is welded in the first groove, an anode tab is welded in the second groove, a first insulating adhesive layer is covered on the upper and lower surfaces of the cathode tab, and a second insulating adhesive layer is attached to the surface of the cathode membrane corresponding to the second groove. However, during charge-discharge cycles, the second insulating adhesive layer on the surface of the cathode membrane cannot prevent the active lithium in the covered cathode membrane from being released. As a result, the active lithium in the cathode membrane covered by the second insulating adhesive layer will diffuse via concentration gradient to the corresponding anode tab. However, the corresponding anode tab is a second groove and does not have enough space to embed the released active lithium. Therefore, the active lithium will accumulate at the anode tab, resulting in a serious lithium plating problem at the anode tab. Meanwhile, in this patent document, the first and second insulating adhesive layers are green adhesive, which is a single-sided insulating adhesive layer. Due to the very smooth back surface of the single-sided insulating adhesive layer, it cannot adhere to the separator when the back surface comes into contact with the separator. As a result, the region of the lithium-ion battery where the single-sided insulating adhesive layer is applied becomes relatively loose. During the cell shaping process and the charge-discharge process of the lithium-ion battery, this region bulges and becomes the area of maximum deformation. Therefore, the lithium-ion battery with this structure also suffers from severe deformation issues.

Summary of the Utility Model

[0004] In view of the problems existing in the prior art, the objective of the present utility model is to provide a secondary battery cell. When the secondary battery cell forms a secondary battery, it can improve the energy density of the secondary battery and reduce the accumulation of the cathode active material at the anode tab during the charge-discharge process, thereby reducing the problem of cathode active material precipitation at the anode tab and improving the safety performance of the secondary battery.

[0005] To achieve the above objective, the present utility model provides a secondary battery cell, comprising an anode sheet, an anode tab, a cathode sheet, a cathode tab, and a separator. The anode sheet comprises an anode current collector and an anode membrane disposed on the surface of the anode current collector. The cathode sheet comprises a cathode current collector and a cathode membrane disposed on the surface of the cathode current collector. The separator is placed between the anode sheet and the cathode sheet. The anode sheet is formed with an anode tab accommodating groove, the bottom of which is an anode current collector and the peripheral side of which is an anode membrane, and the anode tab is accommodated within the anode tab accommodating groove and is electrically connected to the anode current collector at the anode tab accommodating groove. The cathode sheet is formed with a cathode tab accommodating groove, the bottom of which is a cathode current collector and the peripheral side of which is a cathode membrane, and the cathode tab is accommodated within the cathode tab accommodating groove and is electrically connected to the cathode current collector at the cathode tab accommodating groove. The cathode sheet is further formed with a cathode sheet alignment groove located in a region of the cathode sheet corresponding to the anode tab accommodating groove, the bottom of the cathode sheet alignment groove being a cathode current collector and the peripheral side thereof being a cathode membrane.

[0006] The beneficial effects of the present utility model are as follows:

[0007] In the secondary battery cell according to the present utility model, the cathode sheet alignment groove is located

in the region where the cathode sheet is aligned with the anode tab accommodating groove. There is no cathode active material in the cathode sheet alignment groove. Therefore, when the secondary battery cell forms a secondary battery, while using the anode tab accommodating groove to accommodate the anode tab and the cathode tab accommodating groove to accommodate the cathode tab to improve the energy density of the secondary battery, because the cathode sheet alignment groove is aligned with the anode tab, the cathode active material migrating to the anode tab is reduced, thereby reducing the diffusion of the cathode active material to the aligned anode tab. This can alleviate the accumulation of the cathode active material at the anode tab during the charge-discharge process of the secondary battery, and ultimately alleviate the problem of cathode active material precipitation at the anode tab, thereby improving the safety performance of the secondary battery.

Brief Description of the Accompanying Drawings

[0008] FIG. 1 is a schematic structural diagram of a wound-formed secondary battery cell according to an embodiment of the present utility model;

[0009] FIG. 2 is two views of the cathode sheet of the secondary battery cell in FIG. 1 after being unfolded, wherein (a) is a cross-sectional view taken in a direction parallel to the plane of FIG. 1, and (b) is a bottom view;

[0010] FIG. 3 is two views of the anode sheet of the secondary battery cell in FIG. 1 after being unfolded, wherein (a) is a cross-sectional view taken in a direction parallel to the plane of FIG. 1, and (b) is a top view;

[0011] FIG. 4 is an enlarged schematic diagram of the two dashed box areas in FIG. 1, and for clarity, it is shown in a cross-sectional view, wherein (a) is an enlarged schematic diagram of the right box area indicated by arrow A, and (b) is an enlarged schematic diagram of the left box area indicated by arrow B;

[0012] FIG. 5 shows a schematic structural diagram of an alternative embodiment of FIG. 4;

[0013] FIG. 6 is a schematic diagram of a wound-formed secondary battery cell according to another embodiment of the present utility model;

[0014] FIG. 7 is an enlarged schematic diagram of the two dashed box areas in FIG. 6, and for clarity, it is shown in a cross-sectional view, wherein (a) is an enlarged schematic diagram of the right box area indicated by arrow A, and (b) is an enlarged schematic diagram of the left box area indicated by arrow B;

[0015] FIG. 8 shows a schematic structural diagram of an alternative embodiment of FIG. 7;

[0016] FIG. 9 shows a schematic structural diagram of the prior art;

[0017] FIG. 10 is an enlarged schematic diagram of the two dashed box areas in FIG. 9, and for clarity, it is shown in a cross-sectional view, wherein (a) is an enlarged schematic diagram of the right box area indicated by arrow A, and (b) is an enlarged schematic diagram of the left box area indicated by arrow B.

[0018] The reference numerals herein are explained as follows:

[0019] 1 Anode sheet

[0020] 11 Anode current collector

[0021] 12 Anode membrane

[0022] G11 Anode tab accommodating groove

[0023] R11 Anode matching recess

[0024] 2 Anode tab

[0025] 3 Cathode sheet

[0026] 31 Cathode current collector

[0027] 32 Cathode membrane

[0028] G31 Cathode tab accommodating groove

[0029] G32 Cathode sheet alignment groove

[0030] R31 Cathode matching recess

[0031]	R32 Cathode sheet alignment recess
[0032]	4 Cathode tab
[0033]	5 Separator
[0034]	T1 Double-sided insulating adhesive tape for the cathode sheet alignment groove
[0035]	T2 Double-sided insulating adhesive tape for the cathode tab accommodating groove
[0036]	T3 Double-sided insulating adhesive tape for the cathode matching recess
[0037]	T4 Double-sided insulating adhesive tape for the cathode sheet alignment recess
[0038]	T1' Single-sided insulating adhesive tape for a cathode sheet alignment and accommodating area
[0039]	T2' Single-sided insulating adhesive tape for the cathode tab accommodating groove.
[0040]	T3' Single-sided insulating adhesive tape for the cathode matching recess
[0041]	T4' Single-sided insulating adhesive tape for the cathode sheet alignment and matching area

Detailed Description of the Embodiments

[0042] The secondary battery cell according to the present utility model, as well as the test results of the embodiments and comparative examples, will be described in detail below with reference to the accompanying drawings.

[0043] First, the secondary battery cell according to the present utility model will be described.

[0044] Referring to FIGS. 1 to 8, the secondary battery cell of the present utility model comprises an anode sheet 1, an anode tab 2, a cathode sheet 3, a cathode tab 4, and a separator 5.

[0045] The anode sheet 1 comprises an anode current collector 11 and an anode membrane 12 disposed on the surface of the anode current collector 11. The cathode sheet 3 comprises a cathode current collector 31 and a cathode membrane 32 disposed on the surface of the cathode current collector 31. The separator 5 is placed between the anode sheet 1 and the cathode sheet 3.

[0046] The anode sheet 1 is formed with an anode tab accommodating groove G11, the bottom of which is an anode current collector 11 and the peripheral side of which is an anode membrane 12, and the anode tab 2 is accommodated within the anode tab accommodating groove G11 and is electrically connected to the anode current collector 11 at the anode tab accommodating groove G11.

[0047] The cathode sheet 3 is formed with a cathode tab accommodating groove G31, the bottom of which is a cathode current collector 31 and the peripheral side of which is a cathode membrane 32, and the cathode tab 4 is accommodated within the cathode tab accommodating groove G31 and is electrically connected to the cathode current collector 31 at the cathode tab accommodating groove G31.

[0048] The cathode sheet 3 is further formed with a cathode sheet alignment groove G32 located in a region of the cathode sheet 3 corresponding to the anode tab accommodating groove G11, the bottom of the cathode sheet alignment groove being a cathode current collector 31 and the peripheral side thereof being a cathode membrane 32.

[0049] In the secondary battery cell according to the present utility model, the cathode sheet alignment groove G32 is located in the region where the cathode sheet 3 is aligned with the anode tab accommodating groove G11. There is no cathode active material in the cathode sheet alignment groove G32. Therefore, when the secondary battery cell forms a secondary battery, while using the anode tab accommodating groove G11 to accommodate the anode tab 2 and the cathode tab accommodating groove G31 to accommodate the cathode tab 4 to improve the energy density of the secondary battery, because the cathode sheet alignment groove G32 is aligned with the anode tab 2, the cathode active material migrating to the anode tab 2 is reduced, thereby reducing the diffusion of the cathode active material to the aligned anode tab 2. This can alleviate the accumulation of the cathode active material at the anode tab 2 during the charge-discharge process of the secondary battery, and ultimately alleviate the problem of cathode active material precipitation at the anode tab 2, thereby improving the safety performance of the secondary battery.

[0050] In the secondary battery cell according to the present utility model, in an embodiment, the cathode sheet alignment groove G32 may be larger in both length and width than the anode tab accommodating groove G11. In one embodiment, the cathode sheet alignment groove G32 is larger than the anode tab accommodating groove G11 by 0.5 to 3 mm in both length and width, and preferably larger than the anode tab accommodating groove G11 by 1 to 2 mm in both length and width. In this case,

the accumulation of the cathode active material at the anode tab 2 during the charge-discharge process of the secondary battery can be completely avoided, thus ultimately overcoming the problem of cathode active material precipitation at the anode tab 2 and further improving the safety performance of the secondary battery.

[0051] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 2, FIG. 4, FIG. 5, FIG. 6, FIG. 7, and FIG. 8, the secondary battery cell may further comprise: a double-sided insulating adhesive tape for the cathode sheet alignment groove T1, which covers the entire cathode sheet alignment groove G32, and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment groove G32 respectively to the two sides thereof.

[0052] In the secondary battery cell according to the present utility model, since the double-sided insulating adhesive tape for the cathode sheet alignment groove T1 covers the entire cathode sheet alignment groove G32 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment groove G32 respectively to the two sides thereof, the bonding area of the double-sided insulating adhesive tape for the cathode sheet alignment groove T1 is tighter than that when a single-sided insulating adhesive tape is used, thereby strengthening the integrity of the secondary battery cell and preventing the area of the secondary battery cell from bulging into the area of maximum deformation during the cell shaping process and after expansion during charge-discharge of the secondary battery.

[0053] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 2, FIG. 4, FIG. 5, FIG. 6, FIG. 7, and FIG. 8, the secondary battery cell may further comprise: a double-sided insulating adhesive tape for the cathode tab accommodating groove T2, which covers the entire cathode tab accommodating groove G31, and bonds the separator 5 and the cathode membrane 32 surrounding the cathode tab accommodating groove G31 respectively to the two sides thereof.

[0054] In the secondary battery cell according to the present utility model, since the double-sided insulating adhesive tape for the cathode tab accommodating groove T2 covers the entire cathode tab accommodating groove G31 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode tab accommodating groove G31 respectively to the two sides thereof, the bonding area of the double-sided insulating adhesive tape for the cathode tab accommodating groove T2 is tighter than that when a single-sided insulating adhesive tape is used, thereby strengthening the integrity of the secondary battery cell and preventing the area of the secondary battery cell from bulging into the area of maximum deformation during the cell shaping process and after expansion during charge-discharge of the secondary battery.

[0055] In the secondary battery cell according to the present utility model, the anode tab 2 can be electrically connected to the anode current collector 11 at the anode tab accommodating groove G11 by means of ultrasonic welding, laser welding, or hot pressing welding.

[0056] In the secondary battery cell according to the present utility model, the cathode tab 4 can be electrically connected to the cathode current collector 31 at the cathode tab accommodating groove G31 by means of ultrasonic welding, laser welding, or hot pressing welding.

[0057] In the secondary battery cell according to the present utility model, the anode tab accommodating groove G11 can be formed by removing the corresponding part of the anode membrane 12 to expose the anode current collector 11 through laser cleaning, mechanical cleaning, or cleaning with a foaming adhesive; or the anode tab accommodating groove G11 can be formed by pre-applying thermosensitive foaming adhesive paper on the anode current collector 11 before applying the anode membrane slurry, then applying and drying the anode membrane slurry to form the anode membrane 12, and peeling the thermosensitive foaming adhesive paper off the anode current collector 11 when the anode membrane slurry is dried; or the anode tab accommodating groove G11 can be formed by pre-applying a foaming slurry on the anode current collector 11 and drying it before applying the anode membrane slurry, then applying and drying the anode membrane slurry to form the anode membrane 12, and peeling the dried foaming slurry off the anode current collector 11 when the anode membrane slurry is dried.

[0058] In the secondary battery cell according to the present utility model, the cathode tab accommodating groove G31 can be formed by removing the corresponding part of the cathode membrane 32 to expose the cathode current collector 31 through laser cleaning, mechanical cleaning, or cleaning with a foaming adhesive; or the cathode tab accommodating groove G31 can be formed by pre-applying thermosensitive foaming adhesive paper on the cathode current collector 31 before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the thermosensitive foaming adhesive paper off the cathode current collector 31 when the cathode

membrane slurry is dried; or the cathode tab accommodating groove G31 can be formed by pre-applying a foaming slurry on the cathode current collector 31 and drying it before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the dried foaming slurry off the cathode current collector 11 when the cathode membrane slurry is dried.

[0059] In the secondary battery cell according to the present utility model, the cathode sheet alignment groove G32 can be formed by removing the corresponding part of the cathode membrane 32 to expose the cathode current collector 31 through laser cleaning, mechanical cleaning, or cleaning with a foaming adhesive; or the cathode sheet alignment groove G32 can be formed by pre-applying thermosensitive foaming adhesive paper on the cathode current collector 31 before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the thermosensitive foaming adhesive paper off the cathode current collector 31 when the cathode membrane slurry is dried; or the cathode sheet alignment groove G32 can be formed by pre-applying a foaming slurry on the cathode current collector 31 and drying it before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the dried foaming slurry off the cathode current collector 11 when the cathode membrane slurry is dried.

[0060] In the secondary battery cell according to the present utility model, the double-sided insulating adhesive tape for the cathode sheet alignment groove T1 can be a double-sided adhesive tape that is initially adhesive on both sides or one side is initially adhesive while the other side becomes adhesive after subsequent hot or cold pressing.

[0061] In the secondary battery cell according to the present utility model, the double-sided insulating adhesive tape for the cathode tab accommodating groove T2 can be a double-sided adhesive tape that is initially adhesive on both sides or one side is initially adhesive while the other side becomes adhesive after subsequent hot or cold pressing.

[0062] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 4, FIG. 6, and FIG. 7, the cathode sheet 3 may further be formed with: a cathode matching recess R31 located on the opposite back side of the cathode tab accommodating groove G31, the bottom of the cathode matching recess being a cathode current collector 31, and the peripheral side thereof being a cathode membrane 32. The provision of the cathode matching recess R31 facilitates the ultrasonic welding of the cathode tab 4 within the cathode tab accommodating groove G31.

[0063] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 4, FIG. 6, and FIG. 7, the secondary battery cell may further comprise: a double-sided insulating adhesive tape for the cathode matching recess T3, which covers the entire cathode matching recess R31, and bonds the separator 5 and the cathode membrane 32 surrounding the cathode matching recess R31 respectively to the two sides thereof.

