

SCORE Placeholder Sheet for IFW Content

Application Number: 16000597

Document Date: 06/05/2018

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.

- Drawing

At the time of document entry (noted above):

- USPTO employees may access SCORE content via eDAN using the Supplemental Content tab, or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

Form Revision Date: August 26, 2013

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		
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. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Chaowang		Lin		
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	
	Fan		Yang		
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					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yisong		Su	
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
	Huawei		Zhong	
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
	Changming		Qu	
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

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

Inventor 6					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Xiaozheng		Zhang		
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		
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	ELECTRODE AND LITHIUM-ION BATTERY		
Attorney Docket Number	DHNG001.004AUS	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	1	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

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.

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		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

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).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
201810162494.1	CN	2018-02-26	

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

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	
☐ Person to whom the inventor is obligated to assign.		☐ Joint Inventor	
☐ 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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

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)	2018-06-05	
First Name	David	Last Name	Dremann	Registration Number	71,708

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

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DHNG001.004AUS
		Application Number	
Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY		

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.**

ELECTRODE AND LITHIUM-ION BATTERY

TECHNICAL FIELD

The present application relates to battery, and more particularly to
5 an electrode and a lithium-ion battery.

BACKGROUND

Lithium-ion batteries have entered the daily life with the advancement of science and technology and the improvement of environmental protection requirements. With the rapid popularization of
10 lithium-ion batteries, safety problems caused by external forces puncturing lithium-ion batteries occasionally occur on the user's side, and their safety performance has been increasingly received attention by people, especially the continued fermentation of some cell phone
15 explosions, causing users, sales backends, and lithium-ion battery manufacturers all place new demands on the safety performance of lithium-ion batteries.

Current methods for improving the safety of lithium-ion batteries are at the expense of the energy density of lithium-ion batteries. Therefore,
20 there is an urgent need to provide a technology that can significantly improve the safety performance of lithium-ion batteries under conditions of higher energy density.

SUMMARY OF THE APPLICATION

25 In the examples of the present application, a double layer design used for the active material layer in the electrode can avoid the internal short circuit of the lithium-ion battery caused by the external force and will not cause the battery to fail.

Some examples of the present application provide an electrode

comprising: a current collector; a first active material layer, comprising a first active material; and a second active material layer, comprising a second active material; wherein the first active material layer is arranged between the current collector and the second active material layer, the first active material layer is formed on at least one surface of the current collector, and a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1.

In above electrode, the first active material has an average particle size in a range of 0.2 μm to 15 μm . The average particle size (Dv50) refers to a particle size that reaches a volume accumulation of 50% from the small particle size side in a volume-based granularity distribution.

In above electrode, a particle size of 90% accumulative volume of the first active material is less than 40 μm . A particle size of 90% accumulative volume (Dv90) refers to a particle size that reaches a volume accumulation of 90% from the small particle size side in a volume-based granularity distribution.

In above electrode, the first active material layer has a thickness of 2 μm to 30 μm .

In above electrode, the second active material layer has a thickness equal to or more than 30 μm .

In above electrode, the first active material comprises one of lithium cobaltate, lithium manganate, lithium nickelate, lithium nickel cobalt manganese oxide, lithium iron phosphate, lithium iron manganese phosphate, lithium vanadium phosphate, lithium vanadyl phosphate, lithium-rich manganese-based materials, lithium nickel cobalt aluminate and lithium titanate, and combinations thereof.

In above electrode, the second active material comprises one of

lithium cobaltate, lithium nickel cobalt manganese oxide, lithium nickel cobalt aluminum oxide, lithium-rich manganese-based material, lithium iron phosphate, and combinations thereof.

In above electrode , the first active material comprises one of
5 artificial graphite, natural graphite, mesocarbon microbeads, soft carbon, hard carbon, silicon, silicon carbide, lithium titanate, and combinations thereof.

In above electrode , each of the first active material layer and the second active material layer further comprises a binder, and the binder
10 comprises one selected from polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylates, polyacrylic acids, polyacrylic acid salt, carboxymethylcellulose sodium, polyethylene pyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene,
15 polyhexafluoropropylene and styrene butadiene rubber, and combinations thereof.

Some examples of the present application further provide a lithium-ion battery comprising above electrode s.

The double-layered active material layer is used for the active
20 material layer in the electrode of the present application to ensure that the lithium-ion battery does not generate a short circuit when pressed by an external force, thereby ensuring the mechanical safety performance of the lithium-ion battery.

25 **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 shows a schematic view of the structure of a positive electrode.

Figure 2 shows a schematic view of the structure of a positive electrode according to some examples of the present application.

DETAILED DESCRIPTION OF THE EXAMPLE

The following examples may enable those skilled in the art to more fully understand the present application, but do not limit the present application in any way.

The double-layered active material layer is used for the active material layer in the electrode in the examples of the present application to ensure that the lithium-ion battery does not generate a short circuit when pressed by an external force (the corresponding test method being a nail test), thereby ensuring the mechanical safety performance of the lithium-ion battery (50% pass the nail test). The technical means of the present application can be applied to a lithium-ion battery and play a great safety role in a lithium-ion battery application terminal. It should be noted that the present application takes the positive electrode as an example, and the negative electrode can also realize the technical solution.

In the process of nail penetration for lithium-ion battery, four short circuits usually occur: positive electrode active material layer-negative electrode active material layer, positive electrode active material layer-negative electrode current collector (usually copper foil), positive electrode current collector (usually aluminum foil)-negative electrode current collector, positive electrode current collector-negative electrode active material layer. In these four short-circuit modes, the short circuit mode of the positive electrode current collector-negative electrode active material layer is the most dangerous among the four short circuit modes because the short circuit power at the time of a short circuit is very large. Therefore, preferentially avoiding such a short circuit mode of the positive electrode current collector-negative electrode active material layer is the most direct means for improving the safety of the lithium-ion

battery penetrating through nails.

In the present application, the short circuit of the positive current collector-negative electrode active material layer is avoided. That is to say, a coating with a higher resistivity is provided on the surface of the negative electrode active material layer, or a coating with a higher resistivity is provided on the surface of the positive electrode current collector to avoid direct contact between the negative electrode active material layer and the positive electrode current collector so as to prevent the most dangerous short circuit mode from occurring. The coating provided on the surface of the negative electrode active material layer or the surface of the separator is usually a ceramic layer. By increasing the thickness of the ceramic layer, a short circuit between the negative electrode active material layer and the positive electrode current collector can be avoided. In order to avoid this short-circuit pattern between the negative electrode active material layer and the positive electrode current collector, the thickness of these coatings should not be too thin (generally at least greater than the surface roughness of the negative electrode active material layer surface), which will bring about the loss of energy density of the lithium-ion battery. In addition, these coatings increase the transmission distance of lithium ions from the positive electrode to the negative electrode, increase the transmission impedance of the lithium-ion battery, and greatly deteriorate the dynamic performance of the lithium-ion battery. And due to the large damage to the lithium-ion battery during the nail process, part of the coating will fall off during the nail process, thus affecting the stability of the nail protection effect.

One technical means is to allow the surface of the positive electrode current collector to adhere to a material with a higher resistivity to avoid direct contact between the positive electrode current collector and the

negative electrode active material layer during the nail process. It is a common practice to reduce the particle size of the positive electrode active material and increase the binder content of the positive electrode active material layer. The decrease of the particle size of the positive electrode active material will reduce the cycle performance of the lithium-ion battery, and increasing the binder content in the positive electrode active material layer will make the positive electrode become brittle, resulting in a greater effects on the production process and the energy density of the lithium-ion battery.

As shown in Figure 1, a schematic view of a positive electrode is shown. The positive electrode current collector 1 is located between two active material layers 2. Figure 2 shows a double-layered active material layer structure of the present application, i.e., an additional active material layer 3 is formed between the active material layer 2 and the positive electrode collector 1. The material and formulation of the active material layer 3 are optimized so that the adhesive force between the active material layer 3 and the positive electrode current collector 1 is increased, thereby protecting the positive electrode current collector 1, and the active material layer 3 will not come off during the nail process. Also, the short-circuit mode of the positive electrode current collector-negative electrode active material layer does not occur during the nail process, thereby ensuring the safety performance of the lithium-ion battery. For better differentiation, the active material layer 3 is hereinafter referred to as a first active material layer, and the active material layer 2 is referred to as a second active material layer. This is merely for better description and does not limit the present application.

The second active material layer 2 and the first active material layer 3 of the present application each contain a positive active material when compared with coating a non-conductive or poorly-conductive material

layer between the positive electrode current collector and the active material layer, so that both the first and second active material layers can provide energy, and their energy density is high. The design of the present application has no effect on the conductive properties of the active material layer, while using a non-conductive or poorly conductive coating for lithium-ion batteries may exert greater influence on the electronic conductance capability of lithium-ion batteries, so that the normal charge and discharge of the lithium-ion battery will be affected.

The positive electrode active material of the first active material layer in the examples of the present application comprises one of lithium cobaltate, lithium manganate, lithium nickelate, lithium nickel cobalt manganese oxide, lithium iron phosphate, lithium iron manganese phosphate, lithium vanadium phosphate, lithium vanadyl phosphate, lithium-rich manganese-based materials, lithium nickel cobalt aluminate and lithium titanate, and combinations thereof. The positive electrode active material of the second active material layer comprises the combination of one or more selected from the group consisting of lithium cobaltate, lithium nickel cobalt manganese oxide, lithium nickel cobalt aluminum oxide, lithium-rich manganese-based material, lithium iron phosphate. The positive electrode active material layer is a two-layer structure, and there are two positive electrode active material layers on the surface of the positive electrode current collector. Although the positive electrode active material of the two active material layers shown in Figure 2 has a clear interface, the interfaces of the two active material layers are bonded to each other without obvious interface by the embedding of the upper and lower layer particles and the binder between the two active material layers.

The active material layer of the double-layer structure protects the positive electrode current collector and the first active material layer

plays a leading role. In order to achieve the protection of the positive electrode current collector, the positive electrode active material of the first active material layer is required to have a small particle size so as to achieve higher coverage and adhesion on the positive electrode current collector (aluminum foil). In order to ensure the covering and bonding of the positive electrode current collector while reducing the influence of the first active material layer on the whole active material layer (the first active material layer has a lower compaction density than the second active material layer, so it is necessary to reduce the volume proportion of the first active material layer in the whole active material layer as much as possible). In the granularity distribution of the positive electrode active material of the first active material layer on a volume basis, a particle size that reaches volume accumulation of 50% from a small particle size (Dv50) ranges from 0.2 μm to 15 μm . And in the granularity distribution of the positive electrode active material of the first active material layer on a volume basis, a particle size that reaches volume accumulation of 90% from a small particle size (Dv90) ranges below 40 μm . In order to ensure the protective effect on the positive electrode current collector, the first active material layer needs to completely cover the positive electrode current collector. The smaller the particles of the positive electrode active material, the thinner the coating can be made while the compaction density of the positive electrode active material of small particles will be lower, leading a certain impact on the energy density of the lithium-ion battery.

In addition, considering that the first active material layer and the second active material layer also have some interactions, comprising the effects of adhesion and electron conduction, and considering that the first active material layer cannot be crushed due to the force transfer of the second active material layer particles during the cold pressing, so the

particle size ratio of the second active material layer and the first active material layer is another important factor that affects the performance of the lithium-ion battery.

In order to prevent the first active material layer from being damaged by the positive active material in the second active material layer during the cold pressing and to ensure the maximum adhesion between the first active material layer and the second active material layer, the ratio of Dv50 between the positive electrode active materials of the first active material layer and the second active material layer is in a certain range, i.e., Dv50 (of the second active material layer): Dv50 (of the first active material layer) = 1: 1 to 40:1. The particles of the positive active material of the second active material layer are too large, and thus the destructive effect on the first active material layer after the cold press increases, thereby resulting in the weakening of the protective effect of the first active material layer on the positive electrode current collector. In addition to the binding effect of the binder between the first active material layer and the second active material layer, the mutual riveting action of the positive electrode active material particles can also provide a certain binding effect. This bonding effect requires that the particle size difference between the particles is not too large. When the particles of the second active material layer are too large, this riveting effect is weakened, so that the interface between the layers becomes distinct or even separate.

In addition, the first active material layer needs a certain thickness in order to achieve full coverage of the positive electrode current collector. In order to achieve this goal, the particle size of the active material of the first active material layer has an upper limit. Since the particle size of the positive electrode active material in the first active material layer is small and the binder contained in the first active material layer is larger than

the binder in the second active material layer, the thickness of the first active material layer cannot be too large, otherwise it will reduce the energy density of lithium-ion batteries. Also, since the first active material layer needs to cover the positive electrode current collector, the thickness of the first active material layer needs to be controlled to 3 μm -40 μm , and the thickness after cold pressing is 2 μm -30 μm . In particular, the thickness of the first active material layer is not less than Dv90 of the positive electrode active material in the first active material layer, which is to ensure the coverage of the first active material layer, thereby achieving complete protection of the positive electrode current collector. Since the positive electrode active material of the first active material layer has a small particle size, the compaction density thereof will be relatively low. Therefore, in order to achieve a high energy density of the lithium-ion battery, the thickness of the second active material layer needs to be increased, and the thickness of the second active material layer is increased, e.g., to 30 μm or more. The thicker the second active material layer, the higher the energy density of the lithium-ion battery.

The positive electrode is cold-pressed under a certain pressure, and the active material layer is pressed into an electrode having a certain thickness. Since the active material layer of the present application has a double-layer structure, the compaction density of the positive electrode can be divided into the compaction density of the second active material layer, the compaction density of the first active material layer, and the overall compaction density. To ensure the energy density of a lithium-ion battery, it is required that the positive electrode has a higher compaction density, the compaction density of the first active material layer is greater than 2.8 g/cc, the compaction density of the second active material layer is greater than 3.3 g/cc and the compaction density

of the all active material layers is greater than 3.2 g/cc.

In addition, in order to achieve higher bonding for the first active material layer, it is required that the first active material layer contains a certain amount of binder, and the binder comprises, but is not limited to, one polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylates, polyacrylic acids, polyacrylates, carboxymethylcellulose sodium, polyethylene pyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene, polyhexafluoropropylene and styrene butadiene rubber, and combinations thereof. On the one hand, the binder allows the active material layer and the positive electrode current collector to have a better adhesion, on the other hand, when the binder content increases, the first active material layer will have a lower compaction density. The mass content of the binder in the first active material layer is selected in the range of 1.5% to 6%, and the mass content of the binder in the second active material layer is selected in the range of 0.5% to 4%.

Since the positive electrode active material in the positive electrode generally has a relatively common conductivity, the active material layer also contains a certain amount of a conductive agent, such as carbon black (SP), carbon nanotubes (CNT), graphene, and the like. The conductive agent increases its electrical conductivity, and the mass content of the conductive agent is selected in the range from 0.5% to 5%.

In addition, some other treatments may be performed on the first active material layer or the second active material layer, or some treatments may be performed on the positive electrode current collector, such as a roughness treatment, a heat treatment, etc.. The working principle or effect comprises enhancing the adhesion of the current collector. Although such principle or effect is not described in detail in this application, it is comprised in the scope of the present application.

The examples of the present application further provide a lithium-ion battery comprising above positive electrode. The lithium-ion battery comprises a positive electrode, a negative electrode, an separator, an electrolyte, and the like. The negative electrode comprises a negative electrode current collector and a negative electrode active material layer coated on the negative electrode current collector, and the negative electrode active material layer comprises a negative electrode active material, a conductive agent and a binder. The negative electrode current collector may be a Cu foil, however, other negative electrode current collectors commonly used in the art may be used. The conductive agent and the binder of the negative electrode active material layer are similar to the conductive agent and the binder of the positive electrode active material layer described above, and will not be described herein. The negative electrode active material comprises, but is not limited to, one of soft carbon, hard carbon, mesocarbon microbeads (MCMB), silicon, silicon-carbon composites, lithium titanate, alloys, artificial graphite, and natural graphite, and combinations thereof. Above negative electrode active material comprises a negative electrode active material that has been doped and/or coated in the prior art.

The separator comprises a polyethylene (PE) separator, a polypropylene (PP) separator, and the like. In addition, the separator comprises one of a bare separation film, an inorganic particle-coated separation film, a polymer-coated separator, or a combination thereof, depending on whether or not the surface of the separator comprises a coating and on the type of the coating. The electrolyte comprises at least two of dimethyl carbonate (DMC), ethyl methyl carbonate (EMC), diethyl carbonate (DEC), ethylene carbonate (EC), propylene carbonate (PC), propyl propionate (PP). Further, the electrolyte may additionally comprise at least one of vinylene carbonate (VC), fluoroethylene

carbonate (FEC), and dinitrile compounds as an electrolyte additive, wherein the dinitrile compound comprises succinonitrile (SN).

The positive electrode, the separator, and the negative electrode are sequentially wound or stacked into a bare cell, and then filled into, for example, an aluminum plastic film, and then the electrolyte is injected,
5 followed by chemical conversion and package. Then, the prepared lithium-ion battery is subjected to performance test and cycle test.

It will be understood by those skilled in the art that above-described method for producing a lithium-ion battery is only an example. Other
10 methods commonly used in the art can be used without departing from the disclosure of the present application.

The electrode of the present application can be used in lithium- ion batteries of different structures. In the examples, a wound lithium-ion battery is taken as an example, but the positive electrode of the present application can be applied to lithium ions of laminated structures,
15 multi-electrode tab structures, and the like, all of which are comprised in the scope of the present application.

The electrode of the present application may be other types of electrode. In the examples, a positive electrode is taken as an example,
20 but the electrode of the present application may be a negative electrode , all of which are comprised in the scope of the present application.

The electrode of the present application can be used in lithium-ion batteries of different types. In the examples, a soft package lithium-ion battery is taken as an example, but the electrode of the present application can be applied to other lithium-ion batteries such as square aluminum shell batteries, cylindrical batteries, and the like, all of which
25 are comprised in the scope of the present application.

Some specific examples and comparative examples are listed below

to better illustrate this application.