[0064] In the secondary battery cell according to the present utility model, the cathode matching recess R31 can be formed by removing the corresponding part of the cathode membrane 32 to expose the cathode current collector 31 through laser cleaning, mechanical cleaning, or cleaning with a foaming adhesive; or the cathode matching recess R31 can be formed by pre-applying thermosensitive foaming adhesive paper on the cathode current collector 31 before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the thermosensitive foaming adhesive paper off the cathode current collector 31 when the cathode membrane slurry is dried; or the cathode matching recess R31 can be formed by pre-applying a foaming slurry on the cathode current collector 31 and drying it before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the dried foaming slurry off the cathode current collector 11 when the cathode membrane slurry is dried.

[0065] In the secondary battery cell according to the present utility model, the double-sided insulating adhesive tape for the cathode matching recess T3 can be a double-sided adhesive tape that is initially adhesive on both sides or one side is initially adhesive while the other side becomes adhesive after subsequent hot or cold pressing.

[0066] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 3, and FIG. 4, the anode sheet 1 may further be formed with: an anode matching recess R11 located on the opposite back side of the anode tab accommodating groove G11, the bottom of the anode matching recess being an anode current collector 11, and the peripheral side thereof being an anode membrane 12. The provision of the anode matching recess R11 facilitates the ultrasonic welding of the anode tab 2 within the anode tab accommodating groove G11.

[0067] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 2, FIG. 3, and FIG. 4, the cathode sheet 3 may further be formed with: a cathode sheet alignment recess R32 that is located

in a region of the cathode sheet 3 aligned with the anode matching recess R11, the bottom of the cathode sheet alignment recess being a cathode current collector 31 and the peripheral side thereof being a cathode membrane 32, and that is larger in both length and width than the anode matching recess R11. Preferably, the cathode sheet alignment recess R32 is larger than the anode matching recess R11 by 1 to 2 mm in both length and width (i.e., the length and the width each being greater by 1 to 2 mm; whether the depths are the same can be determined by the relationship between the thickness of the cathode membrane 32 and the thickness of the anode membrane 12). Of course, the values by which the cathode sheet alignment recess R32 exceeds the anode matching recess R11 in both length and width may be adjusted according to actual conditions.

[0068] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 1, FIG. 2, FIG. 3, and FIG. 4, the secondary battery cell may further comprise: a double-sided insulating adhesive tape for the cathode sheet alignment recess T4, which covers the entire cathode sheet alignment recess R32, and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment recess R32 respectively to the two sides thereof. Since the double-sided insulating adhesive tape for the cathode sheet alignment recess T4 covers the entire cathode sheet alignment recess R32 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment recess R32 respectively to the two sides thereof, the bonding area of the double-sided insulating adhesive tape for the cathode sheet alignment recess T4 is tighter than that when a single-sided insulating adhesive tape is used, thereby strengthening the integrity of the secondary battery cell and preventing the area of the secondary battery cell from bulging into the area of maximum deformation during the cell shaping process and after expansion during charge-discharge of the secondary battery.

[0069] In the secondary battery cell according to the present utility model, the anode matching recess R11 can be formed by removing the corresponding part of the anode membrane 12 to expose the anode current collector 11 through laser cleaning, mechanical cleaning, or cleaning with a foaming adhesive; or the anode matching recess R11 can be formed by pre-applying thermosensitive foaming adhesive paper on the anode current collector 11 before applying the anode membrane slurry, then applying and drying the anode membrane slurry to form the anode membrane 12, and peeling the thermosensitive foaming adhesive paper off the anode current collector 11 when the anode membrane slurry is dried; or the anode matching recess R11 can be formed by pre-applying a foaming slurry on the anode current collector 11 and drying it before applying the anode membrane slurry, then applying and drying the anode membrane slurry to form the anode membrane 12, and peeling the dried foaming slurry off the anode current collector 11 when the anode membrane slurry is dried.

[0070] In the secondary battery cell according to the present utility model, the cathode sheet alignment recess R32 can be formed by removing the corresponding part of the cathode membrane 32 to expose the cathode current collector 31 through laser cleaning, mechanical cleaning, or cleaning with a foaming adhesive; or the cathode sheet alignment recess R32 can be formed by pre-applying thermosensitive foaming adhesive paper on the cathode current collector 31 before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the thermosensitive foaming adhesive paper off the cathode current collector 31 when the cathode membrane slurry is dried; or the cathode sheet alignment recess R32 can be formed by pre-applying a foaming slurry on the cathode current collector 31 and drying it before applying the cathode membrane slurry, then applying and drying the cathode membrane slurry to form the cathode membrane 32, and peeling the dried foaming slurry off the cathode current collector 31 when the cathode membrane slurry is dried.

[0071] In the secondary battery cell according to the present utility model, the double-sided insulating adhesive tape for the cathode sheet alignment recess T4 can be a double-sided adhesive tape that is initially adhesive on both sides or one side is initially adhesive while the other side becomes adhesive after subsequent hot or cold pressing.

[0072] In one embodiment of the secondary battery cell according to the present utility model, the width of the anode tab accommodating groove G11 is 1 to 2 times the width of the anode tab 2, the length of the anode tab accommodating groove G11 is 1 to 3 times the length of the portion of the anode tab 2 accommodated in the anode tab accommodating groove G11, and the depth of the anode tab accommodating groove G11 is equal to the thickness of the anode membrane 12.

[0073] In one embodiment of the secondary battery cell according to the present utility model, the width of the cathode tab accommodating groove G31 is 1 to 2 times the width of the cathode tab 4, the length of the cathode tab accommodating groove G31 is 1 to 3 times the length of the portion of the cathode tab 4 accommodated in the cathode tab accommodating groove G31, and the depth of the cathode tab accommodating groove G31 is equal to the thickness of the cathode membrane 32.

[0074] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 3, the

anode sheet 1 is a single integral sheet, and the secondary battery cell is a wound-type cell; in the unfolded state of the anode sheet 1, the distance from the head to the tail of the anode sheet 1 is defined as D1, the distance between the center line of the anode tab accommodating groove G11 and the head of the anode sheet 1 is defined as d1, d1 being within the range of $1/10 D1$ to $7/10 D1$ calculated from the head of the anode sheet 1, thereby helping to reduce the direct current resistance (DCR) of the secondary battery cell. Preferably, d1 is within the range of $3/10 D1$ to $7/10 D1$ calculated from the head of the anode sheet 1. Furthermore, the closer d1 is to the middle position of the anode sheet 1 (i.e., $1/2 D1$), the smaller the DCR.

[0075] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 3, the anode current collector 11 is located near the head of the anode sheet 1 with only one surface provided with an anode membrane 12.

[0076] In one embodiment of the secondary battery cell according to the present utility model, referring to FIG. 2, the cathode sheet 3 is a single integral sheet, and the secondary battery cell is a wound-type cell; in the unfolded state of the cathode sheet 3, the distance from the head to the tail of the cathode sheet 3 is defined as D2, the distance between the center line of the cathode tab accommodating groove G31 and the head of the cathode sheet 3 is defined as d2, d2 being within the range of $1/10 D2$ to $7/10 D2$ calculated from the head of the cathode sheet 3, thereby helping to reduce the direct current resistance (DCR) of the secondary battery cell. Preferably, d2 is within the range of $3/10 D2$ to $7/10 D2$ calculated from the head of the cathode sheet 3. Furthermore, the closer to the middle position of the cathode sheet 3 (i.e., $1/2 D2$), the smaller the DCR.

[0077] In the secondary battery cell according to the present utility model, the double-sided adhesive tape comprises a substrate and adhesive layers coated on two surfaces of the substrate. The adhesive layer of a double-sided adhesive tape that is initially adhesive on both sides can be a styrene-butadiene rubber layer, a polyurethane layer, a polyacrylate layer, or a polyvinylidene fluoride layer.

[0078] In the secondary battery cell according to the present utility model, in a double-sided adhesive tape where one side is initially adhesive and the other side is adhesive after subsequent hot or cold pressing, the adhesive layer on one side that is initially adhesive can be a styrene-butadiene rubber layer, a polyurethane layer, a polyacrylate layer, or a polyvinylidene fluoride layer; while the adhesive layer on the other side that is adhesive after subsequent hot or cold pressing can be a heat-sensitive adhesive or a pressure-sensitive adhesive that is not initially adhesive at room temperature. The aforementioned heat-sensitive adhesive with no initial adhesiveness at room temperature refers to a heat-sensitive adhesive that does not bond to an object when there is brief contact between the object and the heat-sensitive adhesive at room temperature. The aforementioned pressure-sensitive adhesive with no initial adhesiveness at room temperature refers to a pressure-sensitive adhesive that does not bond to an object when there is brief contact between the object and the pressure-sensitive adhesive under finger pressure at room temperature. The heat-sensitive adhesive that has no initial adhesiveness at room temperature can be selected from one or more of polyolefins, polyvinyl butyral, polyamides, and polyesters. The pressure-sensitive adhesive that has no initial adhesiveness at room temperature can be selected from one or more of ethylene-butylene-polystyrene linear triblock copolymer (SEBS), styrene-butadiene block copolymer (SEPS), and epoxidized styrene-isoprene-styrene block copolymer (ESIS).

[0079] In the secondary battery cell according to the present utility model, the secondary battery may be a lithium-ion battery or a sodium-ion battery. When lithium-ion batteries are used, the cathode active material contains lithium. When sodium-ion batteries are used, the cathode active material contains sodium. The secondary battery can be a soft-pack secondary battery.

[0080] Finally, the embodiments and comparative examples of the present utility model, using soft-pack lithium-ion batteries as examples, and the test results are described.

[0081] Embodiment 1

[0082] Taking the 423482 model soft-pack lithium-ion battery (the finished battery product has a thickness of 4.2 mm, a width of 34 mm, and a length of 82 mm) as an example, the anode tab 2 and the cathode tab 4 have the same size, that is, the welding length of the tab is 15 mm, the tab width is 4 mm, and the thickness is 0.06 mm.

[0083] Using the structure shown in FIGS. 1-4 and after the cold pressing process, the electrode sheets (the thickness of the single-layer anode membrane 12 of the anode sheet 1 is 67 μm , and the thickness of the single-layer

cathode membrane 32 of the cathode sheet 3 is 53 μm) are cleaned with a laser at 1/2 of the anode sheet 1 (i.e., $d1=1/2 D1$) to form the anode tab accommodating groove G11 and the anode matching recess R11 for welding the anode tab 2, and the cathode sheet area aligned with the anode tab 2 is cleaned to form the cathode sheet alignment groove G32 and the cathode sheet alignment recess R32. A laser is used to clean the cathode sheet 3 at its 1/2 position (i.e., $d2=1/2 D2$) to form the cathode tab accommodating groove G31 and the cathode matching recess R31 for welding the cathode tab 4. Here, the cathode tab accommodating groove G31 and the cathode matching recess R31 are each 6 mm wide and 20 mm long, the anode tab accommodating groove G11 and the anode matching recess R11 are each 6 mm wide and 20 mm long, the cathode sheet alignment groove G32 and the cathode sheet alignment recess R32 are each 8 mm wide and 22 mm long, the anode tab 2 is welded to the anode tab accommodating groove G11, and the cathode tab 4 is welded to the cathode tab accommodating groove G31. The double-sided insulating adhesive tape for the cathode sheet alignment groove T1 covers the entire cathode sheet alignment groove G32 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment groove G32 respectively to the two sides thereof, the double-sided insulating adhesive tape for the cathode tab accommodating groove T2 covers the entire cathode tab accommodating groove G31 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode tab accommodating groove G31 respectively to the two sides thereof, the double-sided insulating adhesive tape for the cathode matching recess T3 covers the entire cathode matching recess R31 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode matching recess R31 respectively to the two sides thereof, the double-sided insulating adhesive tape for the cathode sheet alignment recess T4 covers the entire cathode sheet alignment recess R32 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment recess R32 respectively to the two sides thereof, the double-sided insulating adhesive tape for the cathode sheet alignment groove T1, the double-sided insulating adhesive tape for the cathode tab accommodating groove T2, the double-sided insulating adhesive tape for the cathode matching recess T3, and the double-sided insulating adhesive tape for the cathode sheet alignment recess T4 each are a double-sided adhesive tape coated with a polyvinylidene fluoride layer applied on two sides of a PET substrate that is initially adhesive on both sides, and the anode sheet 1, the cathode sheet 3, and the separator 5 are wound together to form a secondary battery cell.

[0084] Embodiment 2

[0085] The structure shown in FIG. 5 differs from Embodiment 1 in that: there is no cathode matching recess R31, no double-sided insulating adhesive tape for the cathode matching recess T3, no anode matching recess R11, no cathode sheet alignment recess R32, and no double-sided insulating adhesive tape for the cathode sheet alignment recess T4. The remainder is the same as in Embodiment 1.

[0086] Embodiment 3

[0087] The structure shown in FIG. 6 and FIG. 7 differs from Embodiment 1 in that: a laser is used to clean the anode sheet 1 at its 3/4 position (i.e., $d1=3/4 D1$, and the anode membrane 12 near the head is set on one side) to form the anode tab accommodating groove G11 for welding the anode tab 2, and the cathode sheet area aligned with the anode tab 2 is cleaned to form the cathode sheet alignment groove G32, and the double-sided insulating adhesive tape for the cathode sheet alignment groove T1 covers the entire cathode sheet alignment groove G32 and bonds the separator 5 and the cathode membrane 32 surrounding the cathode sheet alignment groove G32 respectively to the two sides thereof. The remainder is the same as in Embodiment 1.

[0088] Embodiment 4

[0089] The structure shown in FIG. 8 differs from Embodiment 3 in that: there is no cathode matching recess R31 or double-sided insulating adhesive tape for the cathode matching recess T3. The remainder is the same as in Embodiment 3.

[0090] Comparative Example 1

[0091] The structure shown in FIG. 8 differs from Embodiment 4 in that: the width of the anode tab accommodating groove G11 is 6 mm and the length is 20 mm, and the width of the cathode sheet alignment groove G32 is 4 mm and the length is always 18 mm. The remainder is the same as in Embodiment 4.

[0092] Comparative Example 2

[0093] The structures shown in FIG. 9 and FIG. 10 differ from Embodiment 1 in that: there is no cathode sheet alignment groove G32 or cathode sheet alignment recess R32, but a single-sided insulating adhesive tape for a cathode sheet alignment

and accommodating area T1' is used to bond the surface of a corresponding area of the cathode membrane 32 aligned with the anode tab accommodating groove G11, a single-sided insulating adhesive tape for the cathode sheet alignment and matching area T4' is used to bond the surface of a corresponding area of the cathode membrane 32 aligned with the anode matching recess R11, a single-sided insulating adhesive tape for the cathode tab accommodating groove T2' is used to bond the cathode membrane 32 surrounding the cathode tab accommodating groove G31, and a single-sided insulating adhesive tape for the cathode matching recess T3' is used to bond the cathode membrane 32 surrounding the cathode matching recess R31.

[0094] 20 soft-pack lithium-ion battery samples were selected from each of Embodiments 1-4 and Comparative Examples 1-2 for 1000-cycle charge-discharge tests, the thickness of the samples before and after the test was measured, and the soft-pack lithium-ion battery samples after the test were disassembled to observe the lithium plating. The results are shown in Table 1.

[0095] Table 1 Test results of Embodiments 1-4 and Comparative Examples 1-2

[0096]

	Average thickness/mm			Number of samples that underwent lithium plating
	Before 1000 cycles	After 1000 cycles	Deformation	
Embodiment 1	4.067	4.334	0.267	0
Embodiment 2	4.067	4.334	0.267	0
Embodiment 3	4.066	4.330	0.264	0
Embodiment 4	4.066	4.330	0.264	0
Comparative Example 1	4.067	4.358	0.291	9
Comparative Example 2	4.067	4.381	0.314	20

[0097] As can be seen from Table 1, no lithium plating was observed in Embodiments 1-4; while lithium plating was observed in Comparative Examples 1 and 2, and the lithium plating in Comparative Example 2 was more severe than that in Comparative Example 1; the deformation of Embodiments 1-4 was much smaller than that in Comparative Examples 1 and 2. The deformation of Comparative Example 1 is smaller than that of Comparative Example 2, but the deformation of Comparative Example 1 is greater than that of Embodiment 4.