Comparative Example 1

An aluminum foil is used as the positive electrode collector, and a layer of lithium cobaltate slurry composed of 97.8wt% LiCoO_2 (LCO),
5 0.8wt% polyvinylidene fluoride (PVDF) and 1.4wt% conductive carbon black is evenly coated on the surface of aluminum foil. Then drying was performed at 85 °C, followed by cold pressing, cutting, slitting, and drying under a vacuum condition of 85 °C for 4 h to prepare a positive electrode, wherein the thickness of the coating is 63 μm .

10 A copper foil is used as a negative electrode collector, and a layer of graphite slurry composed of 97.7wt% artificial graphite, 1.3wt% carboxymethyl cellulose sodium (CMC) and 1.0wt% styrene butadiene rubber (SBR) is evenly coated on the surface of copper foil. Then drying was performed at 85 °C, followed by cold pressing, cutting, slitting, and
15 drying under a vacuum condition of 85 °C for 4 h to prepare a negative electrode.

The positive electrode and the negative electrode are wound after being slit, and the positive electrode and the negative electrode are separated by a polyethylene separator to prepare a wound bare cell.
20 After the bare cell is top-side sealed, spray-coded, vacuum-dried, filled with electrolyte, and allowed to stand at high temperatures for chemical conversion and capacity, a finished lithium-ion battery can be obtained.

Example 1

25 An aluminum foil is used as the positive electrode collector, and a layer of small particle lithium nickel cobalt manganese oxide slurry composed of 95.8wt% lithium nickel cobalt manganese oxide, 2.8wt% polyvinylidene fluoride (PVDF) and 1.4wt% conductive carbon black is evenly coated on the surface of aluminum foil for drying under 85 °C; a

layer of lithium cobalt oxide slurry composed of 97.8wt% LiCoO_2 (LCO), 0.8wt% polyvinylidene fluoride (PVDF) and 1.4wt% conductive carbon black is evenly coated as a second active material layer on the first active material layer coated with the lithium nickel cobalt manganese oxide slurry; then drying was performed at 85 °C, followed by cold pressing, cutting, slitting, and drying under a vacuum condition of 85 °C for 4 h to prepare a positive electrode . Wherein, Dv50 of the first active material (lithium nickel cobalt manganese oxide) of the first active material layer is 0.2 μm, and Dv90 of the first active material (lithium nickel cobalt manganese oxide) of the first active material layer is 20 μm. The thickness of the first active material layer is 25 μm, the ratio of Dv50 between the second active material to the first active material is 2:1, and the thickness of the second active material layer is 54 μm.

A copper foil is used as a negative electrode collector, and a layer of graphite slurry composed of 97.7wt% artificial graphite, 1.3wt% carboxymethyl cellulose sodium (CMC) and 1.0wt% styrene butadiene rubber (SBR) is evenly coated on the surface of copper foil. Then drying was performed at 85 °C, followed by cold pressing, cutting, slitting, and drying under a vacuum condition of 85 °C for 4 h to prepare a negative electrode .

The positive electrode and the negative electrode are wound after being slit, and the positive electrode and the negative electrode are separated by a polyethylene separator to prepare a wound bare cell. After the bare cell is top-side sealed, spray-coded, vacuum-dried, filled with electrolyte, and allowed to stand at high temperatures for chemical conversion and capacity, a finished lithium-ion battery can be obtained.

Example 2

It is the same as the preparation method of Example 1, except that

Dv50 of the first active material layer in Example 2 is 0.5 μm .

Example 3

It is the same as the preparation method of Example 1, except that
5 Dv50 of the first active material layer in Example 3 is 1 μm .

Example 4

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 4 is 3 μm .

10

Example 5

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 5 is 5 μm .

15

Example 6

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 6 is 7 μm .

Example 7

20 It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 7 is 9 μm .

Example 8

It is the same as the preparation method of Example 1, except that
25 Dv50 of the first active material layer in Example 8 is 11 μm .

Example 9

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 9 is 15 μm .

Example 10

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 10 is 16 μm .

5

Example 11

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 11 is 7 μm and Dv90 of the first active material layer is 8 μm .

10

Example 12

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 12 is 7 μm and Dv90 of the first active material layer is 10 μm .

15

Example 13

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 13 is 7 μm and Dv90 of the first active material layer is 15 μm .

20

Example 14

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 14 is 7 μm and Dv90 of the first active material layer is 25 μm .

25

Example 15

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 15 is 7 μm and Dv90 of the first active material layer is 40 μm .

Example 16

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 16 is 1 μm and Dv90 of
5 the first active material layer is 2 μm .

Example 17

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 17 is 1 μm and Dv90 of
10 the first active material layer is 5 μm .

Example 18

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 18 is 1 μm and Dv90 of
15 the first active material layer is 10 μm .

Example 19

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 19 is 1 μm and Dv90 of
20 the first active material layer is 15 μm .

Example 20

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 20 is 1 μm and Dv90 of
25 the first active material layer is 20 μm .

Example 21

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 21 is 7 μm and Dv90 of

the first active material layer is 45 μm .

Example 22

It is the same as the preparation method of Example 1, except that
5 Dv50 of the first active material layer in Example 22 is 7 μm and the ratio
of Dv50 between the second active material layer to the first active
material layer is 1:1.

Example 23

10 It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 23 is 7 μm and the ratio
of Dv50 between the second active material layer to the first active
material layer is 5:1.

15 Example 24

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 24 is 1 μm and the ratio
of Dv50 between the second active material layer to the first active
material layer is 1:1.

20

Example 25

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 25 is 1 μm and the ratio
of Dv50 between the second active material layer to the first active
25 material layer is 2:1.

Example 26

It is the same as the preparation method of Example 1, except that
Dv50 of the first active material layer in Example 26 is 1 μm and the ratio

of Dv50 between the second active material layer to the first active material layer is 5:1.

Example 27

5 It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 27 is 1 μm and the ratio of Dv50 between the second active material layer to the first active material layer is 10:1.

10 Example 28

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 28 is 1 μm and the ratio of Dv50 between the second active material layer to the first active material layer is 20:1.

15

Example 29

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 29 is 1 μm and the ratio of Dv50 between the second active material layer to the first active material layer is 40:1.

20

Example 30

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 30 is 1 μm and the ratio of Dv50 between the second active material layer to the first active material layer is 45:1.

25

Example 31

It is the same as the preparation method of Example 1, except that

Dv50 of the first active material layer in Example 31 is 1 μm and the thickness of the first active material layer is 2 μm .

Example 32

- 5 It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 32 is 1 μm and the thickness of the first active material layer is 5 μm .

Example 33

- 10 It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 33 is 1 μm and the thickness of the first active material layer is 7 μm .

Example 34

- 15 It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 34 is 1 μm and the thickness of the first active material layer is 10 μm .

Example 35

- 20 It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 35 is 1 μm and the thickness of the first active material layer is 15 μm .

Example 36

- 25 It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 36 is 1 μm and the thickness of the first active material layer is 20 μm .

Example 37

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 37 is 1 μm and the thickness of the first active material layer is 30 μm .

5 Example 38

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 38 is 7 μm and the thickness of the second active material layer is 30 μm .

10 Example 39

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 39 is 7 μm and the thickness of the second active material layer is 40 μm .

15 Example 40

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 40 is 7 μm and the thickness of the second active material layer is 50 μm .

20 Example 41

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 41 is 7 μm and the thickness of the second active material layer is 60 μm .

25 Example 42

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 42 is 7 μm and the thickness of the second active material layer is 70 μm .

Example 43

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 43 is 7 μm and the thickness of the second active material layer is 80 μm .

5

Example 44

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 44 is 7 μm and the thickness of the second active material layer is 100 μm .

10

Example 45

It is the same as the preparation method of Example 1, except that Dv50 of the first active material layer in Example 45 is 7 μm .

15

Example 46

It is the same as the preparation method of Example 1, except that the positive electrode active material of the first active material layer in Example 46 is lithium cobaltate and Dv50 of the first active material layer is 7 μm .

20

Example 47

It is the same as the preparation method of Example 1, except that the positive electrode active material of the first active material layer in Example 47 is lithium manganese oxide and Dv50 of the first active material layer is 7 μm .

25

Example 48

It is the same as the preparation method of Example 1, except that the positive electrode active material of the first active material layer in

Example 48 is lithium iron phosphate and Dv50 of the first active material layer is 7 μm .

Example 49

5 It is the same as the preparation method of Example 1, except that the positive electrode active material of the first active material layer in Example 49 is lithium nickel cobalt aluminate and Dv50 of the first active material layer is 7 μm .

10 Example 50

It is the same as the preparation method of Example 1, except that the positive electrode active material of the first active material layer in Example 50 is lithium titanate and Dv50 of the first active material layer is 7 μm .

15

Next, the passing rate of nail penetration and energy density of lithium-ion batteries are tested.

1. Method for nail test:

Place the lithium-ion battery in a 25 $^{\circ}\text{C}$ thermostat and allow it to stand
20 for 30 minutes to allow the lithium-ion battery to reach a constant temperature. The thermostated lithium-ion battery is charged at a constant current of 0.5 C to a voltage of 4.4 V, and then charged at a constant voltage of 4.4 V to a current of 0.025 C. The fully-charged lithium-ion battery is transferred to a nailing tester and the test ambient temperature is maintained
25 at 25 $^{\circ}\text{C} \pm 2^{\circ}\text{C}$, and then a steel nail with a 4 mm diameter is used to penetrate through the center of the lithium-ion battery at a uniform speed of 30 mm/s and keep the steel nail for 300 s. If the lithium-ion battery does not fire and explode, it is marked as PASS. Ten lithium-ion batteries are tested each time, and the number of lithium-ion batteries passed the nail test

is used as an indicator to evaluate the safety performance of the lithium-ion battery.

2. Method for testing energy density:

Place the lithium-ion battery in a 25 °C thermostat and allow it to stand for 30 minutes to allow the lithium-ion battery to reach a constant temperature. The thermostated lithium-ion battery is charged at a constant current of 0.5 C to a voltage of 4.4 V, and then charged at a constant voltage of 4.4 V to a current of 0.05C, discharged at 0.5 C to a voltage of 3.0 V, and the discharge energy is recorded.

Energy density = discharge energy / (length * width * thickness of lithium-ion battery).

Experimental parameters and measurement results of the respective examples and comparative examples are shown in Table 1 below.

Table 1

Exam ples	The first active material	Dv50/ μm (the first active mater- ial)	Dv90/ μm (the first active mater- ial)	Dv50 ratio (the secon d active mater- ial : the first active materi- al)	Thickn- ess of the first active materi- al (/μm)	Thickn- ess of the second active materi- al (/μm)	Mass cont- ent of bind- er of the first activ e mater- ial (wt%)	Mas- s cont- ent of bind- er of the seco- nd activ- e mate- rial (wt%)	nail penetr- ation PASS rate	Ene- rgy den- sity (Wh/ L)
1	lithium nickel cobalt manganese oxide	0.2	20	2: 1	25	54	2.8	0.8	10/10	721
2	lithium nickel cobalt manganese oxide	0.5	20	2: 1	25	54	2.8	0.8	10/10	721
3	lithium nickel cobalt manganese oxide	1	20	2: 1	25	54	2.8	0.8	10/10	721
4	lithium nickel cobalt manganese oxide	3	20	2: 1	25	54	2.8	0.8	10/10	729
5	lithium nickel cobalt	5	20	2: 1	25	54	2.8	0.8	10/10	735

	manganese oxide									
6	lithium nickel cobalt manganese oxide	7	20	2: 1	25	54	2.8	0.8	10/10	738
7	lithium nickel cobalt manganese oxide	9	20	2: 1	25	54	2.8	0.8	10/10	741
8	lithium nickel cobalt manganese oxide	11	20	2: 1	25	54	2.8	0.8	8/10	745
9	lithium nickel cobalt manganese oxide	15	20	2: 1	25	54	2.8	0.8	6/10	750
10	lithium nickel cobalt manganese oxide	16	20	2: 1	25	54	2.8	0.8	5/10	752
11	lithium nickel cobalt manganese oxide	7	8	2: 1	25	54	2.8	0.8	10/10	738
12	lithium nickel cobalt manganese oxide	7	10	2: 1	25	54	2.8	0.8	10/10	738
13	lithium nickel cobalt manganese oxide	7	15	2: 1	25	54	2.8	0.8	10/10	738
6	lithium nickel cobalt manganese oxide	7	20	2: 1	25	54	2.8	0.8	10/10	738
14	lithium nickel cobalt manganese oxide	7	25	2: 1	25	54	2.8	0.8	9/10	738
15	lithium nickel cobalt manganese oxide	7	40	2: 1	25	54	2.8	0.8	9/10	738
16	lithium nickel cobalt manganese oxide	1	2	2: 1	25	54	2.8	0.8	10/10	721
17	lithium nickel cobalt manganese oxide	1	5	2: 1	25	54	2.8	0.8	10/10	721
18	lithium nickel cobalt manganese oxide	1	10	2: 1	25	54	2.8	0.8	10/10	721
19	lithium nickel cobalt manganese oxide	1	15	2: 1	25	54	2.8	0.8	10/10	721
20	lithium nickel cobalt manganese oxide	1	20	2: 1	25	54	2.8	0.8	10/10	721
21	lithium nickel cobalt manganese oxide	7	45	2: 1	25	54	2.8	0.8	3/10	737
22	lithium nickel cobalt manganese oxide	7	20	1: 1	25	54	2.8	0.8	10/10	741
6	lithium nickel cobalt manganese oxide	7	20	2: 1	25	54	2.8	0.8	10/10	738
23	lithium nickel cobalt manganese oxide	7	20	5: 1	25	54	2.8	0.8	9/10	725
24	lithium nickel cobalt	1	20	1: 1	25	54	2.8	0.8	10/10	721

	manganese oxide									
25	lithium nickel cobalt manganese oxide	1	20	2: 1	25	54	2.8	0.8	10/10	721
26	lithium nickel cobalt manganese oxide	1	20	5: 1	25	54	2.8	0.8	10/10	721
27	lithium nickel cobalt manganese oxide	1	20	10: 1	25	54	2.8	0.8	10/10	717
28	lithium nickel cobalt manganese oxide	1	20	20: 1	25	54	2.8	0.8	9/10	713
29	lithium nickel cobalt manganese oxide	1	20	40: 1	25	54	2.8	0.8	7/10	709
30	lithium nickel cobalt manganese oxide	1	20	45: 1	25	54	2.8	0.8	2/10	697
31	lithium nickel cobalt manganese oxide	1	20	2: 1	2	54	2.8	0.8	10/10	721
32	lithium nickel cobalt manganese oxide	1	20	2: 1	5	54	2.8	0.8	10/10	719
33	lithium nickel cobalt manganese oxide	1	20	2: 1	7	54	2.8	0.8	10/10	718
34	lithium nickel cobalt manganese oxide	1	20	2: 1	10	54	2.8	0.8	10/10	715
35	lithium nickel cobalt manganese oxide	1	20	2: 1	15	54	2.8	0.8	10/10	711
36	lithium nickel cobalt manganese oxide	1	20	2: 1	20	54	2.8	0.8	10/10	706
37	lithium nickel cobalt manganese oxide	1	20	2: 1	30	54	2.8	0.8	10/10	698
38	lithium nickel cobalt manganese oxide	7	20	2: 1	25	30	2.8	0.8	10/10	723
39	lithium nickel cobalt manganese oxide	7	20	2: 1	25	40	2.8	0.8	10/10	734
40	lithium nickel cobalt manganese oxide	7	20	2: 1	25	50	2.8	0.8	10/10	735
6	lithium nickel cobalt manganese oxide	7	20	2: 1	25	54	2.8	0.8	10/10	738
41	lithium nickel cobalt manganese oxide	7	20	2: 1	25	60	2.8	0.8	10/10	743
42	lithium nickel cobalt manganese oxide	7	20	2: 1	25	70	2.8	0.8	10/10	751
43	lithium nickel cobalt manganese oxide	7	20	2: 1	25	80	2.8	0.8	10/10	766
44	lithium nickel cobalt	7	20	2: 1	25	100	2.8	0.8	10/10	778

	manganese oxide									
45	lithium nickel cobalt manganese oxide	7	20	2: 1	25	54	2.8	0.8	10/10	738
46	lithium cobaltate	7	20	2: 1	25	54	2.8	0.8	10/10	743
47	lithium manganese oxide	7	20	2: 1	25	54	2.8	0.8	10/10	728
48	lithium iron phosphate	7	20	2: 1	25	54	2.8	0.8	10/10	730
49	lithium nickel cobalt aluminate	7	20	2: 1	25	54	2.8	0.8	10/10	735
50	lithium titanate	7	20	2: 1	25	54	2.8	0.8	10/10	723
Comparative Example										
1	/	/	/	/	/	79	/	0.8	0/10	747

Comparing Comparative Example 1 with Examples 1-50, it can be seen that through the use of the active material layer having a double layer structure, the nail penetration PASS rate of the lithium-ion battery has been improved with a different extent, and the energy density is not substantially affected.

From Examples 1-9, it can be seen that as the Dv50 of the first active material layer increases, the energy density also increases, but then the nail penetration PASS rate is reduced. By comparing Examples 1-10, it can be seen that when the Dv50 of the first active material layer is greater than 15 μm , the nail penetration PASS rate of the lithium-ion battery is reduced to a low level.

From Examples 11-20 and 6, it can be seen that as the Dv90 of the first active material layer increases, the energy density is almost constant, but then the nail penetration PASS rate of the lithium-ion battery is reduced. By comparing Example 6 with Examples 11-21, it can be seen that when the Dv90 of the first active material layer of the lithium-ion battery is greater than 40 μm , the nail penetration PASS rate of the lithium-ion battery is reduced to a low level.

By comparing Example 6 with Examples 22-30, it can be seen that as the ratio of the positive electrode active material Dv50 of the second

active material layer and the first active material layer increases, both the energy density and the nail penetration PASS rate decrease, and the second active material decreases. When the ratio of the positive electrode active material Dv50 between the first and second active material layer exceeds 40, the nail penetration PASS rate of the lithium-ion battery is reduced to a low level.