[0098] Therefore, in Embodiments 1-4, the cathode sheet alignment groove G32 is larger than the anode tab accommodating groove G11 in both length and width, which can completely avoid lithium plating and effectively control the deformation of soft-pack lithium-ion batteries. Compared with Comparative Example 2, in Comparative Example 1, the cathode sheet alignment groove G32 is smaller in both length and width than the anode tab accommodating groove G11, which can reduce lithium plating and deformation.

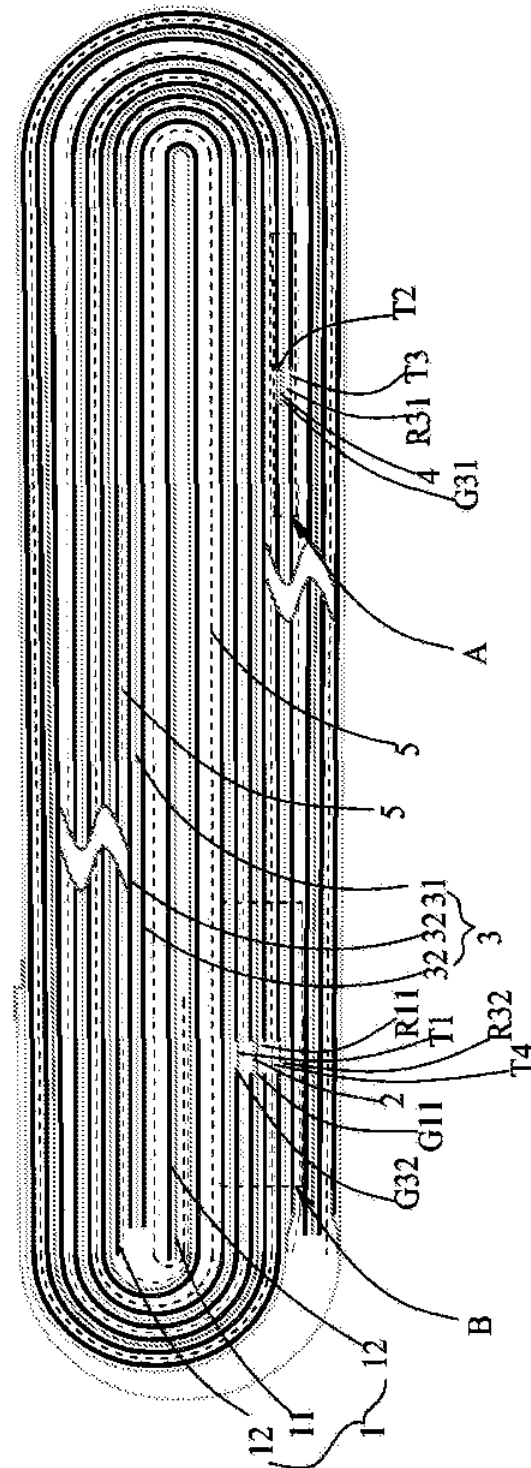


FIG. 1

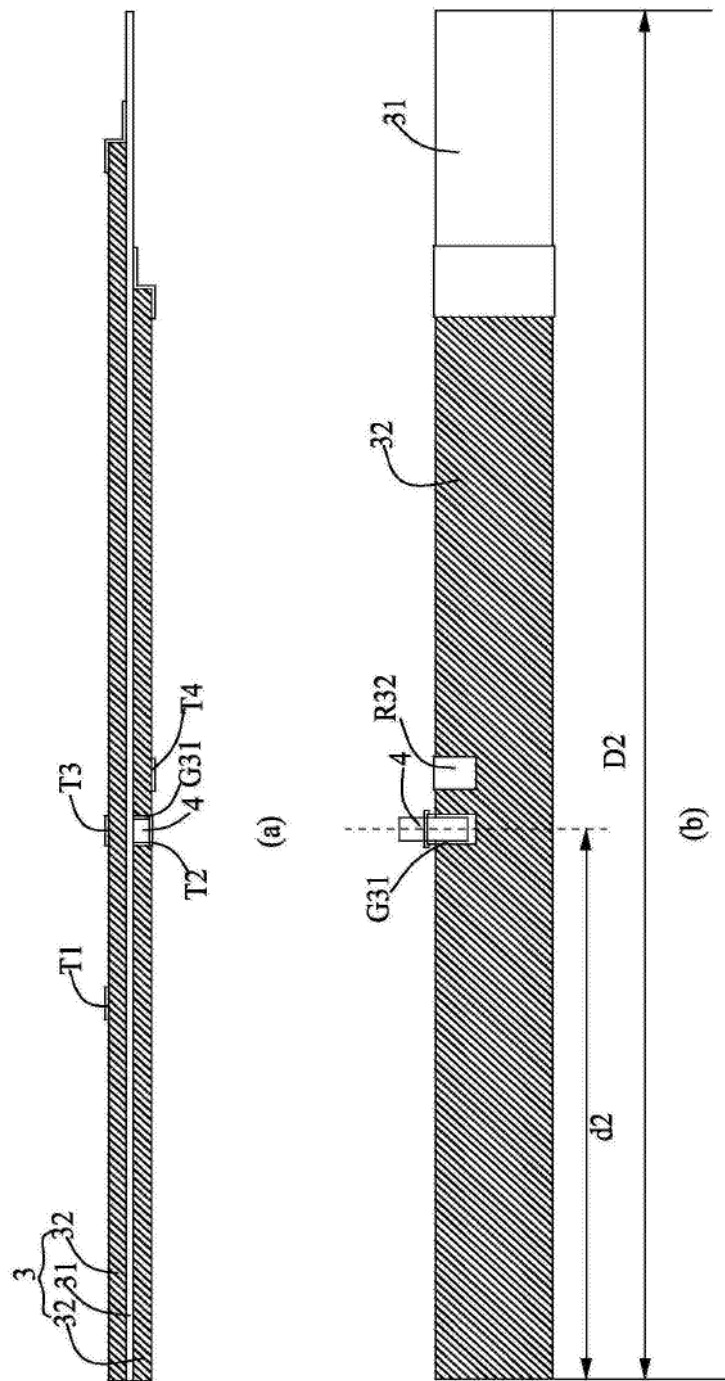


FIG. 2

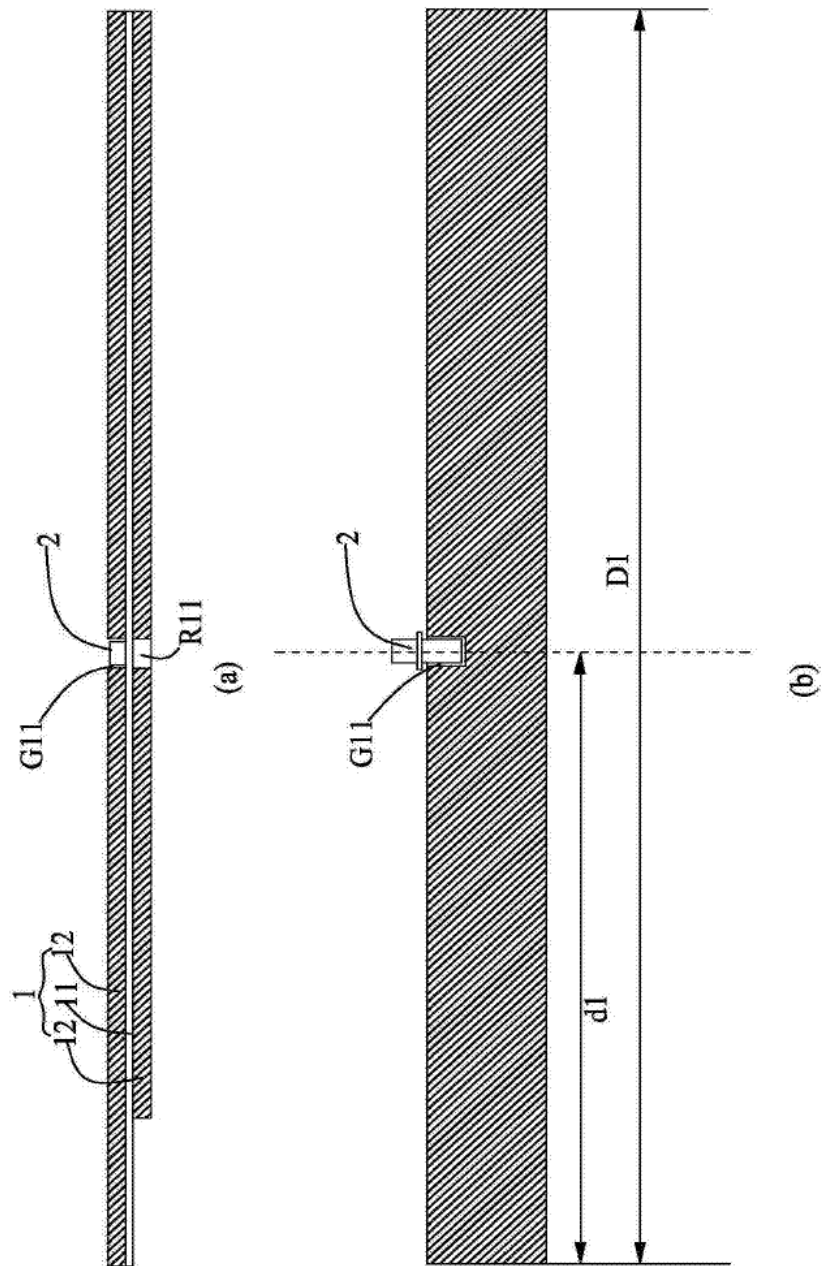


FIG. 3

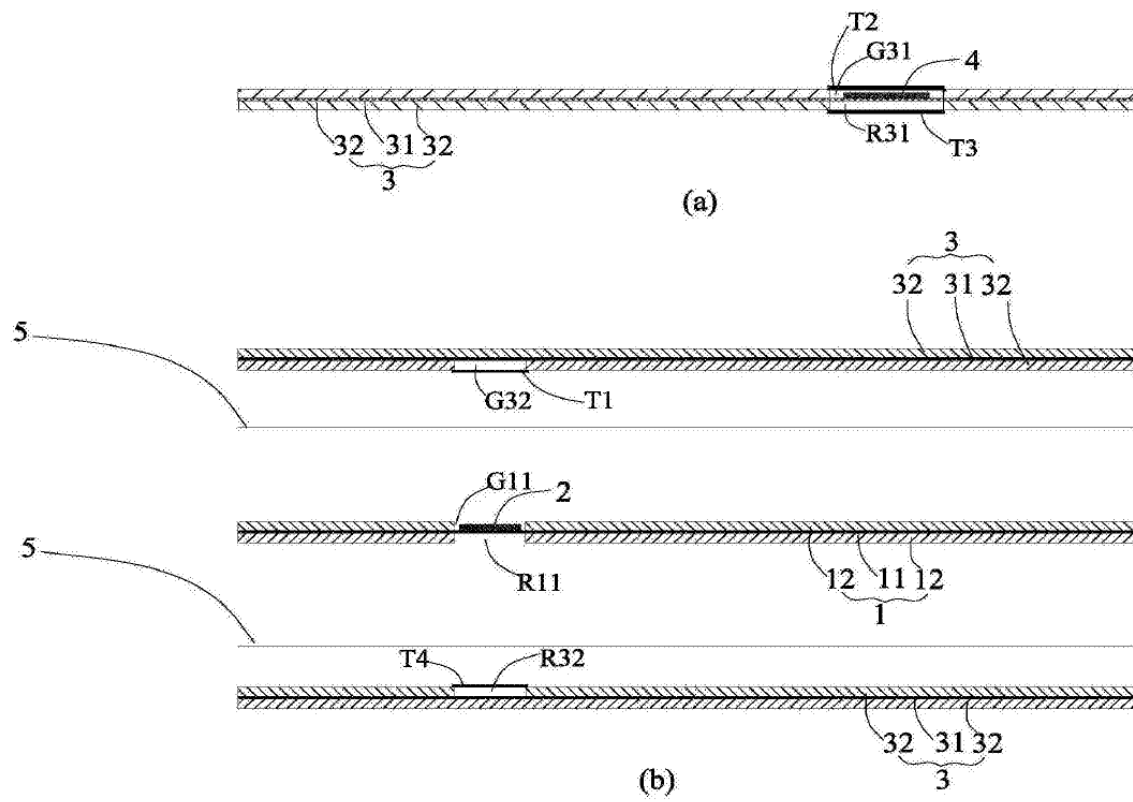


FIG. 4

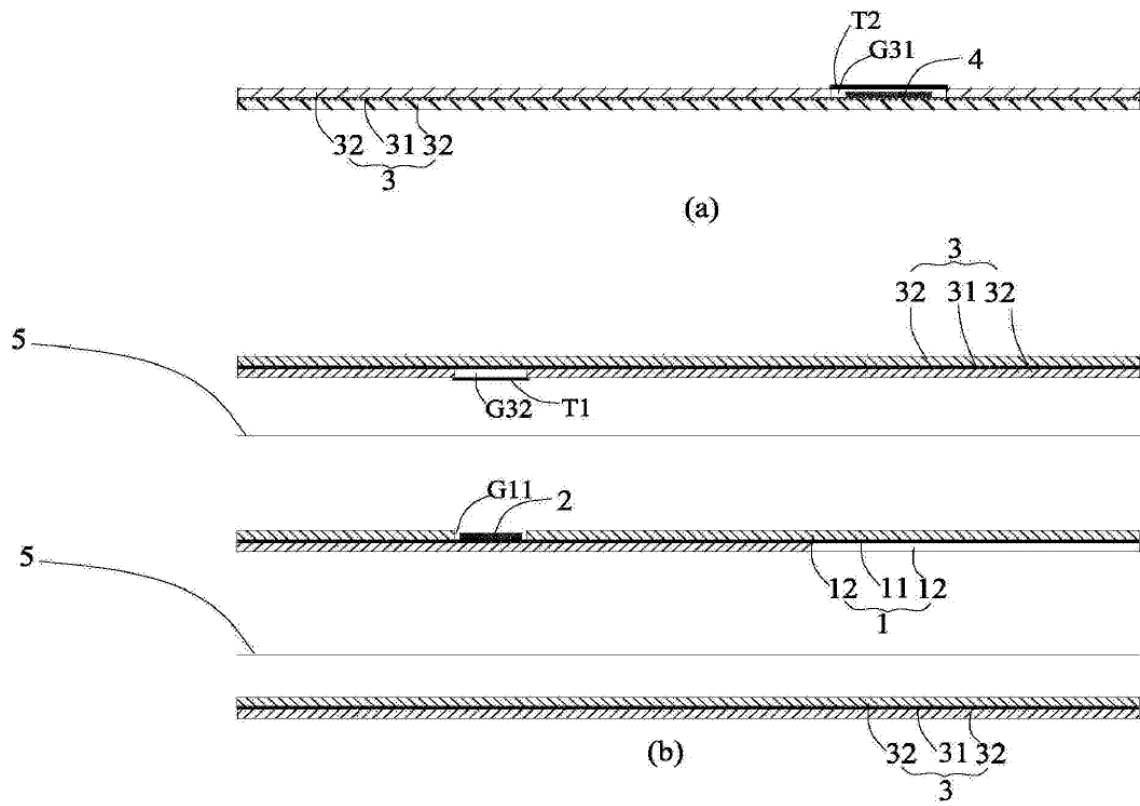


FIG. 5

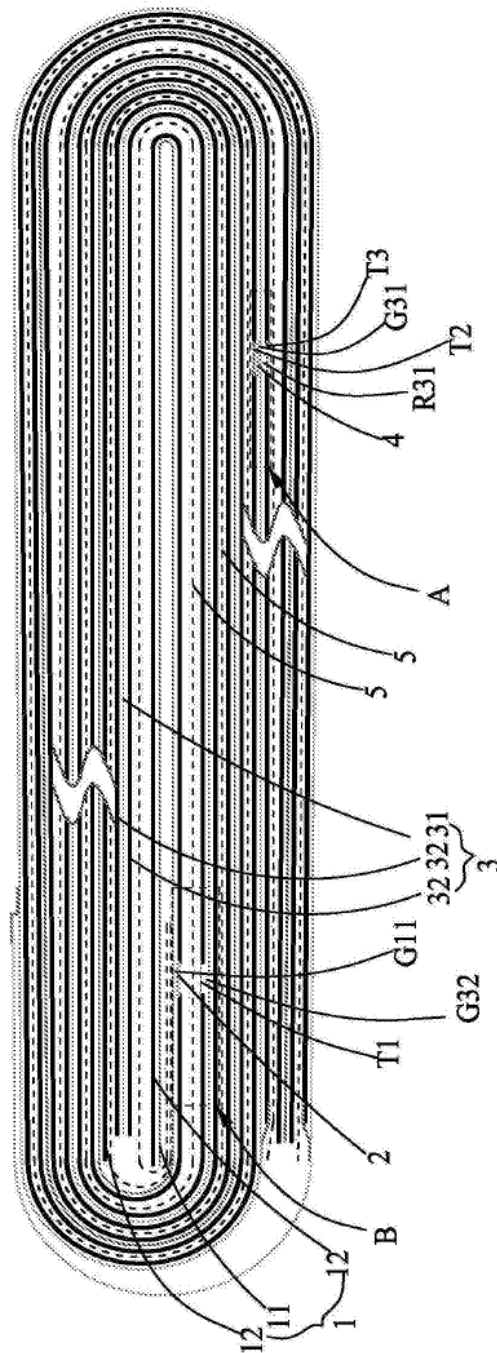


FIG. 6

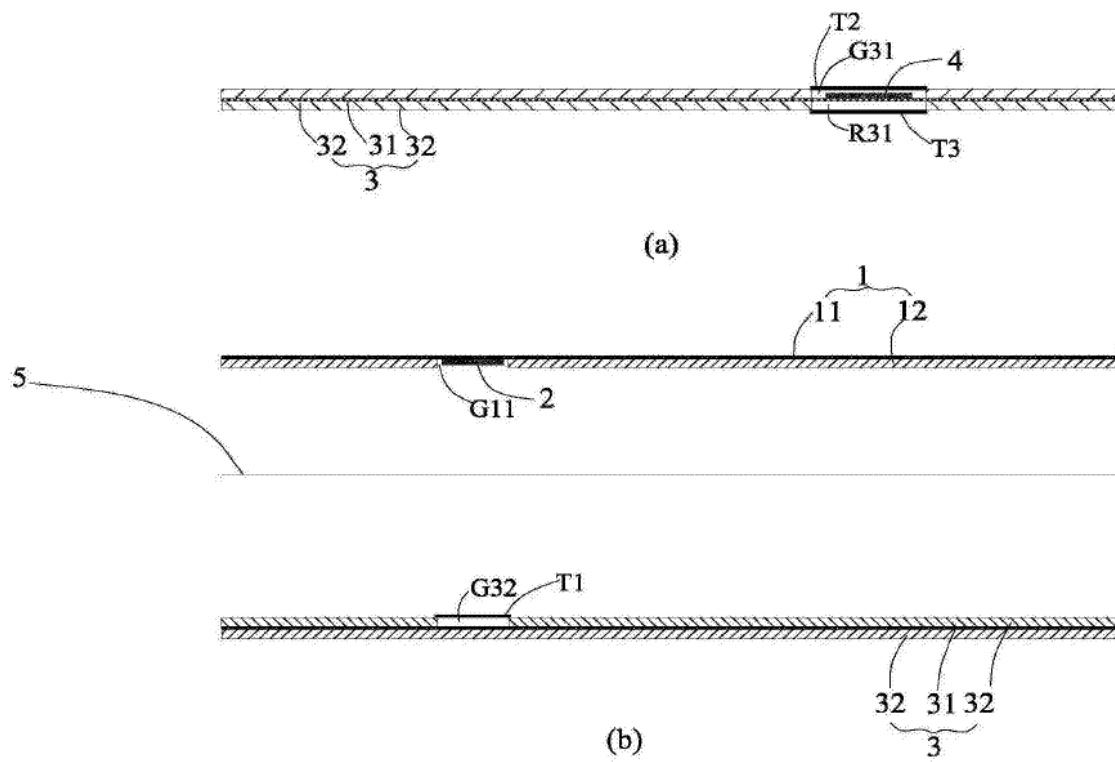


FIG. 7

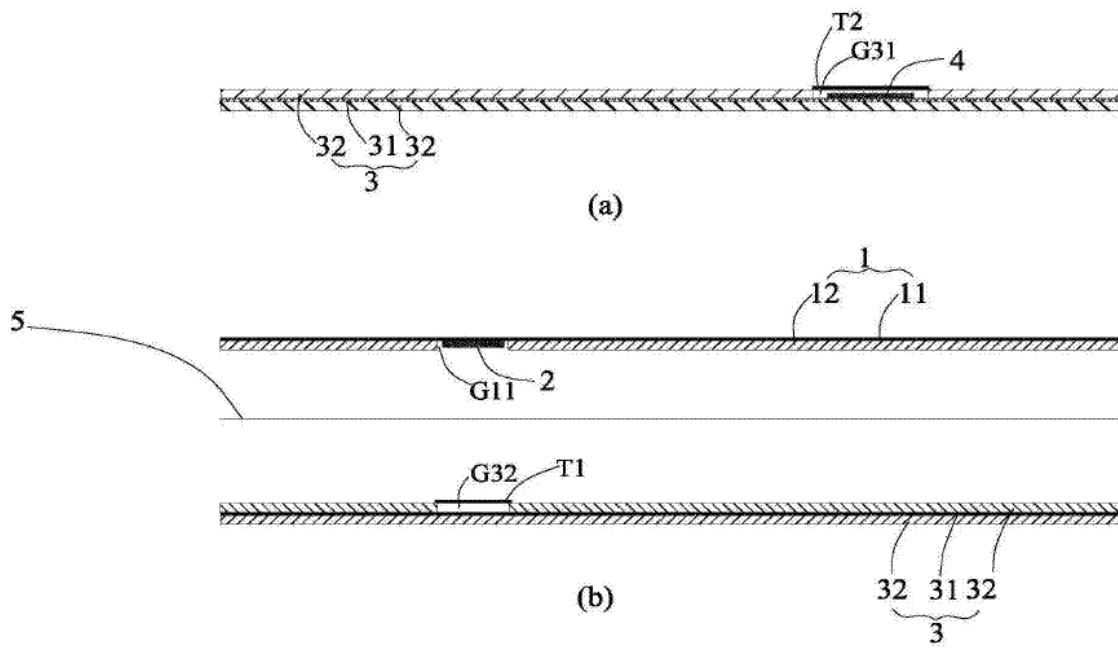


FIG. 8

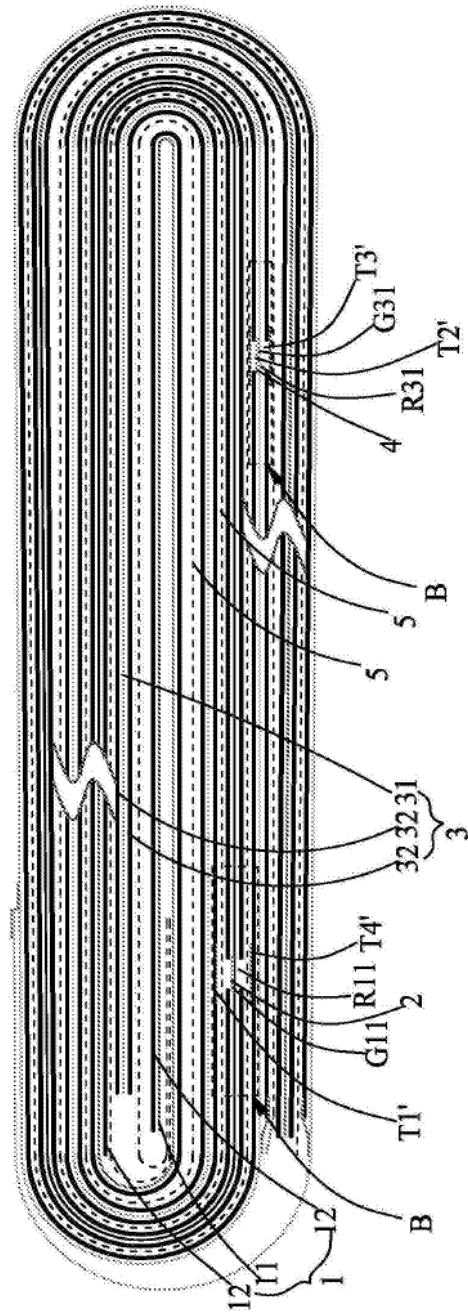


FIG. 9

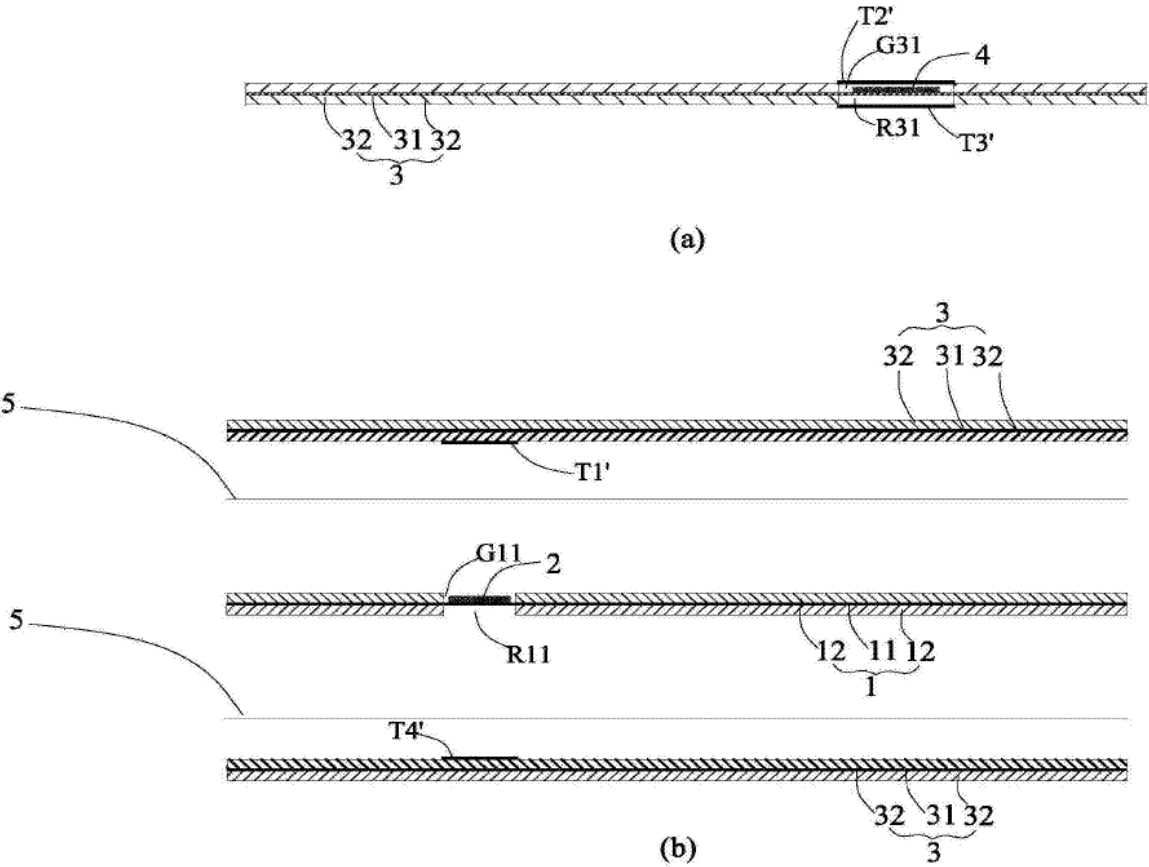


FIG. 10



DECLARATION OF TRANSLATOR

I, Jian Zhang, hereby declare as follows:

1. I personally performed the attached translation from Chinese into English of the patent that is entitled “CN204809314U (Guo)” in Chinese and “CN204809314U (Guo)” in English (also attached).

2. The attached translation is, to the best of my knowledge, a true, full and accurate translation of the attached Chinese document.

3. I am competent to perform this translation, because I have more than 30 years of experience in patent translation between English and Chinese.

4. I declare under the penalty of perjury under the laws of the United States that the foregoing is true and correct; and further declare that I am aware that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 1001 of Title 18 of the United States Code.

Dated: 05/12/2026

A handwritten signature in black ink, appearing to be "Jian Zhang", written over a horizontal line.

(Bibliographic information, abstract, specifications)

(Claims, drawings)



(45) 授权公告日 2015. 11. 25

权利要求书2页 说明书9页 附图10页

1. 一种二次电池电芯,包括:

阳极极片 (1),包括:

阳极集流体 (11);以及

阳极膜片 (12),设置在阳极集流体 (11) 的表面;

阳极极耳 (2);

阴极极片 (3),包括:

阴极集流体 (31);以及

阴极膜片 (32),设置在阴极集流体 (31) 的表面;

阴极极耳 (4);以及

隔离膜 (5),设置于阳极极片 (1) 和阴极极片 (3) 之间;

其中,

阳极极片 (1) 形成有:

阳极极耳收容凹槽 (G11),底部为阳极集流体 (11) 而周侧为阳极膜片 (12),阳极极耳 (2) 收容于阳极极耳收容凹槽 (G11) 内并电连接于阳极极耳收容凹槽 (G11) 处的阳极集流体 (11);

阴极极片 (3) 形成有:

阴极极耳收容凹槽 (G31),底部为阴极集流体 (31) 而周侧为阴极膜片 (32),阴极极耳 (4) 收容于阴极极耳收容凹槽 (G31) 内并电连接于阴极极耳收容凹槽 (G31) 处的阴极集流体 (31);

其特征在于,

阴极极片 (3) 还形成有:

阴极极片对位凹槽 (G32),底部为阴极集流体 (31) 而周侧为阴极膜片 (32),位于阴极极片 (3) 的与阳极极耳收容凹槽 (G11) 对位的区域。

2. 根据权利要求 1 所述的二次电池电芯,其特征在于,阴极极片对位凹槽 (G32) 在长度和宽度上均大于阳极极耳收容凹槽 (G11)。

3. 根据权利要求 1 所述的二次电池电芯,其特征在于,所述二次电池电芯还包括:

阴极极片对位凹槽用双面绝缘胶带 (T1),覆盖整个阴极极片对位凹槽 (G32),且在两面上分别粘接隔离膜 (5) 和阴极极片对位凹槽 (G32) 周围的阴极膜片 (32)。

4. 根据权利要求 1 所述的二次电池电芯,其特征在于,所述二次电池电芯还包括:

阴极极耳收容凹槽用双面绝缘胶带 (T2),覆盖整个阴极极耳收容凹槽 (G31),且在两面上分别粘接隔离膜 (5) 和阴极极耳收容凹槽 (G31) 周围的阴极膜片 (32)。

5. 根据权利要求 1 所述的二次电池电芯,其特征在于,阴极极片 (3) 还形成有:

阴极配对凹部 (R31),底部为阴极集流体 (31) 而周侧为阴极膜片 (32),位于阴极极耳收容凹槽 (G31) 的正对背侧。

6. 根据权利要求 5 所述的二次电池电芯,其特征在于,所述二次电池电芯还包括:

阴极配对凹部用双面绝缘胶带 (T3),覆盖整个阴极配对凹部 (R31),且在两面上分别粘接隔离膜 (5) 和阴极配对凹部 (R31) 周围的阴极膜片 (32)。

7. 根据权利要求 1 所述的二次电池电芯,其特征在于,

阳极极片 (1) 还形成有:

阳极配对凹部 (R11),底部为阳极集流体 (11) 而周侧为阳极膜片 (12),位于阳极极耳收容凹槽 (G11) 的正对背侧;

阴极极片 (3) 还形成有:

阴极极片对位凹部 (R32),底部为阴极集流体 (31) 而周侧为阴极膜片 (32),位于阴极极片 (3) 的与阳极配对凹部 (R11) 对位的区域,且在长度和宽度上均大于阳极配对凹部 (R11)。

8. 根据权利要求 7 所述的二次电池电芯,其特征在于,所述二次电池电芯还包括:

阴极极片对位凹部用双面绝缘胶带 (T4),覆盖整个阴极极片对位凹部 (R32),且在两面上分别粘接隔离膜 (5) 和阴极极片对位凹部 (R32) 周围的阴极膜片 (32)。