According to Examples 31-37, it can be seen that when the thickness of the first active material layer is in a range of 2 μm to 30 μm , the nail penetration performance of the lithium-ion battery is maintained well.

By comparing Example 6 with Examples 38-44, it can be seen that as the thickness of the second active material layer increases, the nail penetration performance of the lithium-ion battery remains substantially unchanged, but the energy density increases.

From Examples 45-50, it can be seen that the positive active material of the first active material layer is selected from different materials, all of the lithium-ion batteries have excellent nail penetration performance, and the energy density varies slightly with different material.

Those skilled in the art should understand that the above examples are merely exemplary examples, and various changes, substitutions, and changes can be made without departing from the spirit and scope of the present application.

25

What is claimed is

1. An electrode, comprising:
a current collector;
a first active material layer, comprising a first active material; and
a second active material layer, comprising a second active material;
wherein the first active material layer is arranged between the current collector and the second active material layer, the first active material layer is formed on at least one surface of the current collector, and a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1.
2. The electrode according to claim 1, wherein the first active material has an average particle size in a range of 0.2 μm to 15 μm .
3. The electrode according to claim 1, wherein a particle size of 90% accumulative volume of the first active material is less than 40 μm .
4. The electrode according to claim 1, wherein the first active material layer has a thickness of 2 μm to 30 μm .
5. The electrode according to claim 1, wherein the second active material layer has a thickness equal to or more than 30 μm .
6. The electrode according to claim 1, wherein the first active material comprises one of lithium cobaltate, lithium manganate, lithium nickelate, lithium nickel cobalt manganese oxide, lithium iron phosphate, lithium iron manganese phosphate, lithium vanadium phosphate, lithium vanadyl phosphate, lithium-rich manganese-based materials, lithium nickel cobalt aluminate and lithium titanate, and combinations thereof.
7. The electrode according to claim 1, wherein the second active material comprises one of lithium cobaltate, lithium nickel cobalt manganese oxide, lithium nickel cobalt aluminum oxide, lithium-rich manganese-based material, lithium iron phosphate, and combinations

thereof.

8. The electrode according to claim 1, wherein the first active material comprises one of artificial graphite, natural graphite, mesocarbon microbeads, soft carbon, hard carbon, silicon, silicon carbide, lithium titanate, and combinations thereof.

9. The electrode according to claim 1, wherein each of the first active material layer and the second active material layer further comprises a binder, and the binder comprises one of polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylates, polyacrylic acids, polyacrylic acid salt, carboxymethylcellulose sodium, polyethylene pyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene, polyhexafluoropropylene and styrene butadiene rubber, and combinations thereof.

10. A lithium-ion battery comprising an electrode, wherein the electrode comprises:

- a current collector;
- a first active material layer, comprising a first active material; and
- a second active material layer, comprising a second active material;

wherein the first active material layer is arranged between the current collector and the second active material layer, the first active material layer is formed on at least one surface of the current collector, and a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1.

11. The lithium-ion battery according to claim 10, wherein the first active material has an average particle size in a range of 0.2 μm to 15 μm .

12. The lithium-ion battery according to claim 10, wherein a particle size of 90% accumulative volume of the first active material is less than

40 μm .

13. The lithium-ion battery according to claim 10, wherein the first active material layer has a thickness of 2 μm to 30 μm .

14. The lithium-ion battery according to claim 10, wherein the second active material layer has a thickness equal to more than 30 μm .

15. The lithium-ion battery according to claim 10, wherein the first active material comprises one of lithium cobaltate, lithium manganate, lithium nickelate, lithium nickel cobalt manganese oxide, lithium iron phosphate, lithium iron manganese phosphate, lithium vanadium phosphate, lithium vanadyl phosphate, lithium-rich manganese-based materials, lithium nickel cobalt aluminate and lithium titanate, and combinations thereof.

16. The lithium-ion battery according to claim 10, wherein the second active material comprises one of lithium cobaltate, lithium nickel cobalt manganese oxide, lithium nickel cobalt aluminum oxide, lithium-rich manganese-based material, lithium iron phosphate, and combinations thereof.

17. The lithium-ion battery according to claim 10, wherein the first active material comprises one of artificial graphite, natural graphite, mesocarbon microbeads, soft carbon, hard carbon, silicon, silicon carbide, lithium titanate, and combinations thereof.

18. The lithium-ion battery according to claim 10, wherein each of the first active material layer and the second active material layer further comprises a binder, and the binder comprises one polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylates, polyacrylic acids, polyacrylic acid salt, carboxymethylcellulose sodium, polyethylene pyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene, polyhexafluoropropylene and styrene butadiene rubber, and

combinations thereof.

ABSTRACT

The present application provides an electrode and a lithium-ion battery. The electrode comprises: a current collector; a first active material layer comprising a first active material; and a second active material layer comprising a second active material; wherein the first active material layer is arranged between the current collector and the second active material layer. The first active material layer is formed on at least one surface of the current collector, and a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1. The active material layer is used in the present application to ensure that the lithium-ion battery does not generate a short circuit when pressed by an external force, thereby ensuring the mechanical safety performance of the lithium-ion battery.

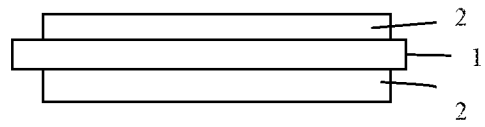


Figure 1

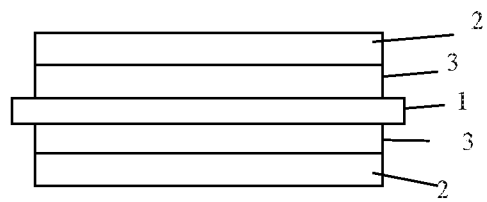


Figure 2

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY			
First Named Inventor/Applicant Name:	Chaowang Lin			
Filer:	David Michael Dremann/Blake Morgan			
Attorney Docket Number:	DHNG001.004AUS			
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:				
LATE FILING FEE FOR OATH OR DECLARATION	1051	1	160	160
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1880

Electronic Acknowledgement Receipt

EFS ID:	32810970
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	David Michael Dremann/Leonardo Quintana
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	05-JUN-2018
Filing Date:	
Time Stamp:	17:40:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1880
RAM confirmation Number	060618INTEFSW17422400
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	Application Data Sheet	DHNG001004AUS_ADS.pdf	212535	no	9
			f6fda358692260be607fe43822b4b44b131dfbd3		
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2		DHNG001004AUS_Spec.pdf	245456	yes	34
			9adff5ef455280dcfd3363c6cb6b48d3b3d5d9e2		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	29	
	Claims		30	33	
	Abstract		34	34	
Warnings:					
Information:					
3	Drawings-other than black and white line drawings	DHNG001004AUS_Figs.pdf	21986	no	1
			7680094dc448d2e63c059805d76f4872bc4213b5		
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	36649	no	2
			672ef6f5c5b1e9a0cda7fd7584b3d78b956cd0637		
Warnings:					
Information:					
Total Files Size (in bytes):			516626		

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/000,597	06/05/2018	1726	1880	DHNG001.004AUS	18	2

CONFIRMATION NO. 8334

FILING RECEIPT



0000000100600349

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

Date Mailed: 07/02/2018

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)

Chaowang Lin, Ningde, CHINA;
Fan Yang, Ningde, CHINA;
Yisong Su, Ningde,, CHINA;
Huawei Zhong, Ningde, CHINA;
Changming Qu, Ningde,, CHINA;
Xiaozheng Zhang, Ningde, CHINA;

Applicant(s)

Ningde Amperex Technology Limited, Ningde, CHINA;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

CHINA 201810162494.1 02/26/2018

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.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 06/27/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/000,597**

Projected Publication Date: 08/29/2019

Non-Publication Request: No

Early Publication Request: No

Title

ELECTRODE AND LITHIUM-ION BATTERY

Preliminary Class

429

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/000,597				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	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), (l), 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(j))	18	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			
			TOTAL			TOTAL	1720			
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	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))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	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))							OR		
	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.										



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
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS

CONFIRMATION NO. 8334

INFORMAL NOTICE



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

Date Mailed: 07/02/2018

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
Chaowang Lin
Fan Yang
Yisong Su
Huawei Zhong
Changming Qu
Xiaozheng Zhang

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.

/hteffer/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/000597
	Filing Date	June 5, 2018
	First Named Inventor	Chaowang Lin
	Art Unit	1726
(Multiple sheets used when necessary)	Examiner	Unassigned
SHEET 1 OF 1	Attorney Docket No.	DHNG001.004AUS

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	CN1658413A	08-24-2005	BIYADI CO LTD		

28671213

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.	

T¹ - Place a check mark in this area when an English language Translation is attached.

INFORMATION DISCLOSURE STATEMENT

First Inventor :	Chaowang Lin
App. No. :	16/000597
Filed :	June 5, 2018
For :	ELECTRODE AND LITHIUM-ION BATTERY
Examiner :	Unassigned
Art Unit :	1726
Conf. No. :	8334

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.

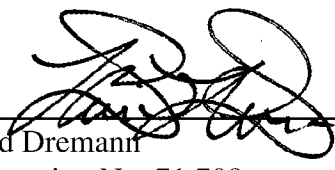
Application No.: 16/000597
Filing Date: June 5, 2018

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: July 16, 2018

By:  _____
David Dreman
Registration No. 71,708
Registered Practitioner
Customer No. 20995
(949) 760-0404

28671388

Electronic Acknowledgement Receipt

EFS ID:	33193232
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	David Michael Dremann/Blake Morgan
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	16-JUL-2018
Filing Date:	05-JUN-2018
Time Stamp:	20:16:15
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	Information Disclosure Statement (IDS) Form (SB08)	DHNG001004AUS_IDS.pdf	21493	no	1
			3f02cce53e8aac21c23c5149157266bf49f5f1408		

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	DHNG001004AUS_IDS_Trans.pdf	33765 4cb27c0a32e39530b06aeefd5f438a554270ae31	no	2
Warnings:					
Information:					
3	Foreign Reference	CN1658413_Abs.pdf	2618620 6e48d14e9f389222dc92581ead01147d78f9705c	no	17
Warnings:					
Information:					
Total Files Size (in bytes):			2673878		
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.					

Please Direct All Correspondence to Customer Number 20995

REQUEST TO CORRECT INVENTORSHIP

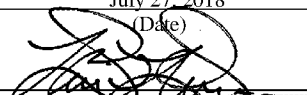
First Inventor : Chaowang Lin
App. No. : 16/000597
Filed : June 5, 2018
For : ELECTRODE AND LITHIUM-ION
BATTERY
Examiner : Unassigned
Art Unit : 1726
Conf. No. : 8334

**CERTIFICATE OF EFS WEB
TRANSMISSION**

I hereby certify that this correspondence, and any other attachment noted on the automated Acknowledgement Receipt, is being transmitted from within the Pacific Time zone to the Commissioner for Patents via the EFS Web server on:

July 27, 2018

(Date)


David Dreiman, Reg. No. 1,708

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.48(f), this Request is being made to correct or change inventorship of the above-captioned patent application, which may include the addition or deletion of inventors, or correction to an inventor's name. Please change the name of the sixth-listed inventor from Xiaozheng Zhang to Xiaozhen Zhang.

This Request is accompanied by:

1. A Corrected Application Data Sheet including markings under 37 C.F.R. § 1.76(c) identifying changes being made to inventorship; and
2. \$140 as directed under 37 CFR 1.17(i)(1) for an entity other than a small or micro entity.

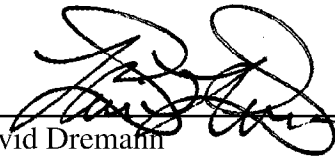
Please Direct All Correspondence to Customer Number 20995

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: July 27, 2018

By:  _____
David Dremahn
Registration No. 71,708
Attorney of Record
Customer No. 20,995
(949) 760-0404

28758066

Electronic Patent Application Fee Transmittal

Application Number:	16000597			
Filing Date:	05-Jun-2018			
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY			
First Named Inventor/Applicant Name:	Chaowang Lin			
Filer:	David Michael Dremann/Blake Morgan			
Attorney Docket Number:	DHNG001.004AUS			
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:				
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				140

Electronic Acknowledgement Receipt

EFS ID:	33309488
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	David Michael Dremann/Leonardo Quintana
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	27-JUL-2018
Filing Date:	05-JUN-2018
Time Stamp:	19:23:40
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 140
RAM confirmation Number	073018INTEFSW19251100
Deposit Account	111410
Authorized User	Leonardo Quintana

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	Application Data Sheet	DHNG001004AUS_ADS.pdf	56958	no	5
			0a861cc8f05c70a88c2f1c25699df5f9e15a7197		
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Request under Rule 48 correcting inventorship	DHNG001004AUS_Request_to_corr_Inventorship.pdf	34947	no	2
			faad8d6101f595fd1b2c5994edfffa3d1b324f4d		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30895	no	2
			1fc614757ac6d99c159e11ec5109b0212b71864d		
Warnings:					
Information:					
Total Files Size (in bytes):			122800		
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.					

CORRECTED APPLICATION DATA SHEET

Application Information

Application Number: 16/000597
Filing Date: June 5, 2018
Application Type: Regular
Subject Matter: Utility
Title: ELECTRODE AND LITHIUM-ION BATTERY
Attorney Docket Number: DHNG001.004AUS
Small Entity?: No

Inventor Information

Inventor 1

Given Name: Chaowang
Middle Name:
Family Name: Lin
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 2

Given Name: Fan
Middle Name:
Family Name: Yang
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 3

Given Name: Yisong
Middle Name:
Family Name: Su
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 4

Given Name: Huawei
Middle Name:
Family Name: Zhong
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 5

Given Name: Changming
Middle Name:
Family Name: Qu
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 6

Given Name: ~~Xiaozheng~~Xiaozhen
Middle Name:
Family Name: Zhang
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Correspondence Information

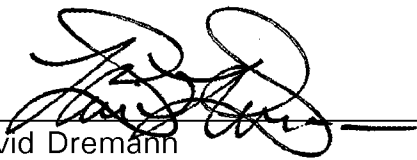
Correspondence Customer Number: 20995
Phone Number: (949) 760-0404
Fax Number: (949) 760-9502
E-Mail Address: efiling@knobbe.com

Representative Information

Representative Customer Number: 20995

Dated: July 27, 2018

By: _____


David Dremann
Registration No. 71,708
Registered Practitioner
Customer No. 20995
(949) 760-0404

28748264

REQUEST FOR CORRECTED FILING RECEIPT

First Inventor : Chaowang Lin
App. No. : 16/000597
Filed : June 5, 2018
For : ELECTRODE AND LITHIUM-ION
BATTERY
Examiner : Unassigned
Art Unit : 1726
Conf. No. : 8334

**CERTIFICATE OF EFS WEB
TRANSMISSION**

I hereby certify that this correspondence, and any other attachment noted on the automated Acknowledgement Receipt, is being transmitted from within the Pacific Time zone to the Commissioner for Patents via the EFS Web server on:

July 27, 2018

(Date)

David Dreimann, Reg. No. 71,708

Commissioner for Patents

P.O. Box 1450
Office of Initial Patent Examination
Customer Service Center
Alexandria, VA 22313-1450

Dear Sir:

Applicant hereby requests that the Official Filing Receipt, a copy of which is enclosed, be corrected to reflect the proper inventorship of the instant application, including: Chaowang Lin, Fan Yang, Yisong Su, Huawei Zhong, Changming Qu, and Xiaozhen Zhang. Presently, the Filing Receipt incorrectly shows the following listing of inventors: Chaowang Lin, Fan Yang, Yisong Su, Huawei Zhong, Changming Qu, and Xiaozheng Zhang. Note, "Xiaozheng Zhang" should read "Xiaozhen Zhang." The following is enclosed as evidence of the proper inventorship:

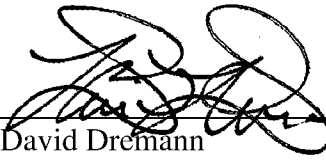
- (X) A copy of the Corrected Application Data Sheet as filed on July 27, 2018
- (X) Marked-up Filing Receipt reflecting the desired changes

Appl. No. : 16/000597
Filed : June 5, 2018

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 27, 2018

By: 

David Dreimann

Registration No. 71,708

Attorney of Record

Customer No. 20,995

(949) 760-0404

28758075

Electronic Acknowledgement Receipt

EFS ID:	33309527
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	David Michael Dremann/Wendi Manzanares
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	27-JUL-2018
Filing Date:	05-JUN-2018
Time Stamp:	19:25:22
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	Application Data Sheet	DHNG001004AUS_ADS.pdf	56958	no	5
			0a861cc8f05c70a88c2f1c25699df5f9e15a7197		

Warnings:

Information:					
This is not an USPTO supplied ADS fillable form					
2	Miscellaneous Incoming Letter	DHNG001004AUS_Marked_FR.pdf	472801 7b69561ef218db72d2b9dc60be823745e8630e5a	no	4
Warnings:					
Information:					
3	Request for Corrected Filing Receipt	DHNG001004AUS_Request.pdf	36159 4b884b192ea41b6598103ec03ac55d0c12754c5e	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			565918		
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.					