9. 根据权利要求 1 所述的二次电池电芯,其特征在于,

阳极极片 (1) 为一整体片,二次电池电芯为卷绕式电芯,在阳极极片 (1) 展开状态下,阳极极片 (1) 的头部至尾部的距离定义为 $D1$,阳极极耳收容凹槽 (G11) 的中心线至阳极极片 (1) 的头部之间的距离定义为 $d1$, $d1$ 处于自阳极极片 (1) 的头部起计算的 $1/10D1 \sim 7/10D1$ 的范围内。

10. 根据权利要求 1 所述的二次电池电芯,其特征在于,

阴极极片 (3) 为一整体片,二次电池电芯为卷绕式电芯,在阴极极片 (3) 展开状态下,阴极极片 (3) 的头部至尾部的距离定义为 $D2$,阴极极耳收容凹槽 (G31) 的中心线至阴极极片 (3) 的头部之间的距离定义为 $d2$, $d2$ 处于自阴极极片 (3) 的头部起计算的 $1/10D2 \sim 7/10D2$ 的范围内。

二次电池电芯

技术领域

[0001] 本实用新型涉及电化学储能装置,尤其涉及一种二次电池电芯。

背景技术

[0002] 锂离子电池(为二次电池的一种)在各类电子产品中均有广泛的应用。随着电子产品趋向小型化、智能化,对锂离子电池的能量密度提出了更高的要求。现有技术主要是通过极片上开设凹槽,将极耳焊接在凹槽内,从而达到提升能量密度的目的。

[0003] 于2014年7月23日授权公告的中国专利文献CN203733894U公开了一种锂离子电池,其中阴极膜片上设置有第一凹槽,阳极膜片上设置有第二凹槽,阴极极耳焊接于第一凹槽内,阳极极耳焊接于第二凹槽内,阴极极耳的上下两个表面上覆盖有第一绝缘胶层,第二凹槽对应的阴极膜片的表面贴有第二绝缘胶层。然而,在充放电循环过程中,由于阴极膜片的表面上的第二绝缘胶层无法阻止被粘盖的阴极膜片中的活性锂游离出来,因此被第二绝缘胶层粘盖的阴极膜片中的活性锂将通过浓差扩散游离至对位的阳极极耳处,但对位的阳极极耳为第二凹槽而无足够空间镶嵌上述游离出的活性锂,因此活性锂将富集在阳极极耳处,使得阳极极耳处出现严重的析锂问题。同时,在该专利文献中,第一绝缘胶层和第二绝缘胶层为绿胶,绿胶为单面绝缘胶层,由于单面绝缘胶层的背面非常光滑,使得单面绝缘胶层的背面和隔离膜接触时不能粘附在一起,造成锂离子电池在粘贴了单面绝缘胶层的区域比较疏松,在锂离子电池的电芯整形工序及充放电过程中,该区域隆起而成为最大变形区,因此该结构的锂离子电池还存在着严重的变形问题。

实用新型内容

[0004] 鉴于现有技术中存在的问题,本实用新型的目的在于提供一种二次电池电芯,当二次电池电芯形成二次电池后,在提高二次电池的能量密度的同时,能减轻二次电池在充放电过程中阴极活性物质富集在阳极极耳处,减轻阳极极耳处出现析出阴极活性物质的问题,提高二次电池的安全性能。

[0005] 为了实现上述目的,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。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。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。隔离膜设置于阳极极片和阴极极片之间。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。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。阴极极片还形成有:阴极极片对位凹槽,底部为阴极集流体而周侧为阴极膜片,位于阴极极片的与阳极极耳收容凹槽对位的区域。

[0006] 本实用新型的有益效果如下:

[0007] 在根据本实用新型所述的二次电池电芯中,阴极极片对位凹槽位于阴极极片的与

阳极极耳收容凹槽对位的区域,阴极极片对位凹槽无阴极活性物质存在,所以当二次电池电芯形成二次电池后,在利用阳极极耳收容凹槽收容阳极极耳、阴极极耳收容凹槽收容阴极极耳来提高二次电池的能量密度的同时,因为阴极极片对位凹槽与阳极极耳对位,从而减少了向阳极极耳游离的阴极活性物质,从而减少了阴极活性物质游离扩散至对位的阳极极耳处,进而能减轻在二次电池充放电过程中阴极活性物质富集在阳极极耳处,最终减轻了阳极极耳处出现析出阴极活性物质的问题,提高二次电池的安全性能。

附图说明

[0008] 图 1 是根据本实用新型的一实施例的二次电池电芯卷绕成型后的结构示意图;

[0009] 图 2 是图 1 的二次电池电芯的阴极极片展开后的两个视图,其中 (a) 为平行于图 1 的纸面方向做出的剖视图,而 (b) 为仰视图;

[0010] 图 3 是图 1 的二次电池电芯的阳极极片展开后的两个视图,其中 (a) 为平行于图 1 的纸面方向做出的剖视图,而 (b) 为俯视图;

[0011] 图 4 是图 1 的两个虚线方框区域的放大示意图,为了清楚起见,以剖视图方式示出,其中 (a) 为由箭头 A 指示的右侧方框区域的放大示意图,而 (b) 为由箭头 B 指示的左侧方框区域的放大示意图;

[0012] 图 5 示出了图 4 的替代实施例的结构示意图;

[0013] 图 6 是根据本实用新型另一实施例的二次电池电芯卷绕成型后的示意图;

[0014] 图 7 是图 6 的两个虚线方框区域的放大示意图,为了清楚起见,以剖视图方式示出,其中 (a) 为由箭头 A 指示的右侧方框区域的放大示意图,而 (b) 为由箭头 B 指示的左侧方框区域的放大示意图;

[0015] 图 8 示出了图 7 的替代实施例的结构示意图;

[0016] 图 9 示出了现有技术结构示意图;

[0017] 图 10 是图 9 的两个虚线方框区域的放大示意图,为了清楚起见,以剖视图方式示出,其中 (a) 为由箭头 A 指示的右侧方框区域的放大示意图,而 (b) 为由箭头 B 指示的左侧方框区域的放大示意图。

[0018] 其中,附图标记说明如下:

[0019] 1 阳极极片

[0020] 11 阳极集流体

[0021] 12 阳极膜片

[0022] G11 阳极极耳收容凹槽

[0023] R11 阳极配对凹部

[0024] 2 阳极极耳

[0025] 3 阴极极片

[0026] 31 阴极集流体

[0027] 32 阴极膜片

[0028] G31 阴极极耳收容凹槽

[0029] G32 阴极极片对位凹槽

[0030] R31 阴极配对凹部

- [0031] R32 阴极极片对位凹部
- [0032] 4 阴极极耳
- [0033] 5 隔离膜
- [0034] T1 阴极极片对位凹槽用双面绝缘胶带
- [0035] T2 阴极极耳收容凹槽用双面绝缘胶带
- [0036] T3 阴极配对凹部用双面绝缘胶带
- [0037] T4 阴极极片对位凹部用双面绝缘胶带
- [0038] T1' 阴极极片对位收容区用单面绝缘胶带
- [0039] T2' 阴极极耳收容凹槽用单面绝缘胶带
- [0040] T3' 阴极配对凹部用单面绝缘胶带
- [0041] T4' 阴极极片对位配对区用单面绝缘胶带

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二次电池电芯以及实施例和对比例的测试结果。

[0043] 首先说明根据本实用新型的二次电池电芯。

[0044] 参照图 1 至图 8, 本实用新型的二次电池电芯包括阳极极片 1、阳极极耳 2、阴极极片 3、阴极极耳 4 以及隔离膜 5。

[0045] 阳极极片 1 包括 : 阳极集流体 11 ; 以及阳极膜片 12, 设置在阳极集流体 11 的表面。阴极极片 3 包括 : 阴极集流体 31 ; 以及阴极膜片 32, 设置在阴极集流体 31 的表面。隔离膜 5 设置于阳极极片 1 和阴极极片 3 之间。

[0046] 阳极极片 1 形成有 : 阳极极耳收容凹槽 G11, 底部为阳极集流体 11 而周侧为阳极膜片 12, 阳极极耳 2 收容于阳极极耳收容凹槽 G11 内并电连接于阳极极耳收容凹槽 G11 处的阳极集流体 11。

[0047] 阴极极片 3 形成有 : 阴极极耳收容凹槽 G31, 底部为阴极集流体 31 而周侧为阴极膜片 32, 阴极极耳 4 收容于阴极极耳收容凹槽 G31 内并电连接于阴极极耳收容凹槽 G31 处的阴极集流体 31。

[0048] 阴极极片 3 还形成有 : 阴极极片对位凹槽 G32, 底部为阴极集流体 31 而周侧为阴极膜片 32, 位于阴极极片 3 的与阳极极耳收容凹槽 G11 对位的区域。

[0049] 在根据本实用新型所述的二次电池电芯中, 阴极极片对位凹槽 G32 位于阴极极片 3 的与阳极极耳收容凹槽 G11 对位的区域, 阴极极片对位凹槽 G32 无阴极活性物质存在, 所以当二次电池电芯形成二次电池后, 在利用阳极极耳收容凹槽 G11 收容阳极极耳 2、阴极极耳收容凹槽 G31 收容阴极极耳 4 来提高二次电池的能量密度的同时, 因为阴极极片对位凹槽 G32 与阳极极耳 2 对位, 从而减少了向阳极极耳 2 游离的阴极活性物质, 减少了阴极活性物质游离扩散至对位的阳极极耳 2 处, 进而能减轻在二次电池充放电过程中阴极活性物质富集在阳极极耳 2 处, 最终减轻了阳极极耳 2 处出现析出阴极活性物质的问题, 提高二次电池的安全性能。

[0050] 在根据本实用新型所述的二次电池电芯中, 在实施例, 阴极极片对位凹槽 G32 在长度和宽度上均可大于阳极极耳收容凹槽 G11。在一实施例中, 阴极极片对位凹槽 G32 在

长度和宽度上均大于阳极极耳收容凹槽 G110.5 ~ 3mm, 优选在长度和宽度上均大于阳极极耳收容凹槽 G11 1 ~ 2mm。在这种情况下, 能够完全避免在二次电池充放电过程中阴极活性物质富集在阳极极耳 2 处, 最终完全克服阳极极耳 2 处出现析出阴极活性物质的问题, 进一步提高二次电池的安全性能。

[0051] 在根据本实用新型所述的二次电池电芯中, 在一实施例中, 参照图 1、图 2、图 4、图 5、图 6、图 7 以及图 8, 所述二次电池电芯还可包括: 阴极极片对位凹槽用双面绝缘胶带 T1, 覆盖整个阴极极片对位凹槽 G32, 且在两面上分别粘接隔离膜 5 和阴极极片对位凹槽 G32 周围的阴极膜片 32。

[0052] 在根据本实用新型所述的二次电池电芯中, 由于阴极极片对位凹槽用双面绝缘胶带 T1 覆盖整个阴极极片对位凹槽 G32 且在两面上分别粘接隔离膜 5 和阴极极片对位凹槽 G32 周围的阴极膜片 32, 所以阴极极片对位凹槽用双面绝缘胶带 T1 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。

[0053] 在根据本实用新型所述的二次电池电芯中, 在一实施例中, 参照图 1、图 2、图 4、图 5、图 6、图 7 以及图 8, 所述二次电池电芯还可包括: 阴极极耳收容凹槽用双面绝缘胶带 T2, 覆盖整个阴极极耳收容凹槽 G31, 且在两面上分别粘接隔离膜 5 和阴极极耳收容凹槽 G31 周围的阴极膜片 32。

[0054] 在根据本实用新型所述的二次电池电芯中, 由于阴极极耳收容凹槽用双面绝缘胶带 T2 覆盖整个阴极极耳收容凹槽 G31 且在两面上分别粘接隔离膜 5 和阴极极耳收容凹槽 G31 周围的阴极膜片 32, 所以阴极极耳收容凹槽用双面绝缘胶带 T2 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。

[0055] 在根据本实用新型所述的二次电池电芯中, 阳极极耳 2 可采用超声波焊接、激光焊接或热压焊接方式电连接于阳极极耳收容凹槽 G11 处的阳极集流体 11。

[0056] 在根据本实用新型所述的二次电池电芯中, 阴极极耳 4 可采用超声波焊接、激光焊接或热压焊接方式电连接于阴极极耳收容凹槽 G31 处的阴极集流体 31。

[0057] 在根据本实用新型所述的二次电池电芯中, 阳极极耳收容凹槽 G11 可通过激光清洗、机械清洗或发泡胶清洗将阳极膜片 12 的对应部分去除以露出阳极集流体 11 而形成; 或者阳极极耳收容凹槽 G11 可通过涂布阳极膜片浆料之前预置热敏型发泡胶纸在阳极集流体 11 上、之后涂布并干燥阳极膜片浆料以形成阳极膜片 12 且在干燥阳极膜片浆料时热敏型发泡胶纸从阳极集流体 11 上剥离形成; 或者阳极极耳收容凹槽 G11 可通过在涂布阳极膜片浆料之前预涂发泡浆料在阳极集流体 11 上并干燥、之后涂布并干燥阳极膜片浆料以形成阳极膜片 12 且在干燥阳极膜片浆料时干燥的发泡浆料从阳极集流体 11 上剥离形成。

[0058] 在根据本实用新型所述的二次电池电芯中, 阴极极耳收容凹槽 G31 可通过激光清洗、机械清洗或发泡胶清洗将阴极膜片 32 的对应部分去除以露出阴极集流体 31 而形成; 或者阴极极耳收容凹槽 G31 可通过涂布阴极膜片浆料之前预置热敏型发泡胶纸在阴极集流体 31 上、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时热敏型发泡胶纸从阴极集流体 31 上剥离形成; 或者阴极极耳收容凹槽 G31 可通过在涂布阴极膜片浆料之前预涂发泡浆料在阴极集流体 31 上并干燥、之后涂布并干燥阴极膜片浆料以

形成阴极膜片 32 且在干燥阴极膜片浆料时干燥的发泡浆料从阴极集流体 11 上剥离形成。

[0059] 在根据本实用新型所述的二次电池电芯中,阴极极片对位凹槽 G32 可通过激光清洗、机械清洗或发泡胶清洗而将阴极膜片 32 的对应部分去除以露出阴极集流体 31 而形成;或者阴极极片对位凹槽 G32 可通过涂布阴极膜片浆料之前预置热敏型发泡胶纸在阴极集流体 31 上、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时热敏型发泡胶纸从阴极集流体 31 上剥离形成;或者阴极极片对位凹槽 G32 可通过在涂布阴极膜片浆料之前预涂发泡浆料在阴极集流体 31 上并干燥、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时干燥的发泡浆料从阴极集流体 11 上剥离形成。

[0060] 在根据本实用新型所述的二次电池电芯中,阴极极片对位凹槽用双面绝缘胶带 T1 可为双面初始时均已有粘性或是一个单面初始时已有粘性而另一单面是经后续的热压或冷压后有粘性的双面胶带。

[0061] 在根据本实用新型所述的二次电池电芯中,阴极极耳收容凹槽用双面绝缘胶带 T2 可为双面初始时均已有粘性或是一个单面初始时已有粘性而另一单面是经后续的热压或冷压后有粘性的双面胶带。

[0062] 在根据本实用新型所述的二次电池电芯中,在一实施例中,参照图 1、图 4、图 6 以及图 7,阴极极片 3 还可形成有:阴极配对凹部 R31,底部为阴极集流体 31 而周侧为阴极膜片 32,位于阴极极耳收容凹槽 G31 的正对背侧。阴极配对凹部 R31 的设置,便于阴极极耳 4 超声焊接于阴极极耳收容凹槽 G311 中。

[0063] 在根据本实用新型所述的二次电池电芯中,在一实施例中,参照图 1、图 4、图 6 以及图 7,所述二次电池电芯还可包括:阴极配对凹部用双面绝缘胶带 T3,覆盖整个阴极配对凹部 R31,且在两面上分别粘接隔离膜 5 和阴极配对凹部 R31 周围的阴极膜片 32。

[0064] 在根据本实用新型所述的二次电池电芯中,阴极配对凹部 R31 可通过激光清洗、机械清洗或发泡胶清洗将阴极膜片 32 的对应部分去除以露出阴极集流体 31 而形成;或者阴极配对凹部 R31 可通过涂布阴极膜片浆料之前预置热敏型发泡胶纸在阴极集流体 31 上、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时热敏型发泡胶纸从阴极集流体 31 上剥离形成;或者阴极配对凹部 R31 可通过在涂布阴极膜片浆料之前预涂发泡浆料在阴极集流体 31 上并干燥、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时干燥的发泡浆料从阴极集流体 11 上剥离形成。

[0065] 在根据本实用新型所述的二次电池电芯中,阴极配对凹部用双面绝缘胶带 T3 可为双面初始时均已有粘性或是一个单面初始时已有粘性而另一单面是经后续的热压或冷压后有粘性的双面胶带。

[0066] 在根据本实用新型所述的二次电池电芯中,在一实施例中,参照图 1、图 3 以及图 4,阳极极片 1 还可形成有:阳极配对凹部 R11,底部为阳极集流体 11 而周侧为阳极膜片 12,位于阳极极耳收容凹槽 G11 的正对背侧。阳极配对凹部 R11 的设置,便于阳极极耳 2 超声焊接于阳极极耳收容凹槽 G11 中。

[0067] 在根据本实用新型所述的二次电池电芯中,在一实施例中,参照图 1、图 2、图 3 以及图 4,阴极极片 3 还可形成有:阴极极片对位凹部 R32,底部为阴极集流体 31 而周侧为阴极膜片 32,位于阴极极片 3 的与阳极配对凹部 R11 对位的区域,且在长度和宽度上均大于阳极配对凹部 R11。优选地,阴极极片对位凹部 R32 在长度和宽度上均大于阳极配对凹部 R11

1 ~ 2mm (即长度和宽度分别大 1 ~ 2mm, 至于深度是否相同可以阴极膜片 32 的厚度与阳极膜片 12 的厚度之间的关系来确定)。当然, 阴极极片对位凹部 R32 在长度和宽度上均大于阳极配对凹部 R11 的数值可以视实际情况来调整。

[0068] 在根据本实用新型所述的二次电池电芯中, 在一实施例中, 参照图 1、图 2、图 3 以及图 4, 所述二次电池电芯还可包括: 阴极极片对位凹部用双面绝缘胶带 T4, 覆盖整个阴极极片对位凹部 R32, 且在两面上分别粘接隔离膜 5 和阴极极片对位凹部 R32 周围的阴极膜片 32。由于阴极极片对位凹部用双面绝缘胶带 T4 覆盖整个阴极极片对位凹部 R32 且在两面上分别粘接隔离膜 5 和阴极极片对位凹部 R32 周围的阴极膜片 32, 所以阴极极片对位凹部用双面绝缘胶带 T4 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。

[0069] 在根据本实用新型所述的二次电池电芯中, 阳极配对凹部 R11 可通过激光清洗、机械清洗或发泡胶清洗将阳极膜片 12 的对应部分去去除以露出阳极集流体 11 而形成; 或者阳极配对凹部 R11 可通过涂布阳极膜片浆料之前预置热敏型发泡胶纸在阳极集流体 11 上、之后涂布并干燥阳极膜片浆料以形成阳极膜片 12 且在干燥阳极膜片浆料时热敏型发泡胶纸从阳极集流体 11 上剥离形成; 或者阳极配对凹部 R11 可通过在涂布阳极膜片浆料之前预涂发泡浆料在阳极集流体 11 上并干燥、之后涂布并干燥阳极膜片浆料以形成阳极膜片 12 且在干燥阳极膜片浆料时干燥的发泡浆料从阳极集流体 11 上剥离形成。

[0070] 在根据本实用新型所述的二次电池电芯中, 阴极极片对位凹部 R32 可通过激光清洗、机械清洗或发泡胶清洗将阴极膜片 32 的的对应部分去除以露出阴极集流体 31 而形成; 或者阴极极片对位凹部 R32 可通过涂布阴极膜片浆料之前预置热敏型发泡胶纸在阴极集流体 31 上、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时热敏型发泡胶纸从阴极集流体 31 上剥离形成; 或者阴极极片对位凹部 R32 可通过在涂布阴极膜片浆料之前预涂发泡浆料在阴极集流体 31 上并干燥、之后涂布并干燥阴极膜片浆料以形成阴极膜片 32 且在干燥阴极膜片浆料时干燥的发泡浆料从阴极集流体 11 上剥离形成。

[0071] 在根据本实用新型所述的二次电池电芯中, 阴极极片对位凹部用双面绝缘胶带 T4 可为双面初始时均已有粘性或是一个单面初始时已有粘性而另一单面是经后续的热压或冷压后有粘性的双面胶带。

[0072] 在根据本实用新型所述的二次电池电芯中, 在一实施例中, 阳极极耳收容凹槽 G11 的宽度为阳极极耳 2 的宽度的 1 ~ 2 倍, 阳极极耳收容凹槽 G11 的长度为阳极极耳 2 的收容于阳极极耳收容凹槽 G11 内的部分的长度的 1 ~ 3 倍, 阳极极耳收容凹槽 G11 的深度等于阳极膜片 12 的厚度。

[0073] 在根据本实用新型所述的二次电池电芯中, 在一实施例中, 阴极极耳收容凹槽 G31 的宽度为阴极极耳 4 的宽度的 1 ~ 2 倍, 阴极极耳收容凹槽 G31 的长度为阴极极耳 4 的收容于阴极极耳收容凹槽 G31 内的部分的长度的 1 ~ 3 倍, 阴极极耳收容凹槽 G31 的深度等于阴极膜片 32 的厚度。

[0074] 在根据本实用新型所述的二次电池电芯中, 在一实施例中, 参照图 3, 阳极极片 1 为一整体片, 二次电池电芯为卷绕式电芯, 在阳极极片 1 展开状态下, 阳极极片 1 的头部至尾部的距离定义为 D1, 阳极极耳收容凹槽 G11 的中心线至阳极极片 1 的头部之间的距离定

义为 $d1$, $d1$ 处于自阳极极片 1 的头部起计算的 $1/10D1 \sim 7/10D1$ 的范围内,从而有利于降低二次电池电芯的直流阻抗 DCR(Direct current resistance)。优选地, $d1$ 处于自阳极极片 1 的头部起计算的 $3/10D1 \sim 7/10D1$ 的范围内。进一步地, $d1$ 越靠近阳极极片 1 的中间位置(即 $1/2D1$),DCR 越小。

[0075] 在根据本实用新型所述的二次电池电芯中,在一实施例中,参照图 3,阳极集流体 11 位于阳极极片 1 的头部附近处仅一个表面设置阳极膜片 12。

[0076] 在根据本实用新型所述的二次电池电芯中,在一实施例中,参照图 2,阴极极片 3 为一整体片,二次电池电芯为卷绕式电芯,在阴极极片 3 展开状态下,阴极极片 3 的头部至尾部的距离定义为 $D2$,阴极极耳收容凹槽 G31 的中心线至阴极极片 3 的头部之间的距离定义为 $d2$, $d2$ 处于自阴极极片 3 的头部起计算的 $1/10D2 \sim 7/10D2$ 的范围内,从而有利于降低二次电池电芯的直流阻抗 DCR。优选地, $d2$ 处于自阴极极片 3 的头部起计算的 $3/10D2 \sim 7/10D2$ 的范围内。进一步地,越靠近阴极极片 3 的中间位置(即 $1/2D2$),DCR 越小。

[0077] 在根据本实用新型所述的二次电池电芯中,双面胶带包括基材和涂覆在基材的两个表面的胶层。双面初始时均已有粘性的双面胶带的胶层可以为丁苯橡胶层、聚氨酯层、聚丙烯酸酯层或聚偏氟乙烯层。

[0078] 在根据本实用新型所述的二次电池电芯中,在一个单面初始时已有粘性而另一单面是经后续的热压或冷压后有粘性的双面胶带中,一个单面初始时已有粘性的胶层可以为丁苯橡胶层、聚氨酯层、聚丙烯酸酯层或聚偏氟乙烯层;而另一单面是经后续的热压或冷压后有粘性的胶层可以为常温下无初粘性的温敏胶或常温下无初粘性的压敏胶。所述常温下无初粘性的温敏胶是指在常温下,当物体和温敏胶之间发生短暂接触时,不会对物体产生粘结作用的温敏胶。所述常温下无初粘性的压敏胶是指在常温下,当物体和压敏胶之间在指压下发生短暂接触时,不会对物体产生粘结作用的压敏胶。所述常温下无初粘性的温敏胶可选自聚烯烃、聚乙烯醇缩丁醛、聚酰胺类以及聚酯类中的一种或几种。所述常温下无初粘性的压敏胶可选自乙烯-丁烯-聚苯乙烯线性三嵌段共聚物(SEBS)、苯乙烯-丁二烯嵌段共聚物(SEPS)以及环氧化苯乙烯-异戊二烯-苯乙烯嵌段共聚物(ESIS)中的一种或几种。

[0079] 在根据本实用新型的二次电池电芯中,二次电池可为锂离子电池或钠离子电池。当采用锂离子电池时,阴极活性物质含锂。当采用钠离子电池时,阴极活性物质含钠。所述二次电池可为软包装二次电池。

[0080] 最后说明根据本实用新型的以软包装锂离子电池作为举例的实施例和对比例及测试结果。

[0081] 实施例 1

[0082] 以 423482 型号软包装锂离子电池(成品电池厚度为 4.2mm、宽度为 34mm、长度为 82mm)为例,阳极极耳 2 与阴极极耳 4 尺寸一致,即极耳的焊接长度为 15mm,极耳宽度为 4mm、厚度为 0.06mm。

[0083] 采用图 1~4 所示的结构,经冷压工序后的极片(阳极极片 1 的单层阳极膜片 12 的厚度为 $67\mu\text{m}$ 、阴极极片 3 的单层阴极膜片 32 的厚度为 $53\mu\text{m}$),采用激光在阳极极片 1 的 $1/2$ 处(即 $d1 = 1/2D1$)清洗出用于焊接阳极极耳 2 的阳极极耳收容凹槽 G11 以及阳极配对凹部 R11,并在阳极极耳 2 对位的阴极极片区清洗出阴极极片对位凹槽 G32 以及阴极极

片对位凹部 R32。采用激光在阴极极片 3 的 $1/2$ 处（即 $d2 = 1/2D2$ ）清洗出用于焊接阴极极耳 4 的阴极极耳收容凹槽 G31 以及阴极配对凹部 R31。其中阴极极耳收容凹槽 G31 以及阴极配对凹部 R31 各自宽度均为 6mm、长度均为 20mm，阳极极耳收容凹槽 G11 以及阳极配对凹部 R11 各自宽度均为 6mm、长度均为 20mm，阴极极片对位凹槽 G32 以及阴极极片对位凹部 R32 各自宽度均为 8mm、长度均为 22mm，将阳极极耳 2 焊接于阳极极耳收容凹槽 G11、将阴极极耳 4 焊接于阴极极耳收容凹槽 G31。阴极极片对位凹槽用双面缘胶带 T1 覆盖整个阴极极片对位凹槽 G32 且在两面上分别粘接隔离膜 5 和阴极极片对位凹槽 G32 周围的阴极膜片 32，阴极极耳收容凹槽用双面绝缘胶带 T2 覆盖整个阴极极耳收容凹槽 G31 且在两面上分别粘接隔离膜 5 和阴极极耳收容凹槽 G31 周围的阴极膜片 32，阴极配对凹部用双面绝缘胶带 T3 覆盖整个阴极配对凹部 R31 且在两面上分别粘接隔离膜 5 和阴极配对凹部 R31 周围的阴极膜片 32，阴极极片对位凹部用双面绝缘胶带 T4 覆盖整个阴极极片对位凹部 R32 且在两面上分别粘接隔离膜 5 和阴极极片对位凹部 R32 周围的阴极膜片 32，阴极极片对位凹槽用双面绝缘胶带 T1、阴极极耳收容凹槽用双面绝缘胶带 T2、阴极配对凹部用双面绝缘胶带 T3、阴极极片对位凹部用双面绝缘胶带 T4 均为双面初始时均已有粘性的 PET 基材上双面涂覆聚偏氟乙烯层的双面胶带，阳极极片 1、阴极极片 3 和隔离膜 5 卷绕，由此形成二次电池电芯。

[0084] 实施例 2

[0085] 采用图 5 所示的结构，与实施例 1 的不同之处：无阴极配对凹部 R31、阴极配对凹部用双面绝缘胶带 T3、阳极配对凹部 R11、阴极极片对位凹部 R32 以及阴极极片对位凹部用双面绝缘胶带 T4。其余同实施例 1。

[0086] 实施例 3

[0087] 采用图 6 和图 7 所示的结构，与实施例 1 的不同之处：采用激光方式在阳极极片 1 的 $3/4$ 处（即 $d1 = 3/4D1$ ，靠近头部附近的阳极膜片 12 单面设置）清洗出用于焊接阳极极耳 2 的阳极极耳收容凹槽 G11，并在阳极极耳 2 对位的阴极极片区清洗出阴极极片对位凹槽 G32，阴极极片对位凹槽用双面缘胶带 T1 覆盖整个阴极极片对位凹槽 G32 且在两面上分别粘接隔离膜 5 和阴极极片对位凹槽 G32 周围的阴极膜片 32。其余同实施例 1。

[0088] 实施例 4

[0089] 采用如图 8 所示的结构，与实施例 3 的不同之处：无阴极配对凹部 R31 以及阴极配对凹部用双面绝缘胶带 T3。其余同实施例 3。

[0090] 对比例 1

[0091] 采用如图 8 所示结构，与实施例 4 的不同之处：阳极极耳收容凹槽 G11 的宽度为 6mm、长度均为 20mm，阴极极片对位凹槽 G32 的宽度为 4mm、长度均为 18mm。其余同实施例 4。

[0092] 对比例 2

[0093] 采用图 9 和图 10 所示的结构，与实施例 1 的不同之处：无阴极极片对位凹槽 G32 和阴极极片对位凹部 R32，但采用阴极极片对位收容区用单面绝缘胶带 T1' 粘贴阴极膜片 32 的与阳极极耳收容凹槽 G11 对位的相应区域的表面，采用阴极极片对位配对区用单面绝缘胶带 T4' 粘贴阴极膜片 32 的阳极配对凹部 R11 对位的相应区域的表面，采用阴极极耳收容凹槽用单面绝缘胶带 T2' 粘贴阴极极耳收容凹槽 G31 周围的阴极膜片 32，采用阴极配对

凹部用单面绝缘胶带 T3' 粘贴阴极配对凹部 R31 周围的阴极膜片 32。

[0094] 在实施例 1-4 和对比例 1-2 中分别选取 20 个软包装锂离子电池样品进行 1000 个循环充放电测试,对测试前后的样品的厚度进行测量,并且对测试后的软包装锂离子电池样品进行拆解观察析锂的情况,所得结果示如表 1 所示。

[0095] 表 1 实施例 1-4 与对比例 1-2 的测试结果

[0096]

	平均厚度/mm			发生析锂 的样品个 数
	1000 循环前	1000 循环后	变形量	
实施例 1	4.067	4.334	0.267	0
实施例 2	4.067	4.334	0.267	0
实施例 3	4.066	4.330	0.264	0
实施例 4	4.066	4.330	0.264	0
对比例 1	4.067	4.358	0.291	9
对比例 2	4.067	4.381	0.314	20

[0097] 从表 1 看出,实施例 1-4 无析锂;而对比例 1 和对比例 2 有析锂,且对比例 2 比对比例 1 析锂严重;实施例 1-4 的变形量远小于对比例 1 和对比例 2。对比例 1 的变形量比对比例 2 的变形量小,但对比例 1 的变形量大于实施例 4 的变形量。

[0098] 由此可见,实施例 1-4 中,阴极极片对位凹槽 G32 在长度和宽度上均大于阳极极耳收容凹槽 G11,能完全避免析锂,且能有效控制软包装锂离子电池的变形。相比对比例 2,在对比例 1 中,阴极极片对位凹槽 G32 在长度和宽度上均小于阳极极耳收容凹槽 G11,能减轻析锂,并减轻变形量。