CORRECTED APPLICATION DATA SHEET

Application Information

Application Number: 16/000597
Filing Date: June 5, 2018
Application Type: Regular
Subject Matter: Utility
Title: ELECTRODE AND LITHIUM-ION BATTERY
Attorney Docket Number: DHNG001.004AUS
Small Entity?: No

Inventor Information

Inventor 1

Given Name: Chaowang
Middle Name:
Family Name: Lin
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 2

Given Name: Fan
Middle Name:
Family Name: Yang
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 3

Given Name: Yisong
Middle Name:
Family Name: Su
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 4

Given Name: Huawei
Middle Name:
Family Name: Zhong
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 5

Given Name: Changming
Middle Name:
Family Name: Qu
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Inventor 6

Given Name: ~~Xiaozheng~~Xiaozhen
Middle Name:
Family Name: Zhang
Name Suffix:
City of Residence: Ningde, Fujian
State or Prov. of Residence:
Country of Residence: CN
Street: No. 1, Xingang Road, Zhangwan Town, Jiaocheng Zone
City: Ningde, Fujian
State or Province:
Country: CN
Postal or Zip Code: 352100

Correspondence Information

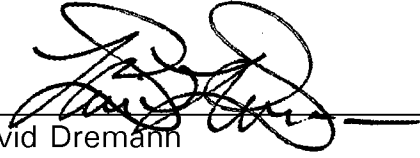
Correspondence Customer Number: 20995
Phone Number: (949) 760-0404
Fax Number: (949) 760-9502
E-Mail Address: efiling@knobbe.com

Representative Information

Representative Customer Number: 20995

Dated: July 27, 2018

By: _____


David Dremann
Registration No. 71,708
Registered Practitioner
Customer No. 20995
(949) 760-0404

28748264



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	CRP ART UNIT	FIL. FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
16/000,597	06/05/2018	1726	1880	DHNG001.004AUS	18	2

CONFIRMATION NO. 8334

FILING RECEIPT



0000000100600349

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

Date Mailed: 07/02/2018

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)

Chaowang Lin, Ningde, CHINA;
Fan Yang, Ningde, CHINA;
Yisong Su, Ningde, CHINA;
Huawei Zhong, Ningde, CHINA;
Changming Qu, Ningde, CHINA;
~~Xiaozhen Zhang, Ningde, CHINA;~~

← Xiaozhen Zhang, Ningde, CHINA;

Applicant(s)

Ningde Amperex Technology Limited, Ningde, CHINA;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

CHINA 201810162494.1 02/26/2018

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.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 06/27/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/000,597**

Projected Publication Date: 08/29/2019

Non-Publication Request: No

Early Publication Request: No

Title

ELECTRODE AND LITHIUM-ION BATTERY

Preliminary Class

429

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



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	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/000,597	06/05/2018	1725	1880	DHNG001.004AUS	18	2

CONFIRMATION NO. 8334

UPDATED FILING RECEIPT

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



Date Mailed: 08/03/2018

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)

Chaowang Lin, Ningde, CHINA;
Fan Yang, Ningde, CHINA;
Yisong Su, Ningde,, CHINA;
Huawei Zhong, Ningde, CHINA;
Changming Qu, Ningde,, CHINA;
Xiaozhen Zhang, Ningde, CHINA;

Applicant(s)

Ningde Amperex Technology Limited, Ningde, CHINA;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

CHINA 201810162494.1 02/26/2018

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.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

Projected Publication Date: 08/29/2019

Non-Publication Request: No

Early Publication Request: No

Title

ELECTRODE AND LITHIUM-ION BATTERY

Preliminary Class

429

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



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
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS

CONFIRMATION NO. 8334

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

37 CFR 1.48(f)
ACKNOWLEDGEMENT LETTER



Date Mailed: 08/03/2018

NOTICE OF ACCEPTANCE OF REQUEST UNDER 37 CFR 1.48(f)

This is in response to the applicant's request under 37 CFR 1.48(f) submitted on 07/27/2018.

The request under 37 CFR 1.48(f) to correct the inventorship, to correct or update the name of an inventor, or to correct the order of names of joint inventors is accepted.

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.

/hteffer/

Please Direct All Correspondence to Customer Number 20995

DECLARATION TRANSMITTAL

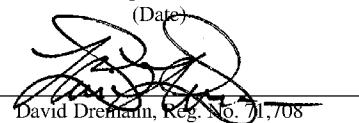
First Inventor : Chaowang Lin
App. No. : 16/000597
Filed : June 5, 2018
For : ELECTRODE AND LITHIUM-ION
BATTERY
Examiner : Unassigned
Art Unit : 1725
Conf. No. : 8334

**CERTIFICATE OF EFS WEB
TRANSMISSION**

I hereby certify that this correspondence, and any other attachment noted on the automated Acknowledgement Receipt, is being transmitted from within the Pacific Time zone to the Commissioner for Patents via the EFS Web server on:

August 6, 2018

(Date)



David Dreimann, Reg. No. 71,708

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Commissioner:

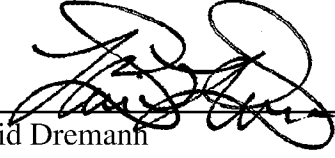
The above-captioned application was filed without a Declaration and/or Substitute Statement. Enclosed for filing in the above-identified application are:

- (X) Declaration(s) for:
- Chaowang Lin
 - Fan Yang
 - Yisong Su
 - Huawei Zhong
 - Changming Qu
 - Xiaozhen Zhang

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: August 6, 2018

By: 
David Dremanh
Registration No. 71,708
Registered Practitioner
Customer No. 20995
(949) 760-0404

28808359

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

Title of
Invention

ELECTRODE AND LITHIUM-ION BATTERY

As the below named inventor, I hereby declare that:

This declaration
is directed to:

☐

The attached application, or

☒

United States application or PCT international application number 16/000597

filed on June 5, 2018

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: Huawei Zhong

Date (Optional): July 24 2018

Signature: Huawei Zhong

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-9198 and select option 2.

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.

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

ELECTRODE AND LITHIUM-ION BATTERY

As the below named inventor, I hereby declare that:

This declaration
is directed to:☐

The attached application, or

☒United States application or PCT international application number 16/000597filed on June 5, 2018

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 INVENTORInventor: Xiaozhen ZhangDate (Optional): July 24 2018Signature: Xiaozhen Zhang

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 this form, call 1-800-PTO-9199 and select option 2.

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.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)Title of
Invention**ELECTRODE AND LITHIUM-ION BATTERY**

As the below named inventor, I hereby declare that:

This declaration
is directed to:☐

The attached application, or

☒United States application or PCT international application number 16/000597filed on June 5, 2018

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 INVENTORInventor: Fan YangDate (Optional): July 27 2018Signature: Fan Yang

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 this form, call 1-800-PTO-9199 and select option 2.

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

Title of Invention **ELECTRODE AND LITHIUM-ION BATTERY**

As the below named inventor, I hereby declare that:

This declaration is directed to: ☐ The attached application, or

☒ United States application or PCT international application number 16/000597

filed on June 5, 2018

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: Yisong Su

Date (Optional): July 24 2018

Signature: Yisong Su

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.

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.

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

Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number <u>16/000597</u> filed on <u>June 5, 2018</u> 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:	<u>Changming Qu</u> Date (Optional): <u>July 24 2018</u>
Signature:	<u>Changming Qu</u>
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.

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

Title of Invention	ELECTRODE AND LITHIUM-ION BATTERY
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number <u>16/000597</u> filed on <u>June 5, 2018</u> 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: <u>Chaowang Lin</u> Date (Optional): <u>July 24 2018</u> Signature: <u>Chaowang Lin</u>	
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 Acknowledgement Receipt

EFS ID:	33388902
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	David Michael Dremann/Daniela Lopez
Filer Authorized By:	David Michael Dremann
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	06-AUG-2018
Filing Date:	05-JUN-2018
Time Stamp:	19:55:47
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	Miscellaneous Incoming Letter	2018-08-06_DeclarationTransmittal-DHNG001_004AUS.PDF	32300 101e08f8f9dd3df664e37c4c271714fbcd08faca	no	2

Warnings:

Information:					
2	Oath or Declaration filed	Declarations.pdf	6004076	no	6
			1d9521ddb5ee06cc0e1b635a06edb0647d93aca		
Warnings:					
Information:					
			Total Files Size (in bytes):	6036376	
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.					



证 明

本证明之附件是向本局提交的下列专利申请文件副本。

申 请 号：201810162494.1

申 请 类 型：发明专利

发 明 创 造 名 称：极片和锂离子电池

申 请 日：2018 年 02 月 26 日

申 请 人：宁德新能源科技有限公司

发明人或设计人：林超旺、杨帆、苏义松、钟华炜、屈长明、张晓振

局长

申长雨

2018 年 08 月 08 日

权 利 要 求 书

1. 一种极片，包括：

集流体；

5 第一活性物质层，包括第一活性物质；以及
第二活性物质层，包括第二活性物质；

其中，所述第一活性物质层设置于所述集流体和所述第二活性物质层之间，所述第一活性物质层形成在所述集流体的至少一个表面上，所述第二活性物质的平均粒径与所述第一活性物质的平均粒径的比值为 1:1~40:1。

10 2. 根据权利要求 1 所述的极片，其中，所述第一活性物质的平均粒径在 $0.2\mu\text{m}$ ~ $15\mu\text{m}$ 的范围内。

3. 根据权利要求 1 所述的极片，其中，所述第一活性物质的体积累积 90% 的粒径为 $40\mu\text{m}$ 以下。

15 4. 根据权利要求 1 所述的极片，其中，所述第一活性物质层的厚度为 $2\mu\text{m}$ ~ $30\mu\text{m}$ 。

5. 根据权利要求 1 所述的极片，其中，所述第二活性物质层的厚度为 $30\mu\text{m}$ 以上。

6. 根据权利要求 1 所述的极片，其中，所述第一活性物质包括选自钴酸锂、锰酸锂、镍酸锂、镍钴锰酸锂、磷酸铁锂、磷酸锰铁锂、磷酸钒锂、
20 磷酸钒氧锂、富锂锰基材料、镍钴铝酸锂和钛酸锂中的一种及其组合。

7. 根据权利要求 1 所述的极片，其中，所述第二活性物质包括选自钴酸锂、镍钴锰酸锂、镍钴铝酸锂、富锂锰基材料、磷酸铁锂中的一种及其组合。

8. 根据权利要求 1 所述的极片，其中，所述第一活性物质包括选自人
25 造石墨、天然石墨、中间相碳微球、软碳、硬碳、硅、硅碳化合物、钛酸锂中的一种及其组合。

9. 根据权利要求 1 所述的极片，其中，所述第一活性物质层和所述第二活性物质层均还包括粘结剂，所述粘结剂包括选自聚偏氟乙烯、偏氟乙烯-六氟丙烯的共聚物、聚酰胺、聚丙烯腈、聚丙烯酸酯、聚丙烯酸、聚丙烯



烯酸盐、羧甲基纤维素钠、聚乙烯吡咯烷酮、聚乙烯醚、聚甲基丙烯酸甲酯、聚四氟乙烯、聚六氟丙烯和丁苯橡胶中的一种及其组合。

10. 一种锂离子电池，包括根据权利要求 1-9 中任一项所述的极片。

说明书

极片和锂离子电池

5 技术领域

本申请的实施例涉及电池，更具体地，涉及极片和锂离子电池。

背景技术

锂离子电池已伴随着科技的进步及环保要求的提高进入了我们日常的生活。随着锂离子电池的大量普及，在用户端偶尔会出现因外力刺破锂离子电池导致的安全问题，其安全性能越来越受到人们的重视，尤其是一些手机爆炸事件的持续发酵，使得包括使用者、售后端及锂离子电池生产厂商都对锂离子电池的安全性能提出了新的要求。

目前改善锂离子电池安全的方法都是以牺牲锂离子电池的能量密度为代价，因此，急需提供一种在较高能量密度的条件下，能够显著提高锂离子电池安全性能的技术手段。

发明内容

本申请的实施例通过将极片中的活性物质层采用双层设计，可以避免锂离子电池受外力作用产生内短路而造成电池失效。

本申请的一些实施例提供了一种极片，包括：集流体；第一活性物质层，包括第一活性物质；以及第二活性物质层，包括第二活性物质；其中，所述第一活性物质层设置于所述集流体和所述第二活性物质层之间，所述第一活性物质层形成在所述集流体的至少一个表面上，所述第二活性物质的平均粒径与所述第一活性物质的平均粒径的比值为 1:1~40:1。

在上述极片中，其中，所述第一活性物质的平均粒径在 $0.2\mu\text{m}$ ~ $15\mu\text{m}$ 的范围内，所述平均粒径 (D_{v50}) 是指，在体积基准的粒度分布中，从小粒径侧起、达到体积累积 50% 的粒径。

在上述极片中，其中，所述第一活性物质的体积累积 90% 的粒径为

40 μm 以下, 所述体积累积 90%的粒径 (D_{v90}) 是指, 在体积基准的粒度分布中, 从小粒径侧起、达到体积累积 90%的粒径。

在上述极片中, 其中, 所述第一活性物质层的厚度为 2 μm ~30 μm 。

在上述极片中, 其中, 所述第二活性物质层的厚度为 30 μm 以上。

5 在上述极片中, 其中, 所述第一活性物质包括选自钴酸锂、锰酸锂、镍酸锂、镍钴锰酸锂、磷酸铁锂、磷酸锰铁锂、磷酸钒锂、磷酸钒氧锂、富锂锰基材料、镍钴铝酸锂和钛酸锂中的一种及其组合。

在上述极片中, 其中, 所述第二活性物质包括选自钴酸锂、镍钴锰酸锂、镍钴铝酸锂、富锂锰基材料、磷酸铁锂中的一种及其组合。

10 在上述极片中, 其中, 所述第一活性物质包括选自人造石墨、天然石墨、中间相碳微球、软碳、硬碳、硅、硅碳化合物、钛酸锂中的一种及其组合。

在上述极片中, 其中, 所述第一活性物质层和所述第二活性物质层均还包括粘结剂, 所述粘结剂包括选自聚偏氟乙烯、偏氟乙烯-六氟丙烯的共聚物、聚酰胺、聚丙烯腈、聚丙烯酸酯、聚丙烯酸、聚丙烯酸盐、羧甲基纤维素钠、聚乙烯吡咯烷酮、聚乙烯醚、聚甲基丙烯酸甲酯、聚四氟乙烯、聚六氟丙烯和丁苯橡胶中的一种及其组合。

本申请的一些实施例还提供了一种锂离子电池, 包括上述极片。

20 本申请通过将极片中的活性物质层采用双层设计, 确保了锂离子电池在受到外力挤压时不产生短路, 从而确保了锂离子电池的机械安全性能。

附图说明

图 1 示出了一种正积极片的结构的示意图。

图 2 示出了根据本申请的一些实施例的正积极片的结构的示意图。

25

具体实施方式

下面的实施例可以使本领域技术人员更全面地理解本申请, 但不以任何方式限制本申请。

本申请的实施例通过将极片中的活性物质层采用双层设计, 确保了锂

离子电池在受到外力挤压时不产生短路（相应的测试方法为穿钉（nail）测试），从而确保了锂离子电池的机械安全性能（穿钉测试 50%通过）。本申请的技术手段可应用于锂离子电池中，在锂离子电池应用终端发挥巨大的安全作用。需要说明的是本申请以正积极片为示例，负积极片也可以实现本技术方案。

锂离子电池穿钉过程中通常会发生四种短路：正极活性物质层-负极活性物质层，正极活性物质层-负极集流体（通常为铜箔），正极集流体（通常为铝箔）-负极集流体，正极集流体-负极活性物质层。在这四种短路模式中，正极集流体-负极活性物质层的短路模式是四种短路模式中最为危险的，因为短路时短路功率非常大。因此，优先考虑避免正极集流体-负极活性物质层的这种短路模式是改善锂离子电池穿钉安全最直接的手段。

在本申请中，避免正极集流体-负极活性物质层的短路，顾名思义就是在负极活性物质层的表面设置电阻率更大的涂层或者在正极集流体的表面设置电阻率更大的涂层，以避免负极活性物质层和正极集流体直接接触，从而避免产生最危险的短路模式。负极活性物质层或隔离膜表面设置的涂层通常是陶瓷层，通过增加陶瓷层的厚度，可以避免负极活性物质层和正极集流体之间的短路。为了避免负极活性物质层和正极集流体之间这种短路模式的发生，这些涂层的厚度都不能太薄（一般至少要大于负极表面的粗糙度），由此会带来锂离子电池的能量密度的损失；另外，这些涂层增加了锂离子从正极到负极的传输距离，增大了锂离子电池的传输阻抗，对锂离子电池的动力学性能有较大的恶化；而且，由于穿钉过程对锂离子电池的破坏较大，部分涂层会在穿钉过程中脱落从而影响穿钉保护效果的稳定性。

一种技术手段是让正极集流体的表面粘附电阻率更大的物质，以避免正极集流体和负极活性物质层的直接接触，通常做法是降低正极活性物质的粒度和增加正极活性物质层中的粘结剂含量来实现。正极活性物质的颗粒度减小会降低锂离子电池的循环性能，而增加正极活性物质层中粘结剂含量则会使得正积极片变脆，对生产过程及锂离子电池的能量密度带来较大的影响。

如图 1 所示，示出了一种正积极片的示意图。正极集流体 1 位于两层活性物质层 2 之间。图 2 示出了本申请的双层活性物质层结构，即：在活性物质层 2 和正极集流体 1 之间形成额外的活性物质层 3。对活性物质层 3 的材料及配方进行优化，使得活性物质层 3 与正极集流体 1 的粘结力增大，从而保护了正极集流体 1，穿钉过程中活性物质层 3 不会脱落，穿钉过程中不发生正极集流体-负极活性物质层这种短路模式，从而确保了锂离子电池的安全性能。为了更好地区分，下文将活性物质层 3 称为第一活性物质层，将活性物质层 2 称为第二活性物质层，这仅是为了更好地描述而并不对本申请进行限制。

相对于在正极集流体及活性物质层之间涂布一层不导电或者导电性能较差的物质层，本申请的第二活性物质层 2 和第一活性物质层 3 均含有正极活性物质，使得第一和第二活性物质层均能提供能量，其能量密度较高；本申请的设计对活性物质层的导电性能没有影响，而采用不导电或者导电性能较差的涂层，对锂离子电池的电子电导能力影响会很大，从而使得锂离子电池的正常充放电受到影响。

本申请实施例的第一活性物质层的正极活性物质可以包括钴酸锂、锰酸锂、镍酸锂、镍钴锰酸锂、磷酸铁锂、磷酸锰铁锂、磷酸钒锂、磷酸钒氧锂、富锂锰基材料、镍钴铝酸锂和钛酸锂中的至少一种及其组合，第二活性物质层的正极活性物质可以包括钴酸锂、镍钴锰酸锂、镍钴铝酸锂、富锂锰基材料、磷酸铁锂中的一种或多种的组合。正极活性物质层为双层结构，在正极集流体表面有两层正极活性物质层，虽然图 2 中示出两层活性物质层的正极活性物质具有一明显的界面，但是两层活性物质层的界面依靠上下层颗粒的嵌入作用及两层活性物质层间的粘结剂互相粘结在一起，并不出现明显的界面。

双层结构活性物质层对正极集流体的保护主要是第一活性物质层起主导作用，为了实现对正极集流体的保护，要求第一活性物质层的正极活性物质具有较小的颗粒度，从而能够对正极集流体（铝箔）实现较高的覆盖度和粘结作用。为了保证对正极集流体的覆盖和粘结，同时降低第一活性物质层对整体活性物质层的影响（第一活性物质层的压实密度较第二活性

物质层低，因此需要尽量降低第一活性物质层在整体活性物质层中的体积占比），第一活性物质层的正极活性物质在体积基准的粒度分布中，从小粒径侧起、达到体积累积 50%的粒径（ $Dv50$ ）的范围为 $0.2\mu m \sim 15\mu m$ ，同时第一活性物质层的正极活性物质在体积基准的粒度分布中，从小粒径侧起、达到体积累积 90%的粒径（ $Dv90$ ）的范围为小于等于 $40\mu m$ 。为了保证对正极集流体的保护效果，第一活性物质层需要对正极集流体实现完全覆盖，正极活性物质的颗粒越小，涂层可以做得越薄，但是小颗粒的正极活性物质的压实密度会比较低，对锂离子电池的能量密度有一定影响。

另外，考虑到第一活性物质层和第二活性物质层也有一些相互作用，包括粘结力和电子传导的作用，以及考虑到冷压过程中第一活性物质层不能因为第二活性物质层颗粒的力传导而被压碎，第二活性物质层和第一活性物质层的颗粒度比值是影响锂离子电池性能的另外一个重要因素。

为了避免第二活性物质层中的正极活性物质在冷压时对第一活性物质层的破坏以及保证第一活性物质层和第二活性物质层粘结能力的最大化，第一活性物质层和第二活性物质层的正极活性物质的 $Dv50$ 在一定的比值范围， $Dv50$ （第二活性物质）： $Dv50$ （第一活性物质）=1：1~40:1；第二活性物质层的正极活性物质的颗粒太大，冷压后对第一活性物质层的破坏作用增加，从而导致第一活性物质层对正极集流体的保护作用减弱；第一活性物质层和第二活性物质层除了粘结剂的粘结作用外，正极活性物质颗粒之间相互的铆接作用也可以提供一定的粘结作用，这个粘结作用就需要颗粒之间粒度差异不太大，当第二活性物质层的颗粒太大时，这种铆接作用减弱，从而层间界面变得明显甚至分离。

此外，第一活性物质层需要一定的厚度，才能实现对正极集流体的全覆盖，为了实现这个目标，第一活性物质层的活性物质的颗粒度有一个上限。由于第一活性物质层中正极活性物质的颗粒度较小，而且第一活性物质层中含有的粘结剂比第二活性物质层中的粘结剂多，因此第一活性物质层的厚度不能太厚，否则会降低锂离子电池的能量密度，又由于第一活性物质层需实现对正极集流体的覆盖，因此第一活性物质层的厚度需要控制在 $3\mu m \sim 40\mu m$ ，冷压后厚度为 $2\mu m \sim 30\mu m$ ；特别的，第一活性物质层的厚

度不小于第一活性物质层内的正极活性物质的 Dv90, 这是为了保证第一活性物质层的覆盖度, 从而实现对正极集流体的完整保护。第一活性物质层的正极活性物质由于颗粒较小, 其压实密度会比较低, 因此锂离子电池要实现高能量密度, 就要增加第二活性物质层的厚度, 第二活性物质层的厚度为 30 μ m 以上, 第二活性物质层越厚, 锂离子电池的能量密度越高。

通过一定压力对正积极片进行冷压, 活性物质层被压成具有一定厚度的极片, 由于本申请的活性物质层具有双层结构, 因此正积极片的压实密度可分为第二活性物质层的压实密度、第一活性物质层的压实密度及整体压实密度, 要保证锂离子电池的能量密度, 需要正积极片具有较高的压实密度, 第一活性物质层的压实密度大于 2.8g/cc, 第二活性物质层的压实密度大于 3.3g/cc, 活性物质层整体的压实密度大于 3.2g/cc。

另外, 第一活性物质层要实现较高的粘结作用, 需要第一活性物质层中含有一定量的粘结剂, 粘结剂包括但不限于聚偏氟乙烯、偏氟乙烯-六氟丙烯的共聚物、聚酰胺、聚丙烯腈、聚丙烯酸酯、聚丙烯酸、聚丙烯酸盐、羧甲基纤维素钠、聚乙烯吡咯烷酮、聚乙烯醚、聚甲基丙烯酸甲酯、聚四氟乙烯、聚六氟丙烯和丁苯橡胶中的一种及其组合。粘结剂一方面使得活性物质层与正极集流体可以有更好的粘结, 另一方面粘结剂含量增加, 第一活性物质层的压实密度更低, 第一活性物质层的粘结剂的质量含量选择范围为 1.5%~6%, 第二活性物质层的粘结剂的质量含量的选择范围为 0.5%~4%。

由于正积极片中的正极活性物质通常情况下导电子能力比较一般, 因此在活性物质层中还含有一定量的导电剂, 如炭黑(SP)、碳纳米管(CNT)、石墨烯等, 导电剂增加其导电能力, 导电剂的质量含量的选择范围为 0.5%~5%。

此外, 可以对第一活性物质层或第二活性物质层进行一些其他处理, 或者对正极集流体进行一些处理, 如粗糙度处理、热处理等, 其作用原理或者作用效果可以是增强对集流体的粘结, 虽然本申请中未涉详细描述, 但其包括在本申请的范围内。

本申请的实施例还提供了包括上述正积极片的锂离子电池。该锂离子

电池包括正极极片、负极极片、隔离膜以及电解液等。负极极片包括负极集流体和涂覆在负极集流体上的负极活性物质层，负极活性物质层包括负极活性物质、导电剂和粘结剂。负极集流体可以采用 Cu 箔，然而，可以采用本领域常用的其他负极集流体。负极活性物质层的导电剂和粘结剂与上面描述的正极活性物质层的导电剂和粘结剂类似，在此不再赘述。负极活性物质包括但不限于软碳、硬碳、中间相碳微球（MCMB）、硅、硅碳复合物、钛酸锂、合金、人造石墨和天然石墨中的一种及其组合，以上负极活性物质包括现有技术中经过掺杂和/或包覆处理的负极活性物质。

隔离膜包括聚乙烯(PE)隔离膜、聚丙烯(PP)隔离膜等。此外，根据隔离膜表面是否含有涂层和涂层的类别，隔离膜包括无涂覆层的裸隔离膜、无机颗粒涂覆的隔离膜和聚合物涂覆的隔离膜中的一种及其组合。电解液包括碳酸二甲酯（DMC）、碳酸甲乙酯（EMC）、碳酸二乙酯（DEC）、碳酸乙烯酯（EC）、碳酸丙烯酯（PC）、丙酸丙酯（PP）中的至少两种。此外，电解液还可以额外地包括作为电解液添加剂的碳酸亚乙烯酯（VC）、氟代碳酸乙烯酯（FEC）和二腈化合物中的至少一种，其中，二腈化合物包括丁二腈（SN）。

将正极极片、隔离膜、负极极片按顺序卷绕或堆叠成裸电芯，之后装入例如铝塑膜中，注入电解液，化成、封装，即制成锂离子电池。然后，对制备的锂离子电池进行性能测试及循环测试。

本领域的技术人员将理解，以上描述的锂离子电池的制备方法仅是实施例。在不背离本申请公开的内容的基础上，可以采用本领域常用的其他方法。

本申请的极片可用于不同结构的锂离子电池中，实施例中以卷绕型锂离子电池作为实例，但是本申请的正极极片可以应用于叠片结构、多极耳结构等的锂离子电池，所有这些均包含在本申请的范围内。

本申请的极片可以为其他类型的极片，实施例中以正极极片为实例，但是本申请的极片可以是负极极片，所有这些均包含在本申请的范围内。

本申请的极片可用于不同类型的锂离子电池中，实施例中以软包型锂离子电池作为实例，但是本申请的极片可以应用于方形铝壳电池、圆柱形

电池等其他锂离子电池，所有这些均包含在本申请的范围内。

下面列举了一些具体实施例和对比例以更好地对本申请进行说明。

对比例 1

采用铝箔作为正极集流体，在铝箔表面均匀的涂布一层钴酸锂浆料，
5 钴酸锂浆料的组成为 97.8wt%LiCoO₂ (LCO)、0.8wt%聚偏氟乙烯 (PVDF)
和 1.4wt%导电炭黑，85℃下烘干，并随后进行冷压、裁片、分切，在 85℃
的真空条件下干燥 4h，制备得到正积极片。其中，涂层的厚度为 63μm。

采用铜箔作为负极集流体，在铜箔表面均匀的涂布一层石墨浆料，浆
料组成为 97.7wt%人造石墨、1.3wt%羧甲基纤维素钠 (CMC) 以及 1.0wt%
10 丁苯橡胶 (SBR) 的组合，85℃下烘干，并随后进行冷压、裁片、分切，
在 85℃的真空条件下干燥 4h，制备得到负积极片。

正积极片和负积极片经分条后进行卷绕，正积极片和负积极片之间以
聚乙烯隔离膜进行分隔，从而制备得到卷绕裸电芯。裸电芯经顶侧封、喷
码、真空干燥、注入电解液、高温静置后进行化成及容量，即可得到成品
15 锂离子电池。

实施例 1

采用铝箔作为正极集流体，在铝箔表面均匀的涂布一层小颗粒镍钴锰
酸锂浆料，镍钴锰酸锂浆料的组成为 95.8wt%镍钴锰酸锂、2.8wt%聚偏氟
20 乙烯 (PVDF) 和 1.4wt%导电炭黑，85℃下烘干；在涂布有镍钴锰酸锂浆
料的第一活性物质层上继续涂布一层钴酸锂浆料作为第二活性物质层，浆
料组成为 97.8wt%LiCoO₂ (LCO)、0.8wt%聚偏氟乙烯 (PVDF) 和 1.4wt%
导电炭黑，85℃下烘干，经过冷压、裁片、分切后，在 85℃的真空条件下
干燥 4h，制备得到正积极片。其中，第一活性物质层的第一活性物质 (镍
25 钴锰酸锂) 的 Dv50 为 0.2μm，第一活性物质层的第一活性物质 (镍钴锰酸
锂) 的 Dv90 为 20μm，第一活性物质层的厚度为 25μm，第二活性物质与
第一活性物质的 Dv50 比值为 2:1，第二活性物质层的厚度为 54μm。

采用铜箔作为负极集流体，在铜箔表面均匀的涂布一层石墨浆料，浆
料组成为 97.7wt%人造石墨、1.3wt%羧甲基纤维素钠 (CMC) 以及 1.0wt%

丁苯橡胶（SBR）的组合，85℃下烘干，并随后进行冷压、裁片、分切，在85℃的真空条件下干燥4h，制备得到负极极片。

正极极片和负极极片经分条后进行卷绕，正极极片和负极极片之间以聚乙烯隔离膜进行分隔，从而制备得到卷绕裸电芯。裸电芯经顶侧封、喷
5 码、真空干燥、注入电解液、高温静置后进行化成及容量，即可得到成品锂离子电池。

实施例 2

与实施例 1 的制备方法相同，不同的地方是实施例 2 中的第一活性物
10 质层的 Dv50 为 0.5μm。

实施例 3

与实施例 1 的制备方法相同，不同的地方是实施例 3 中的第一活性物
15 质层的 Dv50 为 1μm。

实施例 4

与实施例 1 的制备方法相同，不同的地方是实施例 4 中的第一活性物
20 质层的 Dv50 为 3μm。

实施例 5

与实施例 1 的制备方法相同，不同的地方是实施例 5 中的第一活性物
25 质层的 Dv50 为 5μm。

实施例 6

与实施例 1 的制备方法相同，不同的地方是实施例 6 中的第一活性物
30 质层的 Dv50 为 7μm。

实施例 7

与实施例 1 的制备方法相同，不同的地方是实施例 7 中的第一活性物



质层的 Dv50 为 9 μ m。

实施例 8

与实施例 1 的制备方法相同，不同的地方是实施例 8 中的第一活性物
5 质层的 Dv50 为 11 μ m。

实施例 9

与实施例 1 的制备方法相同，不同的地方是实施例 9 中的第一活性物
质层的 Dv50 为 15 μ m。

10

实施例 10

与实施例 1 的制备方法相同，不同的地方是实施例 10 中的第一活性物
质层的 Dv50 为 16 μ m。

15

实施例 11

与实施例 1 的制备方法相同，不同的地方是实施例 11 中的第一活性物
质层的 Dv50 为 7 μ m，第一活性物质层的 Dv90 为 8 μ m。

实施例 12

20

与实施例 1 的制备方法相同，不同的地方是实施例 12 中的第一活性物
质层的 Dv50 为 7 μ m，第一活性物质层的 Dv90 为 10 μ m。

实施例 13

与实施例 1 的制备方法相同，不同的地方是实施例 13 中的第一活性物
25 质层的 Dv50 为 7 μ m，第一活性物质层的 Dv90 为 15 μ m。

实施例 14

与实施例 1 的制备方法相同，不同的地方是实施例 14 中的第一活性物
质层的 Dv50 为 7 μ m，第一活性物质层的 Dv90 为 25 μ m。



实施例 15

与实施例 1 的制备方法相同，不同的地方是实施例 15 中的第一活性物质层的 Dv50 为 7 μm ，第一活性物质层的 Dv90 为 40 μm 。

5

实施例 16

与实施例 1 的制备方法相同，不同的地方是实施例 16 中的第一活性物质层的 Dv50 为 1 μm ，第一活性物质层的 Dv90 为 2 μm 。

10

实施例 17

与实施例 1 的制备方法相同，不同的地方是实施例 17 中的第一活性物质层的 Dv50 为 1 μm ，第一活性物质层的 Dv90 为 5 μm 。

实施例 18

15 与实施例 1 的制备方法相同，不同的地方是实施例 18 中的第一活性物质层的 Dv50 为 1 μm ，第一活性物质层的 Dv90 为 10 μm 。

实施例 19

20 与实施例 1 的制备方法相同，不同的地方是实施例 19 中的第一活性物质层的 Dv50 为 1 μm ，第一活性物质层的 Dv90 为 15 μm 。

实施例 20

与实施例 1 的制备方法相同，不同的地方是实施例 20 中的第一活性物质层的 Dv50 为 1 μm ，第一活性物质层的 Dv90 为 20 μm 。

25

实施例 21

与实施例 1 的制备方法相同，不同的地方是实施例 21 中的第一活性物质层的 Dv50 为 7 μm ，第一活性物质层的 Dv90 为 45 μm 。



实施例 22

与实施例 1 的制备方法相同，不同的地方是实施例 22 中的第一活性物质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 1:1。

5 实施例 23

与实施例 1 的制备方法相同，不同的地方是实施例 23 中的第一活性物质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 5:1。

实施例 24

10 与实施例 1 的制备方法相同，不同的地方是实施例 24 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 1:1。

实施例 25

15 与实施例 1 的制备方法相同，不同的地方是实施例 25 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 2:1。

实施例 26

与实施例 1 的制备方法相同，不同的地方是实施例 26 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 5:1。

20

实施例 27

与实施例 1 的制备方法相同，不同的地方是实施例 27 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 10:1。

25

实施例 28

与实施例 1 的制备方法相同，不同的地方是实施例 28 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 20:1。



实施例 29

与实施例 1 的制备方法相同，不同的地方是实施例 29 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 40:1。

实施例 30

与实施例 1 的制备方法相同，不同的地方是实施例 30 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第二活性物质层与第一活性物质层的 Dv50 比值为 45:1。

实施例 31

与实施例 1 的制备方法相同，不同的地方是实施例 31 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $2\mu\text{m}$ 。

实施例 32

与实施例 1 的制备方法相同，不同的地方是实施例 32 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $5\mu\text{m}$ 。

实施例 33

与实施例 1 的制备方法相同，不同的地方是实施例 33 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $7\mu\text{m}$ 。

实施例 34

与实施例 1 的制备方法相同，不同的地方是实施例 34 中的第一活性物质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $10\mu\text{m}$ 。

实施例 35

与实施例 1 的制备方法相同，不同的地方是实施例 35 中的第一活性物

质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $15\mu\text{m}$ 。

实施例 36

与实施例 1 的制备方法相同，不同的地方是实施例 36 中的第一活性物
5 质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $20\mu\text{m}$ 。

实施例 37

与实施例 1 的制备方法相同，不同的地方是实施例 37 中的第一活性物
质层的 Dv50 为 $1\mu\text{m}$ ，第一活性物质层的厚度为 $30\mu\text{m}$ 。

10

实施例 38

与实施例 1 的制备方法相同，不同的地方是实施例 38 中的第一活性物
质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $30\mu\text{m}$ 。

15

实施例 39

与实施例 1 的制备方法相同，不同的地方是实施例 39 中的第一活性物
质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $40\mu\text{m}$ 。

实施例 40

与实施例 1 的制备方法相同，不同的地方是实施例 40 中的第一活性物
20 质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $50\mu\text{m}$ 。

实施例 41

与实施例 1 的制备方法相同，不同的地方是实施例 41 中的第一活性物
25 质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $60\mu\text{m}$ 。

实施例 42

与实施例 1 的制备方法相同，不同的地方是实施例 42 中的第一活性物
质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $70\mu\text{m}$ 。



实施例 43

与实施例 1 的制备方法相同，不同的地方是实施例 43 中的第一活性物质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $80\mu\text{m}$ 。