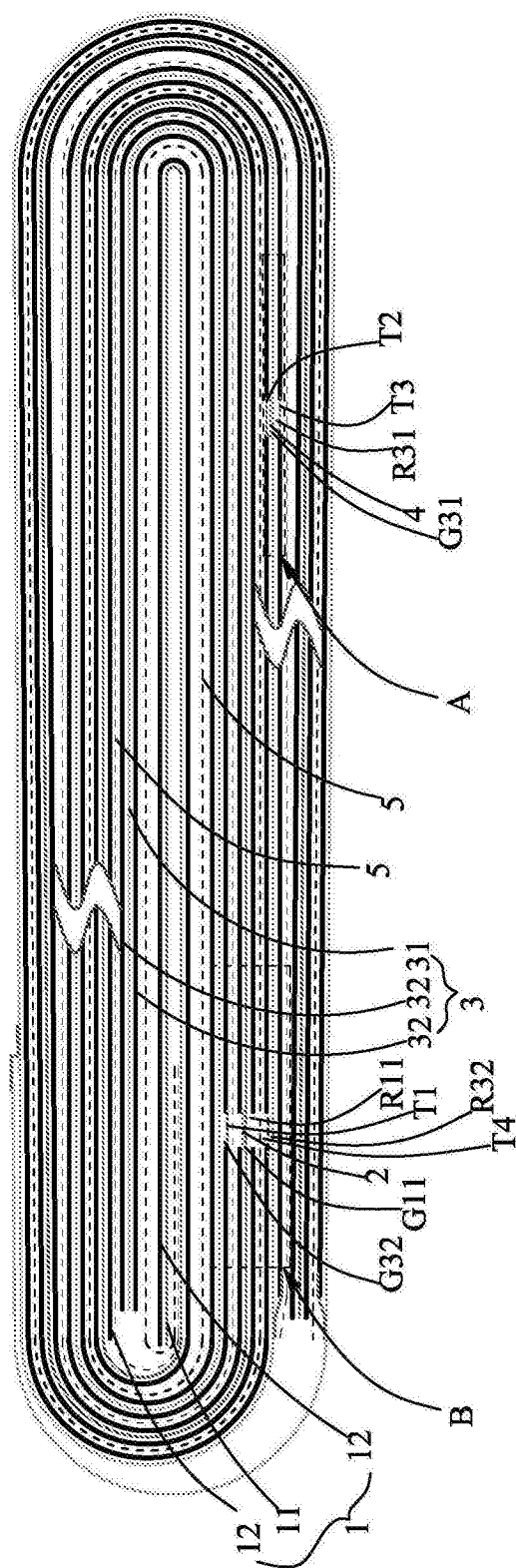


图 1

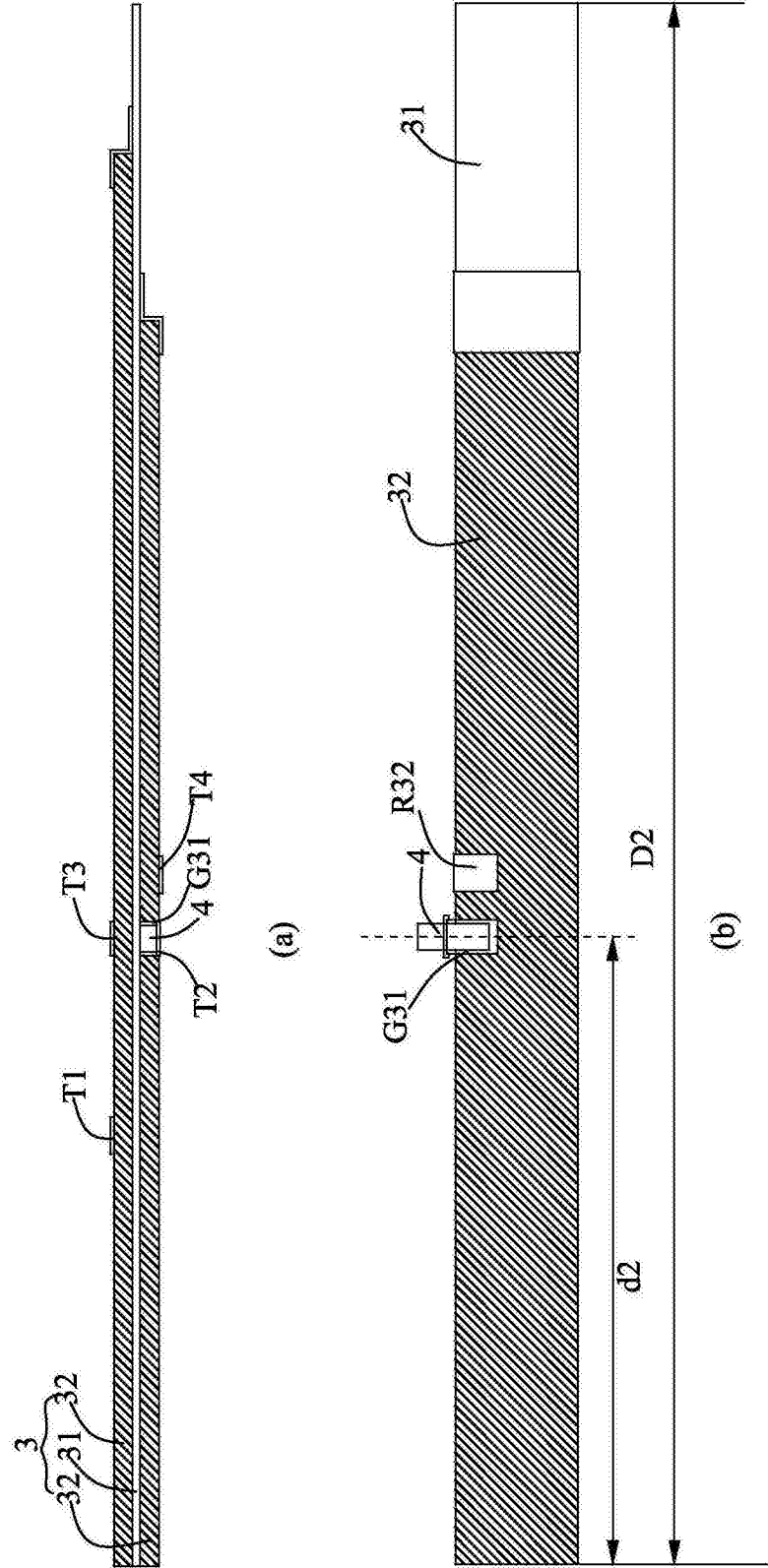


图 2

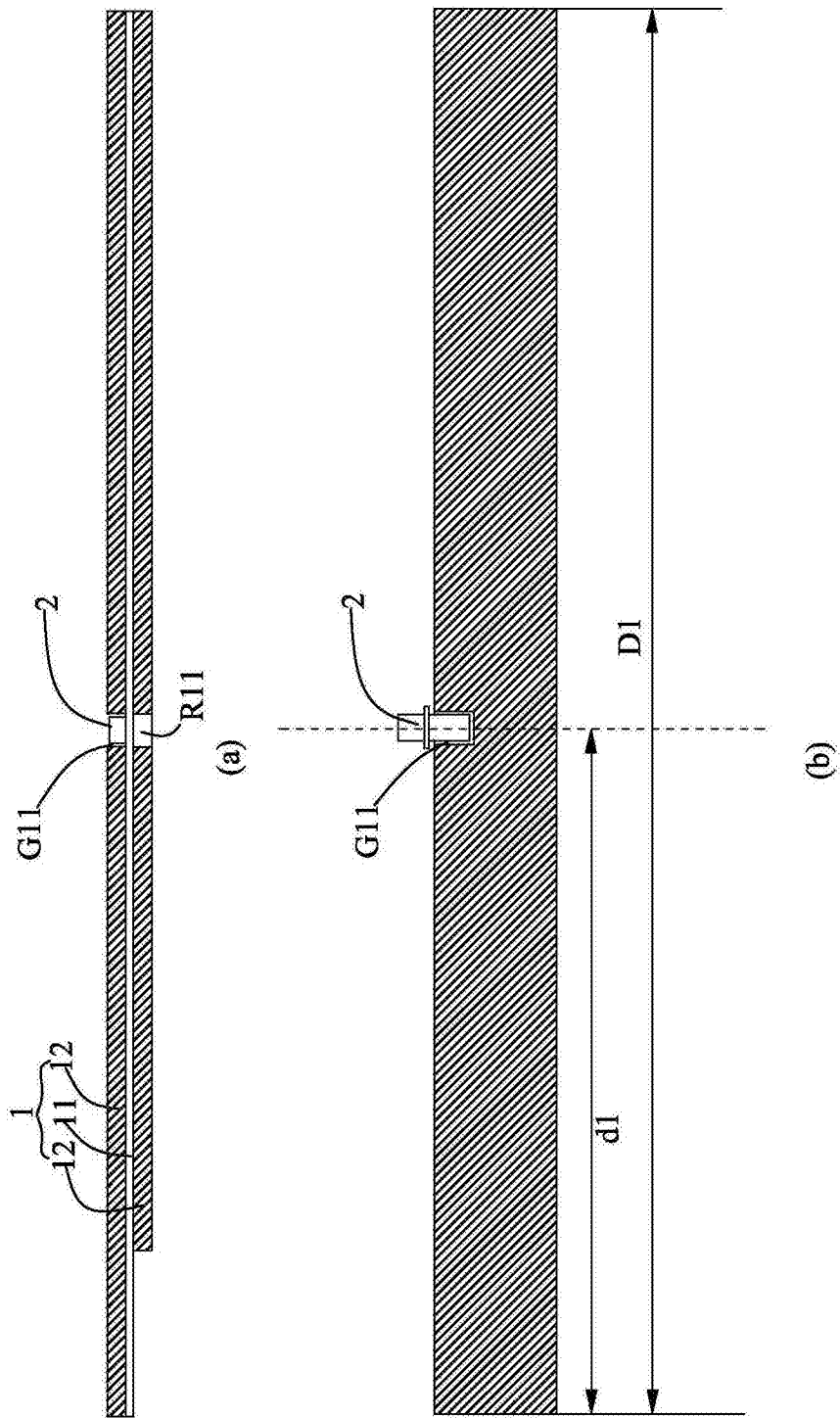


图 3

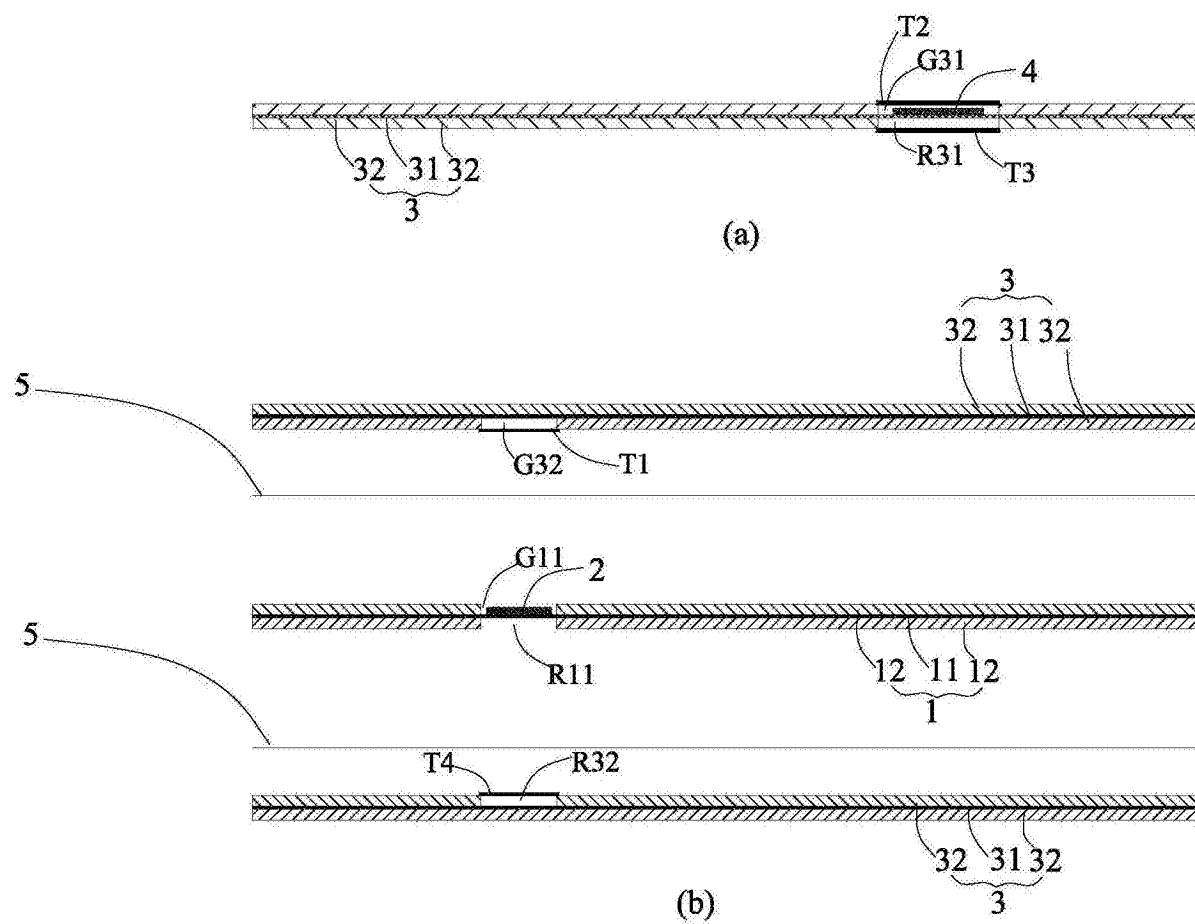


图 4

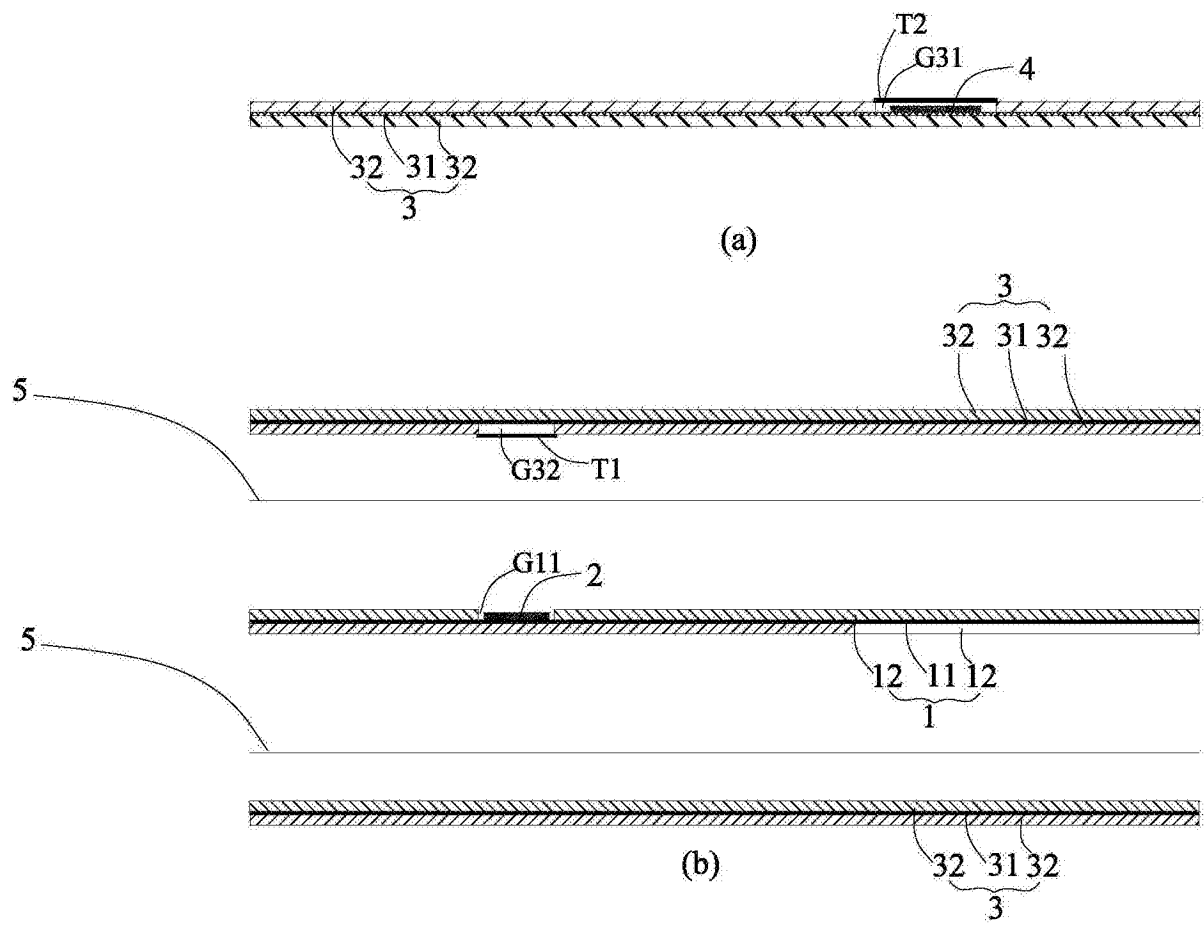


图 5