5

实施例 44

与实施例 1 的制备方法相同，不同的地方是实施例 44 中的第一活性物质层的 Dv50 为 $7\mu\text{m}$ ，第二活性物质层的厚度为 $100\mu\text{m}$ 。

10

实施例 45

与实施例 1 的制备方法相同，不同的地方是实施例 45 中的第一活性物质层的 Dv50 为 $7\mu\text{m}$ 。

实施例 46

15

与实施例 1 的制备方法相同，不同的地方是实施例 46 中的第一活性物质层的正极活性物质为钴酸锂，第一活性物质层的 Dv50 为 $7\mu\text{m}$ 。

实施例 47

与实施例 1 的制备方法相同，不同的地方是实施例 47 中的第一活性物质层的正极活性物质为锰酸锂，第一活性物质层的 Dv50 为 $7\mu\text{m}$ 。

20

实施例 48

与实施例 1 的制备方法相同，不同的地方是实施例 48 中的第一活性物质层的正极活性物质为磷酸铁锂，第一活性物质层的 Dv50 为 $7\mu\text{m}$ 。

25

实施例 49

与实施例 1 的制备方法相同，不同的地方是实施例 49 中的第一活性物质层的活性物质为镍钴铝酸锂，第一活性物质层的 Dv50 为 $7\mu\text{m}$ 。



实施例 50

与实施例 1 的制备方法相同，不同的地方是实施例 50 中的第一活性物质层的正极活性物质为钛酸锂，第一活性物质层的 Dv50 为 7μm。

5 接下来对锂离子电池的穿钉通过率以及能量密度进行测试。

穿钉测试方法：

1、将锂离子电池置于 25℃恒温箱中，静置 30 分钟，使锂离子电池达到恒温。将达到恒温的锂离子电池以 0.5C 恒流充电至电压为 4.4V，然后以 4.4V 恒压充电至电流为 0.025C。将满充锂离子电池转移至穿钉测试机上，保持测试环境温度 25℃±2℃，用直径为 4mm 的钢钉，以 30mm/s 的速度匀速穿过锂离子电池中心，保留 300s，锂离子电池不起火不爆炸记为通过。每次测试 10 块锂离子电池，以通过穿钉测试的锂离子电池数量作为评价锂离子电池安全性能的指标。

2、能量密度的测试方法：

15 将锂离子电池置于 25℃恒温箱中，静置 30 分钟，使锂离子电池达到恒温。将达到恒温的锂离子电池以 0.5C 恒流充电至电压为 4.4V，然后以 4.4V 恒压充电至电流为 0.05C，0.5C 放电至电压为 3.0V，记录放电能量。

能量密度=放电能量/（锂离子电池的长度*宽度*厚度）。

各个实施例以及对比例的实验参数和测量结果如下表 1 所示。

20 表 1

实施例	第一活性物质	Dv50/μm (第一活性物质)	Dv90/μm (第一活性物质)	Dv50 比值 (第二活性物质:第一活性物质)	第一活性物质层的厚度(μm)	第二活性物质层的厚度/μm	第一活性物质层的粘结剂的质量含量(wt%)	第二活性物质层的粘结剂的质量含量(wt%)	穿钉通过率	能量密度(Wh/L)
1	镍钴锰酸锂	0.2	20	2: 1	25	54	2.8	0.8	10/10	721
2	镍钴锰酸锂	0.5	20	2: 1	25	54	2.8	0.8	10/10	721
3	镍钴锰酸锂	1	20	2: 1	25	54	2.8	0.8	10/10	721

4	镍钴锰酸锂	3	20	2: 1	25	54	2.8	0.8	10/10	729
5	镍钴锰酸锂	5	20	2: 1	25	54	2.8	0.8	10/10	735
6	镍钴锰酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	738
7	镍钴锰酸锂	9	20	2: 1	25	54	2.8	0.8	10/10	741
8	镍钴锰酸锂	11	20	2: 1	25	54	2.8	0.8	8/10	745
9	镍钴锰酸锂	15	20	2: 1	25	54	2.8	0.8	6/10	750
10	镍钴锰酸锂	16	20	2: 1	25	54	2.8	0.8	5/10	752
11	镍钴锰酸锂	7	8	2: 1	25	54	2.8	0.8	10/10	738
12	镍钴锰酸锂	7	10	2: 1	25	54	2.8	0.8	10/10	738
13	镍钴锰酸锂	7	15	2: 1	25	54	2.8	0.8	10/10	738
6	镍钴锰酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	738
14	镍钴锰酸锂	7	25	2: 1	25	54	2.8	0.8	9/10	738
15	镍钴锰酸锂	7	40	2: 1	25	54	2.8	0.8	9/10	738
16	镍钴锰酸锂	1	2	2: 1	25	54	2.8	0.8	10/10	721
17	镍钴锰酸锂	1	5	2: 1	25	54	2.8	0.8	10/10	721
18	镍钴锰酸锂	1	10	2: 1	25	54	2.8	0.8	10/10	721
19	镍钴锰酸锂	1	15	2: 1	25	54	2.8	0.8	10/10	721
20	镍钴锰酸锂	1	20	2: 1	25	54	2.8	0.8	10/10	721
21	镍钴锰酸锂	7	45	2: 1	25	54	2.8	0.8	3/10	737
22	镍钴锰酸锂	7	20	1: 1	25	54	2.8	0.8	10/10	741
6	镍钴锰酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	738
23	镍钴锰酸锂	7	20	5: 1	25	54	2.8	0.8	9/10	725
24	镍钴锰酸锂	1	20	1: 1	25	54	2.8	0.8	10/10	721
25	镍钴锰酸锂	1	20	2: 1	25	54	2.8	0.8	10/10	721
26	镍钴锰酸锂	1	20	5: 1	25	54	2.8	0.8	10/10	721
27	镍钴锰酸锂	1	20	10: 1	25	54	2.8	0.8	10/10	717
28	镍钴锰酸锂	1	20	20: 1	25	54	2.8	0.8	9/10	713
29	镍钴锰酸锂	1	20	40: 1	25	54	2.8	0.8	7/10	709
30	镍钴锰酸锂	1	20	45: 1	25	54	2.8	0.8	2/10	697
31	镍钴锰酸锂	1	20	2: 1	2	54	2.8	0.8	10/10	721
32	镍钴锰酸锂	1	20	2: 1	5	54	2.8	0.8	10/10	719
33	镍钴锰酸锂	1	20	2: 1	7	54	2.8	0.8	10/10	718
34	镍钴锰酸锂	1	20	2: 1	10	54	2.8	0.8	10/10	715
35	镍钴锰酸锂	1	20	2: 1	15	54	2.8	0.8	10/10	711
36	镍钴锰酸锂	1	20	2: 1	20	54	2.8	0.8	10/10	706
37	镍钴锰酸锂	1	20	2: 1	30	54	2.8	0.8	10/10	698
38	镍钴锰酸锂	7	20	2: 1	25	30	2.8	0.8	10/10	723

39	镍钴锰酸锂	7	20	2: 1	25	40	2.8	0.8	10/10	734
40	镍钴锰酸锂	7	20	2: 1	25	50	2.8	0.8	10/10	735
6	镍钴锰酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	738
41	镍钴锰酸锂	7	20	2: 1	25	60	2.8	0.8	10/10	743
42	镍钴锰酸锂	7	20	2: 1	25	70	2.8	0.8	10/10	751
43	镍钴锰酸锂	7	20	2: 1	25	80	2.8	0.8	10/10	766
44	镍钴锰酸锂	7	20	2: 1	25	100	2.8	0.8	10/10	778
45	镍钴锰酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	738
46	钴酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	743
47	锰酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	728
48	磷酸铁锂	7	20	2: 1	25	54	2.8	0.8	10/10	730
49	镍钴铝酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	735
50	钛酸锂	7	20	2: 1	25	54	2.8	0.8	10/10	723
对比例										
1	/	/	/	/	/	79	/	0.8	0/10	747

通过比较对比例 1 和实施例 1-50 可知, 通过采用双层结构的活性物质层, 锂离子电池的穿钉通过率具有不同程度的改善, 并且能量密度基本没有多大影响。

5 由实施例 1-9 可知, 随着第一活性物质层的 $Dv50$ 的增加, 能量密度也随着增加, 但是之后穿钉通过率会有所降低。通过比较实施例 1- 10 可知, 在第一活性物质层的 $Dv50$ 大于 $15\mu m$ 时, 锂离子电池的穿钉通过率下降到较低水平。

10 从实施例 11-20 和 6 可知, 随着第一活性物质层的 $Dv90$ 的增加, 能量密度几乎不变, 但是穿钉通过率之后会降低。通过比较实施例 6 和 11- 21 可知, 在锂离子电池的第一活性物质层的 $Dv90$ 超过 $40\mu m$ 时, 锂离子电池的穿钉通过率下降到较低水平。

15 通过比较实施例 6 和 22-30 可知, 随着第二活性物质层和第一活性物质层的正极活性物质 $Dv50$ 的比值增加, 能量密度及穿钉通过率均有所降低, 在第二活性物质层和第一活性物质层的正极活性物质 $Dv50$ 的比值超过 40 时, 锂离子电池的穿钉通过率下降到较低水平。

通过实施例 31-37 可知, 第一活性物质层的厚度在 $2\mu m \sim 30\mu m$ 范围内时, 锂离子电池的穿钉性能均保持较好。



通过比较实施例 6 和 38-44 可知,随着第二活性物质层的厚度的增加,锂离子电池的穿钉性能基本不变,但是能量密度提升。

由实施例 45-50 可知,第一活性物质层的正极活性物质选择不同物质,锂离子电池的穿钉性能均较好,能量密度随不同物质略有差别。

- 5 本领域技术人员应理解,以上实施例仅是示例性实施例,在不背离本申请的精神和范围的情况下,可以进行多种变化、替换以及改变。



说明书附图

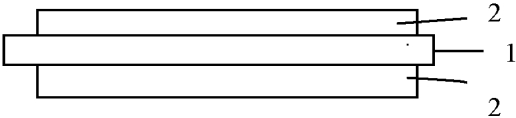


图 1

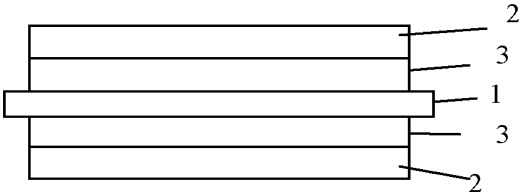


图 2



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
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS

CONFIRMATION NO. 8334

PUBLICATION NOTICE



OC000000110772269

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

Title:ELECTRODE AND LITHIUM-ION BATTERY

Publication No.US-2019-0267664-A1

Publication Date:08/29/2019

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.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS	8334
20995	7590	11/01/2019	EXAMINER	
KNOBBE MARTENS OLSON & BEAR LLP			MARKS, JACOB B	
2040 MAIN STREET			ART UNIT	PAPER NUMBER
FOURTEENTH FLOOR			1729	
IRVINE, CA 92614			NOTIFICATION DATE	DELIVERY MODE
			11/01/2019	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

DETAILED ACTION

Claims 1-18 are pending.

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.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-7 and 9-16 are rejected under 35 U.S.C. 103 as being unpatentable over Imachi et al. (US 2007/026316) in view of Sikha et al. (US 2016/0013480).

Regarding claims 1, 6, 7, 10, 15, and 16, Imachi et al. teaches positive active material for a lithium ion battery comprising a first active material layer 2a comprising lithium manganese oxide and a second active material layer 2b comprising lithium cobalt oxide where in the first layer is between the second layer and a current collector 1 (par. 15-17, 37-54, fig. 3).

Imachi does not teach the ratio of the particle size of the first and second active layer. However, Sikha teaches that modifying the particle size ratio can affect the power yield and cycling characteristics

Art Unit: 1729

of a two-layer active material battery (abstract, par. 23, 24). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the particle size ratio between the two layers of Imachi because Sikha teaches that such a modification can affect the performance of the battery.

Regarding claims 2, 3, 11, and 12 Imachi does not teach that the particle size of the first layer is between 0.2 and 15 microns or that 90% by volume of the first active material is less than 40 microns. However, Sikha teaches that having a cathode active material particle size of between 2 and 15 microns can prevent unwanted side reactions (par. 43). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the particle size of Imachi to between 2 and 15 microns because Sikha teaches that such an adjustment can reduce side reactions.

Regarding claims 4 and 13, Imachi teaches that the thickness of the first layer should be 5 microns or less (par. 41).

Regarding claims 5 and 14, Imachi teaches that the thickness of the second layer should be made large compared to the 5 micron thickness of the first layer (par. 41-42). Imachi does not specifically teach the thickness of the second layer. However, changes in size do not generally impart patentability absent some showing of criticality. Therefore, it would have been obvious to one of ordinary skill in the art to make the thickness of the second layer of Imachi 30 microns or more because Imachi teaches that the second layer should have a large thickness and because courts have recognized that changes in size do not generally impart patentability.

Regarding claims 9 and 18, Imachi teaches that the first and second active materials may comprise a pvdf binder (par. 58-59).

Claims 8 and 17 are rejected under 35 U.S.C. 103 as being unpatentable over Imachi and Sikha as applied above, further in view of Ijiri et al. (US 2014/0295284).

Regarding claims 8 and 17, Imachi teaches that the first active material may comprise a conductive additive such as fibrous carbon (par. 21, 30). Imachi does not teach that the active material comprises graphite. However, Ijiri teaches that graphite and fibrous carbon are both suitable for the purpose of conductivity enhancement (par. 95). Therefore, it would have been obvious to one of ordinary skill in the art to use graphite instead of fibrous carbon in the first active layer of Imachi because Ijiri teaches that graphite is equivalent.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JACOB B MARKS whose telephone number is (571)270-7873. The examiner can normally be reached on Monday through Friday, alternate Fridays off.

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, Ula Ruddock can be reached on 571-272-1481. 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.

/JACOB B MARKS/
Primary Examiner, Art Unit 1729

Notice of References Cited	Application/Control No. 16/000,597		Applicant(s)/Patent Under Reexamination Lin et al.	
	Examiner JACOB B MARKS		Art Unit 1729	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-20070026316-A1	02-2007	Imachi; Naoki	H01M4/13	429/232
*	B	US-20160013480-A1	01-2016	SIKHA; Godfrey	H01M4/0404	427/126.6
*	C	US-20140295284-A1	10-2014	IJIRI; Makiko	H01M4/587	429/231.8
	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.

<i>Search Notes</i> 	Application/Control No. 16/000,597	Applicant(s)/Patent Under Reexamination Lin et al.
	Examiner JACOB B MARKS	Art Unit 1729

CPC - Searched*		
Symbol	Date	Examiner

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	10/28/2019	JBM

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

--	--

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	0	((bilayer (two adj layer) multilayer) with active).ab. same particle adj (size diameter) and h01m\$9 and @Py<"2019"	US-PGPUB; USPAT	OR	ON	2019/10/28 10:51
L3	41	((bilayer (two adj layer) multilayer) with active) same particle adj (size diameter) and h01m\$9 and @Py<"2019"	US-PGPUB; USPAT	OR	ON	2019/10/28 10:51
L4	370	fibrous adj carbon with graphite and h01m\$9 and @pY<"2019"	US-PGPUB; USPAT	OR	ON	2019/10/28 11:45
L5	329	fibrous adj carbon with graphite and h01m\$9 and @pY<"2018"	US-PGPUB; USPAT	OR	ON	2019/10/28 11:46
S1	1	"16000597"	US-PGPUB; USPAT	OR	OFF	2019/10/28 02:05
S2	1528	(bilayer (two adj layer) multilayer (double adj layer\$2)) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese)	US-PGPUB; USPAT	OR	OFF	2019/10/28 02:09
S3	1869	(bilayer (two adj layer) multilayer (double adj layer\$2)) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:10
S4	1103	(bilayer (two adj layer) multilayer) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:10
S5	1001	(bilayer (two adj layer) multilayer (double adj layer\$2)) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese) and particle adj (size diameter)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:11
S6	589	(bilayer (two adj layer) multilayer) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese) and particle adj (size diameter)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:11
S7	25	((bilayer (two adj layer) multilayer) with active).ab. and h01m\$9 and @Py<"2019" and (cobalt nickel manganese) and particle adj (size diameter)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:12

10/ 28/ 2019 12:05:54 PM

C:\ Users\ jmarks\ Documents\ EAST\ Workspaces\ 16000597.wsp

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/000597
	Filing Date	June 5, 2018
	First Named Inventor	Chaowang Lin
	Art Unit	1726
(Multiple sheets used when necessary)	Examiner	Unassigned
SHEET 1 OF 1	Attorney Docket No.	DHNG001.004AUS

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	CN1658413A	08-24-2005	BIYADI CO LTD		

28671213

Examiner Signature /JACOB B MARKS/	Date Considered 10/28/2019
*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.	

~~ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.B.M/~~
T¹ - Place a check mark in this area when an English language Translation is attached.

Bibliographic Data

Application No: 16/000,597

Foreign Priority claimed: ☒ Yes ☐ No

35 USC 119 (a-d) conditions met: ☒ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /JACOB B MARKS/

Examiner's Signature

Initials

Title: ELECTRODE AND LITHIUM-ION BATTERY

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/05/2018	429	1729	DHNG001.004AUS
RULE			

APPLICANTS

Ningde Amperex Technology Limited, Ningde, CHINA

INVENTORS

Chaowang Lin Ningde, CHINA

Fan Yang Ningde, CHINA

Yisong Su Ningde,, CHINA

Huawei Zhong Ningde, CHINA

Changming Qu Ningde,, CHINA

Xiaozhen Zhang Ningde, CHINA

CONTINUING DATA

FOREIGN APPLICATIONS

CHINA 201810162494.1 02/26/2018

IF REQUIRED, FOREIGN LICENSE GRANTED**

STATE OR COUNTRY

CHINA

ADDRESS

KNOBBE MARTENS OLSON & BEAR LLP

2040 MAIN STREET

FOURTEENTH FLOOR

IRVINE, CA 92614

UNITED STATES

FILING FEE RECEIVED

\$1,880

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/000597
	Filing Date	June 5, 2018
	First Named Inventor	Chaowang Lin
	Art Unit	1729
(Multiple sheets used when necessary)	Examiner	Marks, Jacob B
SHEET 1 OF 1	Attorney Docket No.	DHNG001.004AUS

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number Number - Kind Code (if known) Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2002/028380 A1	03-07-2002	Tanjo et al.	

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
	2	CN 103187576	07-03-2013	He et al.		Abs
	3	CN 201153140	11-19-2008	Li et al.		Abs
	4	CN 105304859 A	02-03-2016	Yongjun et al.		Abs
	5	CN 104347842	08-25-2017	Xia et al.		Abs
	6	CN 102306777	01-04-2012	Zhan et al.		Abs
	7	CN 105070882	11-18-2015	Zetian et al.		Abs
	8	CN 103258999	08-03-2016	Charest et al.		Abs

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.	T ¹
	9	First Chinese Office Action for Application No. 201810162494.1 dated August 29, 2019	
	10	Second Chinese Office Action for Application No. 201810162494.1 dated November 21, 2019	

31770927Abs

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.	

T¹ - Place a check mark in this area when an English language Translation is attached.

Electronic Patent Application Fee Transmittal

Application Number:	16000597			
Filing Date:	05-Jun-2018			
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY			
First Named Inventor/Applicant Name:	Chaowang Lin			
Filer:	Daniel J. Fischer/Marlene Vasquez			
Attorney Docket Number:	DHNG001.004AUS			
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:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
Total in USD (\$)				240

Electronic Acknowledgement Receipt

EFS ID:	37865138
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	Daniel J. Fischer/Marlene Vasquez
Filer Authorized By:	Daniel J. Fischer
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	26-NOV-2019
Filing Date:	05-JUN-2018
Time Stamp:	14:50:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$240
RAM confirmation Number	E2019APE50581714
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	Foreign Reference	CN103187576A_wAbs.pdf	628406	no	9
			3db1afe17f616e7a0b590dc87fd4b1464aa44e8e		
Warnings:					
Information:					
2	Foreign Reference	CN201153140_wAbs.pdf	595077	no	11
			912fea4a300b1ced23dc7982a420803357bd90cd		
Warnings:					
Information:					
3	Foreign Reference	CN105304859_wAbs.pdf	15403264	no	12
			1d05d5d63ad9e326a6f4c6dec9fbc66f57bd3a7		
Warnings:					
Information:					
4	Foreign Reference	CN104347842_wAbs.pdf	18800004	no	14
			9f98f97d44659bf343b8b7a05d87f7435f2885dd		
Warnings:					
Information:					
5	Foreign Reference	CN102306777_wAbs.pdf	17446097	no	14
			b8b238ff1f4b6cb29ca6462e5fe60bbccd75434f		
Warnings:					
Information:					
6	Foreign Reference	CN105070882_wAbs.pdf	8829200	no	8
			b41dbacd852fec384931dfd05da402e1754efcdf		
Warnings:					
Information:					

7	Non Patent Literature	CN_OA2_11-21-2019.pdf	22095830	no	16
			11f8502b176e4714a6511d5c0c16ca1b22e16528		
Warnings:					
Information:					
8	Foreign Reference	CN103258999__wAbs_Part1.pdf	25331619	no	21
			99884e077f701beaa4403cfc3582458341e63b38		
Warnings:					
Information:					
9	Foreign Reference	CN103258999_wAbs_Part2.pdf	20466972	no	12
			2d13557226a7d68498845fd92fd63cca2df713d6		
Warnings:					
Information:					
10	Non Patent Literature	CN_OA1_08-29-2019_Part1.pdf	25320981	no	23
			9d2b50439f399208489fca9b726a3d88fedaf069		
Warnings:					
Information:					
11	Non Patent Literature	CN_OA1_08-29-2019_Part2.pdf	25068867	no	18
			374e4f4c9a18f0eb6f503ffcbf19694b71ef7af4		
Warnings:					
Information:					
12	Non Patent Literature	CN_OA1_08-29-2019_Part3.pdf	21312656	no	18
			d92f25345004180eae0a451139da7c9347333a73		
Warnings:					
Information:					
13		DHNG001004AUS_IDS.pdf	163379	yes	3
			bc9061d8d186dd94612afb5b6f7fd614c7d5a925		
	Multipart Description/PDF files in .zip description				
	Document Description	Start	End		

	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:

Information:

14	Fee Worksheet (SB06)	fee-info.pdf	30607	no	2
			c9f7306ea7651c1f6526bb0bff828e3e69156a3f		

Warnings:

Information:

Total Files Size (in bytes):	201492959
-------------------------------------	-----------

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.

INFORMATION DISCLOSURE STATEMENT

First Inventor :	Chaowang Lin
App. No. :	16/000597
Filed :	June 5, 2018
For :	ELECTRODE AND LITHIUM-ION BATTERY
Examiner :	Marks, Jacob B
Art Unit :	1729
Conf. No. :	8334

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.

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 after receipt of a First Office Action, but before the mailing date of a Final Action and before the mailing date of a Notice of Allowance.

This Statement is accompanied by the fees set forth in 37 CFR 1.17(p). The Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Account No. 11-1410.

Application No.: 16/000597
Filing Date: June 5, 2018

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: November 26, 2019

By: /Daniel J. Fischer/ _____
Dan Fischer
Registration No. 68,043
Registered Practitioner
Customer No. 20995
(212) 849-3000

IDS

31771207

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 16/000,597		Filing Date 06/05/2018		☐ 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	01/22/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 18	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	
		(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".						/NINA RATANAVONG/			
*** 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor : Chaowang Lin
App. No. : 16/000597
Filed : June 5, 2018
For : ELECTRODE AND LITHIUM-ION BATTERY
Examiner : Marks, Jacob B
Art Unit : 1729
Conf. No. : 8334

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION**Mail Stop Amendment**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The Office Action mailed on November 01, 2019, has been carefully considered. In response thereto, Applicants hereby submit the following amendments and remarks.

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.

Electronic Acknowledgement Receipt

EFS ID:	38364882
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	Daniel J. Fischer/Kealani Aguon
Filer Authorized By:	Daniel J. Fischer
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	22-JAN-2020
Filing Date:	05-JUN-2018
Time Stamp:	14:02:38
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		response.pdf	419929	yes	12
			613a968c6c8f6ecb29e0e8a04413ff1fae8da948		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	12

Warnings:

Information:

Total Files Size (in bytes):	419929
-------------------------------------	--------

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.

AMENDMENTS TO THE CLAIMS

1. **(Currently amended)** An electrode, comprising:
a current collector;
a first active material layer, comprising a first active material; and
a second active material layer, comprising a second active material;
wherein the first active material layer is arranged between the current collector and the second active material layer, the first active material layer is formed on at least one surface of the current collector, and a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1, wherein a particle size of 90% accumulative volume of the first active material is less than 40 μm .

2. **(Original)** The electrode according to claim 1, wherein the first active material has an average particle size in a range of 0.2 μm to 15 μm .

3. **(Cancelled)**

4. **(Original)** The electrode according to claim 1, wherein the first active material layer has a thickness of 2 μm to 30 μm .

5. **(Original)** The electrode according to claim 1, wherein the second active material layer has a thickness equal to or more than 30 μm .

6. **(Original)** The electrode according to claim 1, wherein the first active material comprises one of lithium cobaltate, lithium manganate, lithium nickelate, lithium nickel cobalt manganese oxide, lithium iron phosphate, lithium iron manganese phosphate, lithium vanadium phosphate, lithium vanadyl phosphate,

lithium-rich manganese-based materials, lithium nickel cobalt aluminate and lithium titanate, and combinations thereof.

7. **(Original)** The electrode according to claim 1, wherein the second active material comprises one of lithium cobaltate, lithium nickel cobalt manganese oxide, lithium nickel cobalt aluminum oxide, lithium-rich manganese-based material, lithium iron phosphate, and combinations thereof.

8. **(Original)** The electrode according to claim 1, wherein the first active material comprises one of artificial graphite, natural graphite, mesocarbon microbeads, soft carbon, hard carbon, silicon, silicon carbide, lithium titanate, and combinations thereof.

9. **(Original)** The electrode according to claim 1, wherein each of the first active material layer and the second active material layer further comprises a binder, and the binder comprises one of polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylates, polyacrylic acids, polyacrylic acid salt, carboxymethylcellulose sodium, polyethylene pyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene, polyhexafluoropropylene and styrene butadiene rubber, and combinations thereof.

10. **(Currently amended)** A lithium-ion battery comprising an electrode, wherein the electrode comprises:

a current collector;

a first active material layer, comprising a first active material; and

a second active material layer, comprising a second active material;

wherein the first active material layer is arranged between the current collector and the second active material layer, the first active material layer is formed on at least one surface of the current collector, and a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1, wherein a particle size of 90% accumulative volume of the first active material is less than 40 μm .

11. **(Original)** The lithium-ion battery according to claim 10, wherein the first active material has an average particle size in a range of 0.2 μm to 15 μm .

12. **(Cancelled)**

13. **(Original)** The lithium-ion battery according to claim 10, wherein the first active material layer has a thickness of 2 μm to 30 μm .

14. **(Original)** The lithium-ion battery according to claim 10, wherein the second active material layer has a thickness equal to more than 30 μm .

15. **(Original)** The lithium-ion battery according to claim 10, wherein the first active material comprises one of lithium cobaltate, lithium manganate, lithium nickelate, lithium nickel cobalt manganese oxide, lithium iron phosphate, lithium iron manganese phosphate, lithium vanadium phosphate, lithium vanadyl phosphate, lithium-rich manganese-based materials, lithium nickel cobalt aluminate and lithium titanate, and combinations thereof.

16. **(Original)** The lithium-ion battery according to claim 10, wherein the second active material comprises one of lithium cobaltate, lithium nickel cobalt manganese oxide, lithium nickel cobalt aluminum oxide, lithium-rich manganese-based material, lithium iron phosphate, and combinations thereof.

17. **(Original)** The lithium-ion battery according to claim 10, wherein the first active material comprises one of artificial graphite, natural graphite, mesocarbon microbeads, soft carbon, hard carbon, silicon, silicon carbide, lithium titanate, and combinations thereof.

18. **(Original)** The lithium-ion battery according to claim 10, wherein each of the first active material layer and the second active material layer further comprises a binder, and the binder comprises one polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylates, polyacrylic acids, polyacrylic acid salt, carboxymethylcellulose sodium, polyethylene pyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene, polyhexafluoropropylene and styrene butadiene rubber, and combinations thereof.

19. **(New)** The electrode according to claim 4, wherein the first active material layer has a thickness of 7 μm to 30 μm .

20. **(New)** The lithium-ion battery according to claim 13, wherein the first active material layer has a thickness of 7 μm to 30 μm .

REMARKS

The Office Action tentatively rejected claims 1-18. In response, Applicant submits the following remarks, in which claims 1 and 10 have been amended, claims 3 and 12 cancelled, and claims 19-20 added. After entry of the foregoing amendments, claims 1-2, 4-11, 13-20 remain pending in the application. Applicant believes no new matter is added.

Claim Rejections

Claims 1-7 and 9-16 were rejected by the Office Action under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent Publication No. 2007/026316 (“Imachi”) in view of U.S. Patent Publication No. 2016/0013480 (“Sikha”). Claims 8 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Imachi and Sikha further in view of Ijiri et al. (US 2014/0295284). Applicant respectfully disagrees.

Rejection of claims 1, 2, 4-9, 10, 11, and 13 - 18

Amended independent claim 1 now recites, *inter alia*, an electrode including “a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1, wherein a particle size of 90% accumulative volume of the first active material is less than 40 μm .”

Support for the amendments to claim 1 can be found in at least claim 3 as originally filed. Applicant respectfully submits that the features set forth in claim 1 are not disclosed or taught by the references relied on by the Office Action. Applicant respectfully submits none of these references discloses the above-recited claim elements in the amended claim 1. Thus claim 1 should be allowable over Imachi and Sikha.

At first, the Office Action in the rejections of claim 1 asserted that Sikha teaches that modifying the particle size ratio can affect the power yield and cycling characteristics of a two-layer active material battery. Sikha, Abstract and paras. 23, 24. The Office Action concludes it would have been obvious to one of ordinary skill in the art to adjust the particle size ratio between the two layers of Imachi because Sikha teaches that such a modification can affect the performance of the battery. Office Action, p. 3. Applicant respectfully disagrees.

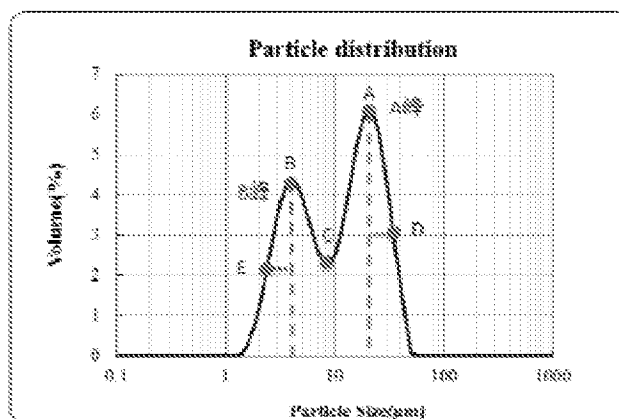
More specifically, the abstract and paragraphs 23 and 24 of Sikha to which the Office Action referred discloses that “the multilayer electrodes have different properties (e.g., porosity,

surface area, electrode composition) in each layer...the active material used to form each layer, the particle size of the active material particles...”. Sikha just teaches adjusting the particle size of each layer. Therefore, Sikha fails to teach “a ratio of an average particle size of the second active material to an average particle size of the first active material is from 1:1 to 40:1” as recited in claim 1.

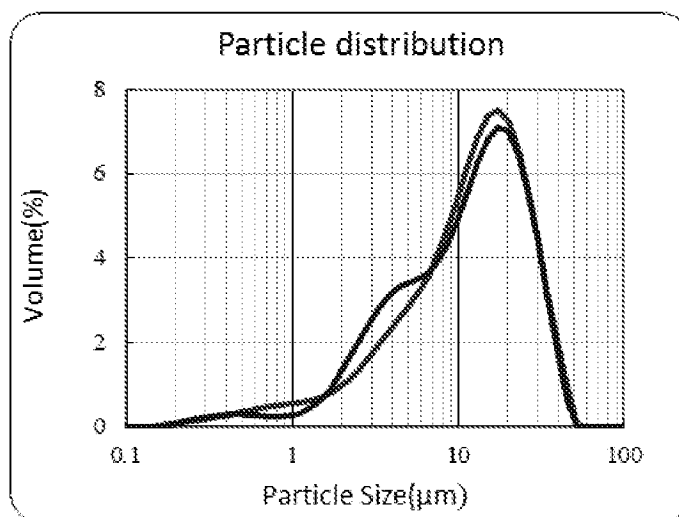
Secondly, the Office Action asserted that Sikha teaches that a cathode active material particle size of between 2 and 15 microns can prevent unwanted side reactions. Therefore, it would have been obvious to a person skilled to adjust the particle size. Applicant respectfully submits none of these references teaches a particle size of 90% accumulative volume of the first active material is less than 40 μm , as presented below.

Referring to paragraph 43 of Sikha cited by the Office Action, Sikha only discloses that a cathode active material particle size of between 2 and 15 microns can avoid inappropriate side reactions that may occur at higher voltages. However, Sikha does not disclose or teach that a particle size of 90% accumulative volume of the first active material is less than 40 μm .

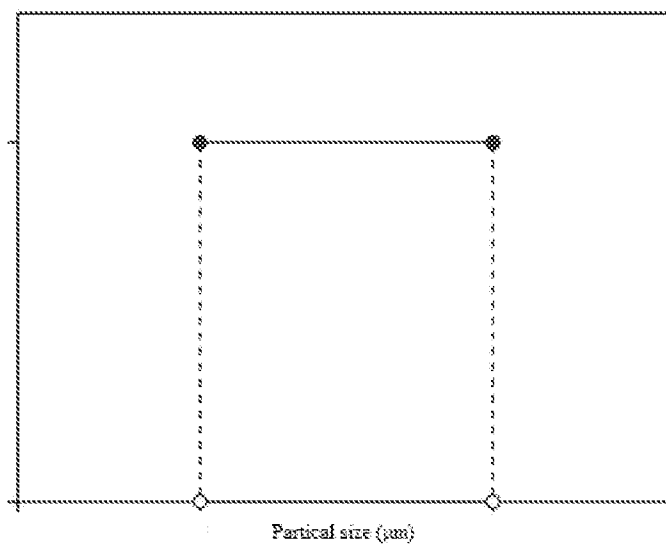
In addition, Sikha only discloses the average particle diameter of the cathode active material. However, when the average particle diameter of the material is the same, there are still many possible particle distributions, such as normal distributions, skew distributions, step distributions, sawtooth distributions, uniform distributions, bimodal distributions, multimodal distributions, etc. As can be seen from the figures below, if only the average particle size of the particles is controlled, there are still millions of size distributions of the particles in the material (especially the distribution of large particles).