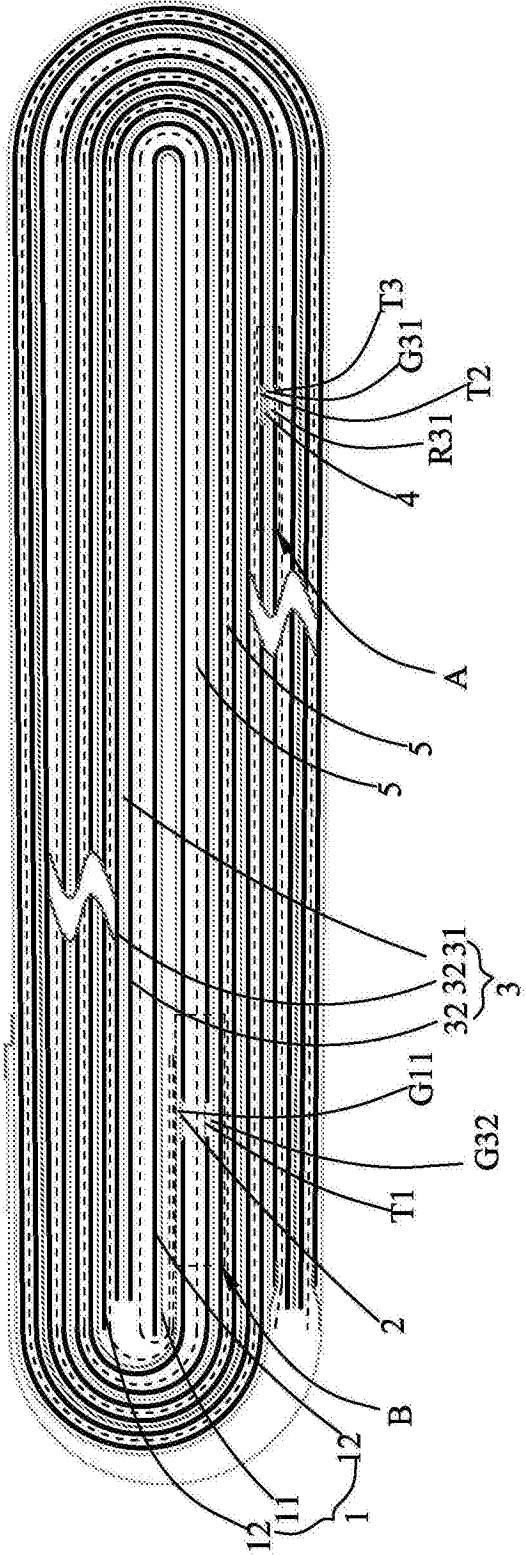


图 6

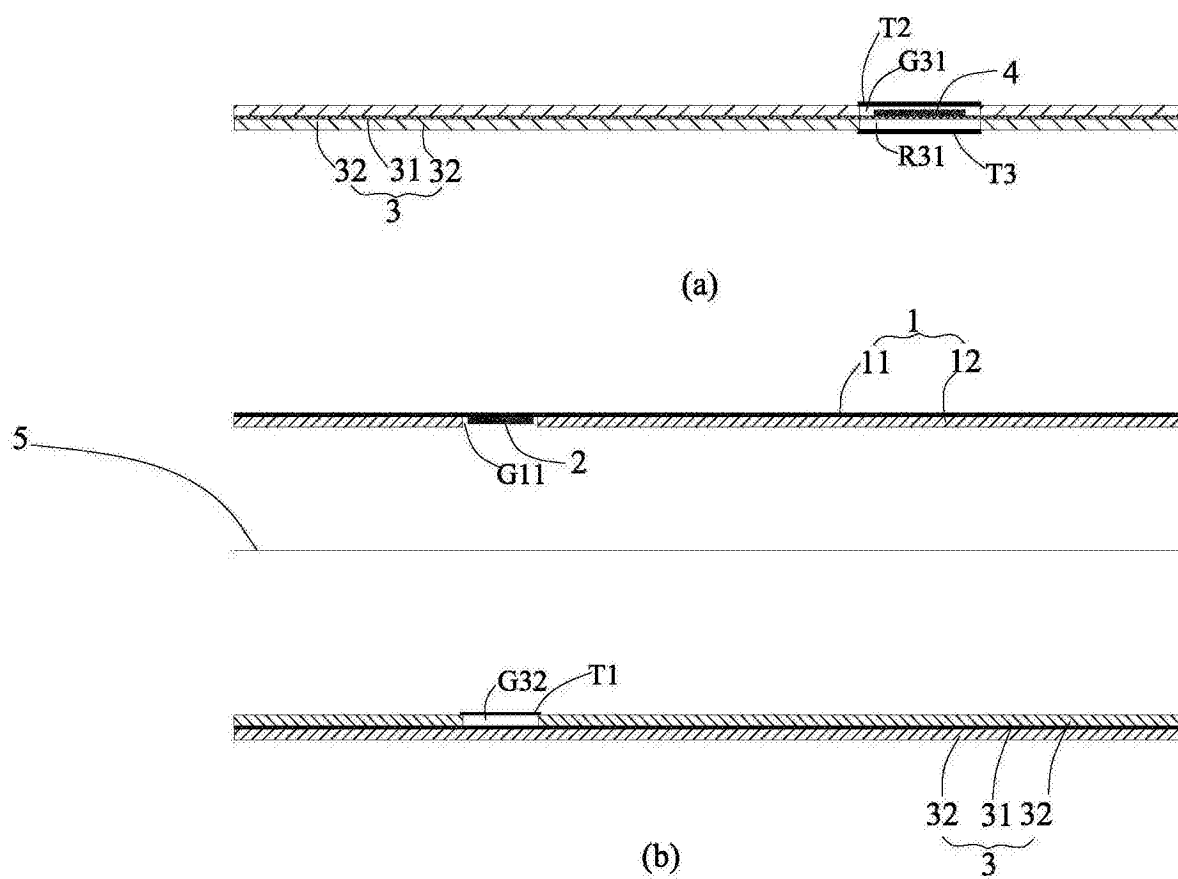


图 7

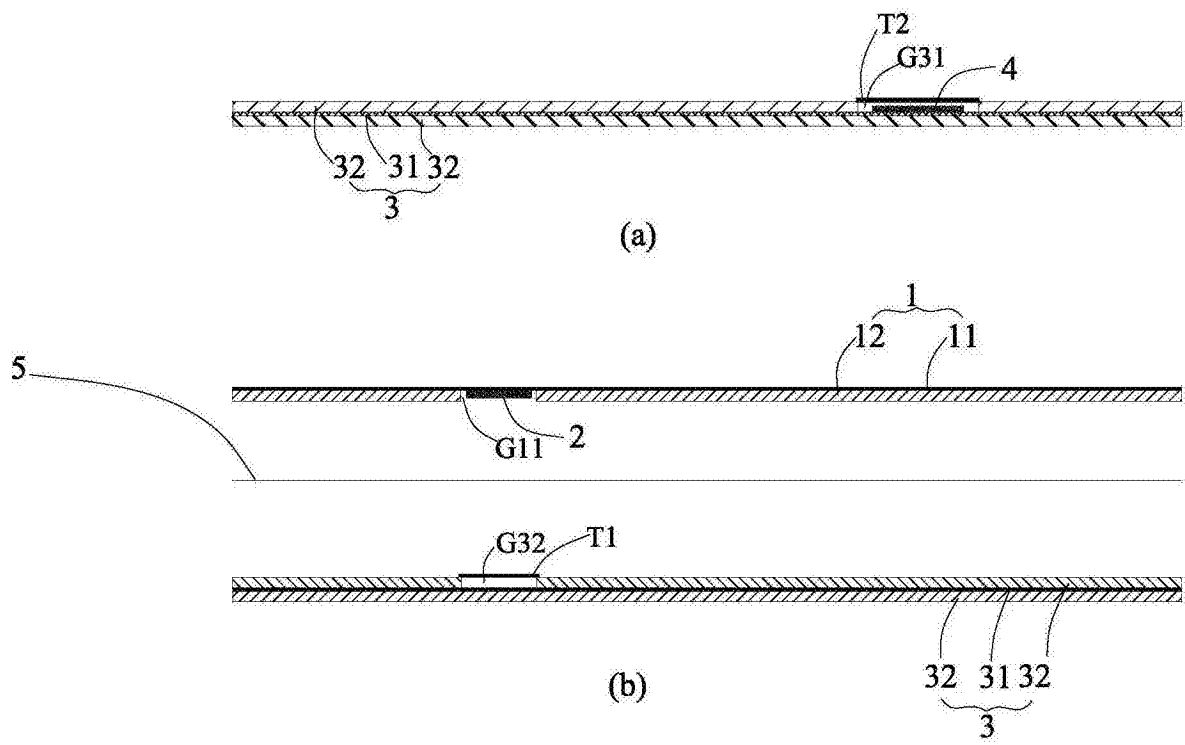


图 8

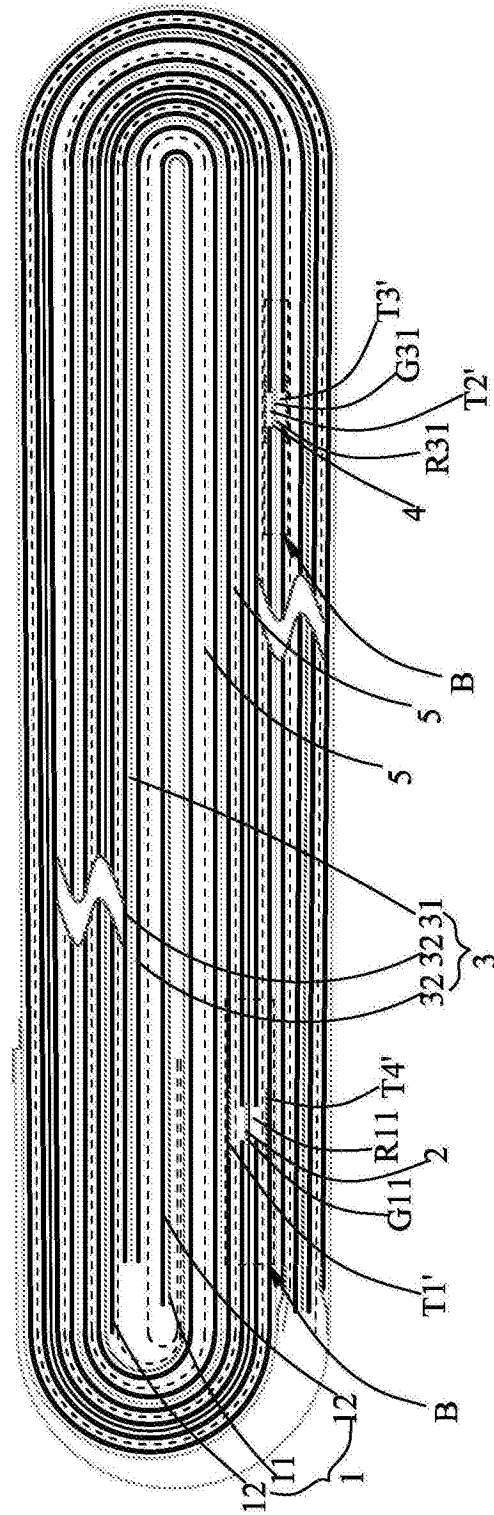


图 9

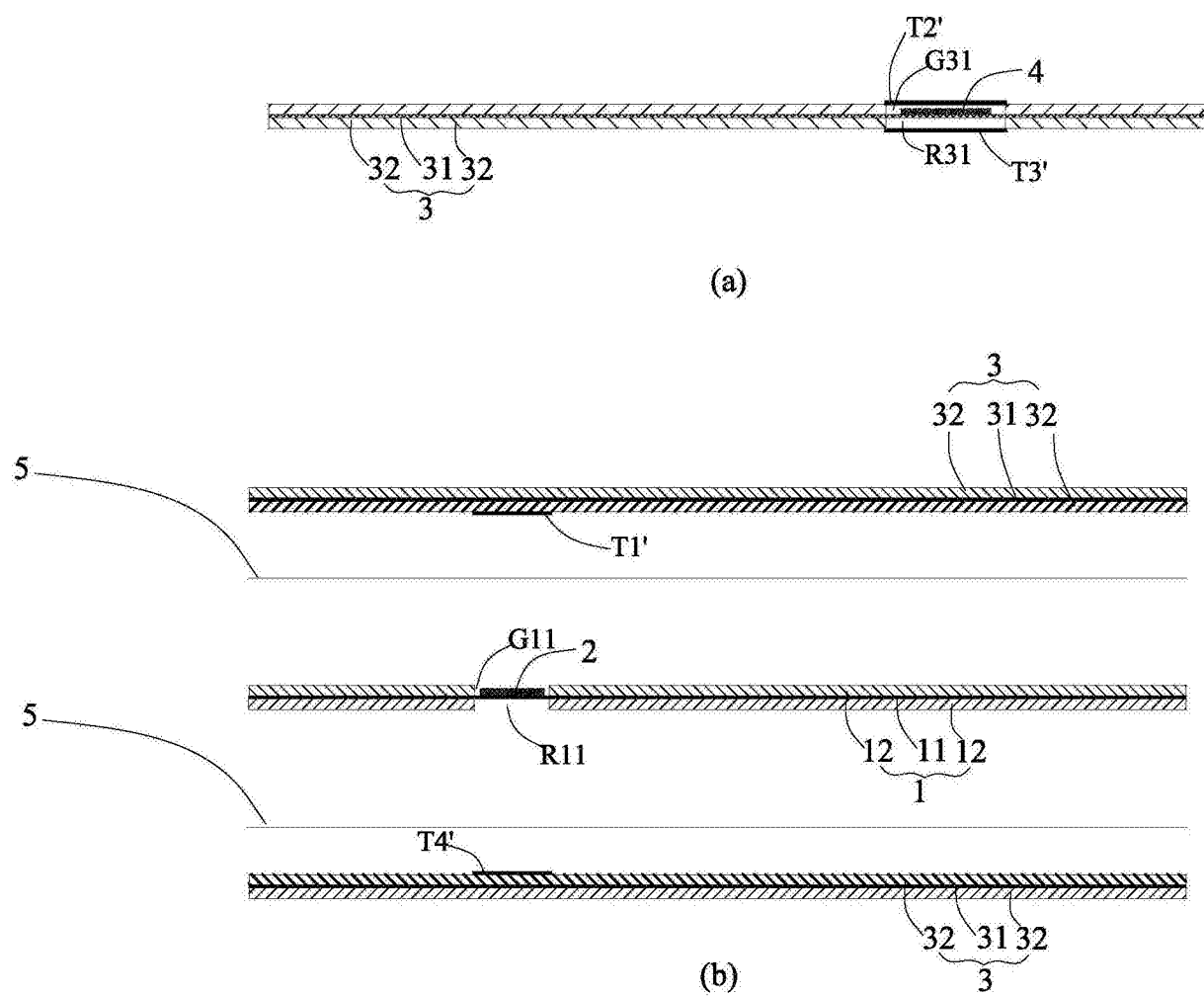


图 10