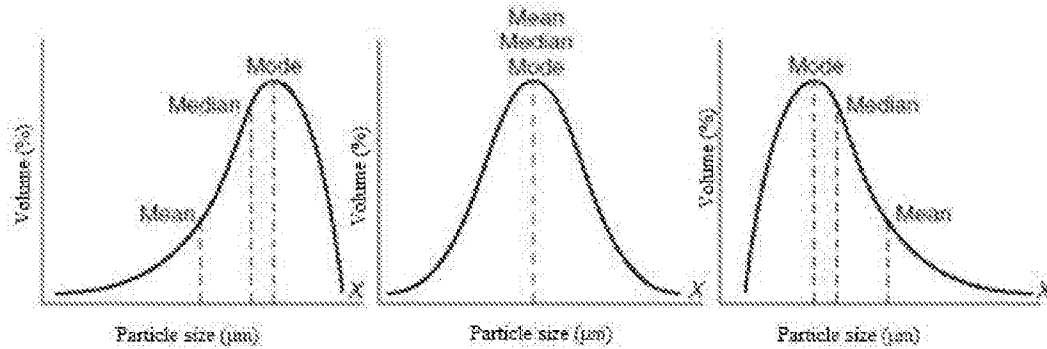
Bimodal distribution



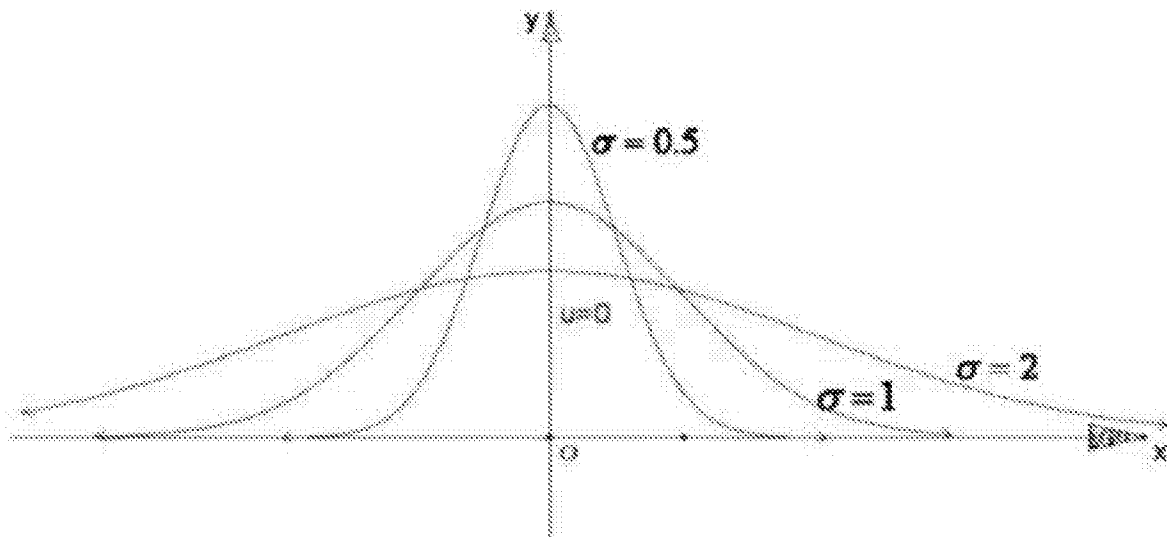
The black line is similar with bimodal distribution.



Uniform distribution



Furthermore, the size distribution of the particles is mostly normal. The average particle size (Dv50) can only represent the average size of the particles, and the particle size (Dv90) with a cumulative volume of 90% indicates the large particles in the materials. Even if Dv50 is the same, there are still millions of distributions in the particles, as is shown in the figure below, when the Dv50 of the materials are the same, but the Dv90 of the materials are different. In addition, the Dv90 of the materials can directly affect the coverage and adhesion of the first active material layer to the current collector. Therefore, it is advantageous to control the Dv90 of the first active material to fully cover the current collector by the first active material layer so as to protect the current collector.



In the application, the Dv90 of the first active material is less than 40 μm, so that all the particles of the first active material are small, so as to achieve higher coverage and adhesion to the current collector. Therefore, the application not only controls the Dv50 of the first active

material, but also controls large particles of the first active material (Dv90). Therefore all the particles in the first active material are controlled within a certain range to achieve higher coverage and adhesion to the current collector.

Accordingly, a particle size of 90% accumulative volume of the first active material is controlled to be less than 40 μm , so that the current collector is completely covered by the first active material layer, so as to achieve the protective effect to the current collector. Imachi and Sikha fails to disclose the above-recited claim elements in amended claim 1. Applicant asserts that the above-recited claim elements are not obvious, even to a person skilled in the art. Thus, Claim 1 should be allowable over Imachi and Sikha.

The amended claim 10 recites, *inter alia*, “a particle size of 90% accumulative volume of the first active material is less than 40 μm .” These claim elements were also recited in the previously presented claim 1. Accordingly, per the discussion provided in the response to the rejection of claim 1, none of Imachi and Sikha discloses these claim elements. Claim 10 should thus be allowable over Imachi and Sikha.

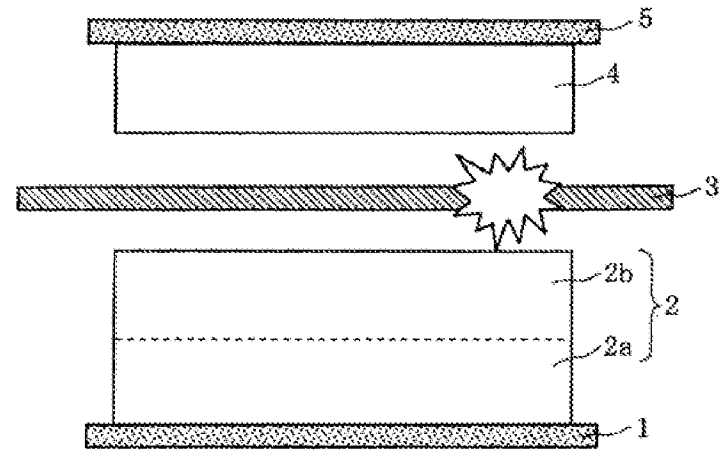
Claims 2 and 4-9 depend from and add further features to independent claim 1. Claims 11 and 13-18 depend from and add further features to independent claim 10. It is respectfully submitted that these dependent claims are allowable by reason of the independent claims on which they depend as well as additional features.

The new claim 19 and claim 20

The new dependent claims 19 and 20 recite “the first active material layer has a thickness of 7 μm to 30 μm .” Support for claims 19 and 20 can be found in at least paragraph 0008 and example 33 of the specification as originally filed. Applicant respectfully submits that the features set forth in claims 19 and 20 are not disclosed or taught by the references relied on by the Office Action.

Specifically, the Office Action refers to the lower layer 2a in FIG. 3 of Imachi (reproduced below) as the first active material layer, and refers to the upper layer 2b in FIG. 3 of Imachi as the second active material layer. However, paragraphs 41-42 of Imachi, the layer (2a) in contact with the current collector (1) has a preferred thickness of 5 μm or less. Then referring to paragraph 19 of Imachi, Imachi discloses that the positive electrode active materials having high resistance increase rates during overcharge show less discharge capacities per unit mass

than the positive electrode active materials having low resistance increase rates during overcharge. Accordingly, from the viewpoint of improvement in energy density, it is advantageous that the thickness of the layer having a high resistance increase rate during overcharge be made as thin as possible. Therefore, Imachi at least fails to teach “the first active material layer has a thickness of 7 μm to 30 μm ” as recited in claims 19 and 20. Imachi fails to disclose the above-recited claim elements in the amended claims 19 and 20. Thus Claims 19 and 20 should be allowable over Imachi.



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.

Application No.: 16/000597
Filing Date: June 5, 2018

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 22, 2020

By: /Daniel J. Fischer/_____
Dan Fischer
Registration No. 68,043
Registered Practitioner
Customer No. 20995
(212) 849-3000

32060895



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

NOTICE OF ALLOWANCE AND FEE(S) DUE

20995 7590 02/11/2020
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
MARKS, JACOB B	
ART UNIT	PAPER NUMBER

1729

DATE MAILED: 02/11/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS	8334

TITLE OF INVENTION: ELECTRODE AND LITHIUM-ION BATTERY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	05/11/2020

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 and an extra copy of the form should be submitted. 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.

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)

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.

20995 7590 02/11/2020
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

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.
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS	8334

TITLE OF INVENTION: ELECTRODE AND LITHIUM-ION BATTERY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	05/11/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
MARKS, JACOB B	1729	429-209000

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; Rev 03-09 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,

1 _____

(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.

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. _____



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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS	8334
20995	7590	02/11/2020	EXAMINER	
KNOBBE MARTENS OLSON & BEAR LLP			MARKS, JACOB B	
2040 MAIN STREET			ART UNIT	
FOURTEENTH FLOOR			PAPER NUMBER	
IRVINE, CA 92614			1729	
DATE MAILED: 02/11/2020				

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.

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) 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. 16/000,597	Applicant(s) Lin et al.	
	Examiner JACOB B MARKS	Art Unit 1729	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 amendment dated 1-22-2020.
☐ 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 1-2,4-11 and 13-20. 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 <u>11-26-2019</u> . 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 _____.
--	--

/JACOB B MARKS/
Primary Examiner, Art Unit 1729

DETAILED ACTION

Claims 1, 2, 4-11, and 13-20 are pending.

All previously asserted prior art rejections are withdrawn in favor of allowance.

Allowable Subject Matter

Claims 1, 2, 4-11, and 13-20 allowed.

The following is an examiner's statement of reasons for allowance:

Claims 1 and 10 recite a lithium ion battery comprising a collector, a first active layer, and a second active layer wherein the first layer is between the second layer and the collector. The claims further recite that the particle size ratio between second and first active layer is from 1:1 to 40:1 and that the particle size of 90% accumulative volume of the first active material is less than 40 microns.

Prior art Imachi (US 2007/0026316) teaches recite a lithium ion battery comprising a collector, a first active layer, and a second active layer wherein the first layer is between the second layer and the collector. Imachi does not teach that the particle size ratio between second and first active layer is from 1:1 to 40:1 and that the particle size of 90% accumulative volume of the first active material is less than 40 microns. In addition, there are unexpected results shown in table 1 of the specification which shows that when the particle size of 90% accumulative volume of the first active material is less than 40 microns there can be reduced nail penetration.

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 JACOB B MARKS whose telephone number is (571)270-7873. The examiner can normally be reached on Monday through Friday, alternate Fridays off.

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, Ula Ruddock can be reached on 571-272-1481. 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.

/JACOB B MARKS/
Primary Examiner, Art Unit 1729

<i>Search Notes</i> 	Application/Control No. 16/000,597	Applicant(s)/Patent Under Reexamination Lin et al.
	Examiner JACOB B MARKS	Art Unit 1729

CPC - Searched*		
Symbol	Date	Examiner
H01M4/02	02/03/2020	JBM

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

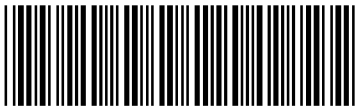
US Classification - Searched*			
Class	Subclass	Date	Examiner

* 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	10/28/2019	JBM
Updated Search	02/03/2020	JBM

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H01M	4/02	02/03/2020	JBM

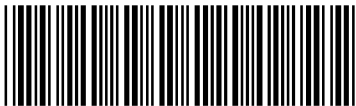
--	--

Issue Classification 	Application/Control No. 16/000,597	Applicant(s)/Patent Under Reexamination Lin et al.
	Examiner JACOB B MARKS	Art Unit 1729

CPC						
Symbol					Type	Version
H01M	/	10	/	0525	F	2013-01-01
H01M	/	4	/	366	I	2013-01-01
H01M	/	4	/	382	I	2013-01-01
H01M	/	4	/	50	I	2013-01-01
H01M	/	4	/	52	I	2013-01-01
H01M	/	4	/	583	I	2013-01-01
H01M	/	4	/	623	I	2013-01-01
H01M	/	4	/	661	I	2013-01-01
H01M	/	2004	/	027	A	2013-01-01
H01M	/	2004	/	028	A	2013-01-01

CPC Combination Sets					
Symbol			Type	Set	Ranking
	/				

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 18	
/JACOB B MARKS/ Primary Examiner, Art Unit 1729 (Primary Examiner) _____ (Date) _____		03 February 2020 O.G. Print Claim(s) 1	O.G. Print Figure 1

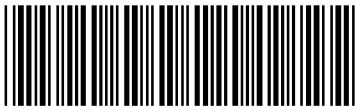
<i>Issue Classification</i> 	Application/Control No. 16/000,597	Applicant(s)/Patent Under Reexamination Lin et al.
	Examiner JACOB B MARKS	Art Unit 1729

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H01M	/	4	/ 02
NON-CLAIMED			
/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
429	122

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	18	
/JACOB B MARKS/ Primary Examiner, Art Unit 1729	03 February 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/000,597	Applicant(s)/Patent Under Reexamination Lin et al.
	Examiner JACOB B MARKS	Art Unit 1729

☒ 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

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 18	
/JACOB B MARKS/ Primary Examiner, Art Unit 1729 (Primary Examiner) _____ (Date) 03 February 2020		O.G. Print Claim(s) 1	O.G. Print Figure 1

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"16000597"	US-PGPUB; USPAT	OR	OFF	2020/02/03 13:50
L2	41	((bilayer (two adj layer) multilayer) with active) same particle adj (size diameter) and h01m\$9 and @Py<"2019"	US-PGPUB; USPAT	OR	ON	2020/02/03 14:01
S1	1	"16000597"	US-PGPUB; USPAT	OR	OFF	2019/10/28 02:05
S2	1528	(bilayer (two adj layer) multilayer (double adj layer\$2)) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese)	US-PGPUB; USPAT	OR	OFF	2019/10/28 02:09
S3	1869	(bilayer (two adj layer) multilayer (double adj layer\$2)) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:10
S4	1103	(bilayer (two adj layer) multilayer) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:10
S5	1001	(bilayer (two adj layer) multilayer (double adj layer\$2)) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese) and particle adj (size diameter)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:11
S6	589	(bilayer (two adj layer) multilayer) with active and h01m\$9 and @Py<"2019" and (cobalt nickel manganese) and particle adj (size diameter)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:11
S7	25	((bilayer (two adj layer) multilayer) with active).ab. and h01m\$9 and @Py<"2019" and (cobalt nickel manganese) and particle adj (size diameter)	US-PGPUB; USPAT	OR	ON	2019/10/28 02:12
S8	0	((bilayer (two adj layer) multilayer) with active).ab. same particle adj (size diameter) and h01m\$9 and @Py<"2019"	US-PGPUB; USPAT	OR	ON	2019/10/28 10:51
S9	41	((bilayer (two adj layer) multilayer) with active) same particle adj (size diameter) and h01m\$9 and @Py<"2019"	US-PGPUB; USPAT	OR	ON	2019/10/28 10:51
S10	370	fibrous adj carbon with graphite and h01m\$9 and @pY<"2019"	US-PGPUB; USPAT	OR	ON	2019/10/28 11:45
S11	329	fibrous adj carbon with graphite and h01m\$9 and @pY<"2018"	US-PGPUB; USPAT	OR	ON	2019/10/28 11:46

2/ 3/ 2020 2:11:18 PM
C:\Users\jmarks\Documents\EAST\Workspaces\16000597.wsp

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/000597
	Filing Date	June 5, 2018
	First Named Inventor	Chaowang Lin
	Art Unit	1729
(Multiple sheets used when necessary)	Examiner	Marks, Jacob B
SHEET 1 OF 1	Attorney Docket No.	DHNG001.004AUS

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number Number - Kind Code (if known) Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2002/028380 A1	03-07-2002	Tanjo et al.	

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
	2	CN 103187576	07-03-2013	He et al.		Abs
	3	CN 201153140	11-19-2008	Li et al.		Abs
	4	CN 105304859 A	02-03-2016	Yongjun et al.		Abs
	5	CN 104347842	08-25-2017	Xia et al.		Abs
	6	CN 102306777	01-04-2012	Zhan et al.		Abs
	7	CN 105070882	11-18-2015	Zetian et al.		Abs
	8	CN 103258999	08-03-2016	Charest et al.		Abs

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.	T ¹
/J.B.M./	9	First Chinese Office Action for Application No. 201810162494.1 dated August 29, 2019	
/J.B.M./	10	Second Chinese Office Action for Application No. 201810162494.1 dated November 21, 2019	

31770927Abs

Examiner Signature /JACOB B MARKS/	Date Considered 02/03/2020
------------------------------------	----------------------------

*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.

~~ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.B.M./~~
T¹ - Place a check mark in this area when an English language Translation is attached.

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)

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.

20995 7590 02/11/2020
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

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.
16/000,597	06/05/2018	Chaowang Lin	DHNG001.004AUS	8334

TITLE OF INVENTION: ELECTRODE AND LITHIUM-ION BATTERY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	05/11/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
MARKS, JACOB B	1729	429-209000

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; Rev 03-09 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 Knobbe, Martens,
2 Olson & Bear, LLP
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)

Ningde Amperex Technology Limited

Ningde, 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. 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. 11-1410

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 /Xiaoyu Wang/

Date 2020-05-11

Typed or printed name Xiaoyu Wang

Registration No. 75640

Please Direct All Correspondence to Customer Number 20995

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor	:	Chaowang Lin
App. No.	:	16/000597
Filed	:	June 5, 2018
For	:	ELECTRODE AND LITHIUM-ION BATTERY
Examiner	:	Marks, Jacob B
Art Unit	:	1729
Conf. No.	:	8334

COMMENTS ON EXAMINER'S STATEMENT OF REASONS FOR ALLOWANCE

Mail Stop ISSUE FEE

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Examiner's Statement of Reasons for Allowance mailed on February 11, 2020, Applicant respectfully submits the following comments.

Applicant acknowledges the Examiner's statement regarding Allowable Subject Matter and agrees that the claimed subject matter is patentable. To the extent that there is any implication that the patentability of the claims rests on the recitation of a single feature, Applicant respectfully disagrees with the Examiner's Statement because it is the combination of features that makes the claims patentable. Accordingly, Applicant submits that the claims of the present application are allowable because each of the claims recites a combination of features that are not taught or suggested by the prior art. Applicant takes no other positions regarding the Allowable Subject Matter presented by the Examiner other than the positions Applicant may have previously taken during prosecution. Therefore, the Examiner's statement regarding Allowable Subject Matter should not be attributed to Applicant as an indication of the basis for Applicant's belief that the claims are patentable. Furthermore, Applicant respectfully asserts that

there may also be additional reasons for patentability of the claimed subject matter not explicitly stated in this record and Applicant does not waive rights to such arguments by not further addressing such reasons herein.

To the extent that there is any implication that the patentability of dependent claims is only attributable to the limitations in the independent claim from which each depends or that the dependent claims have the same scope as the claims from which they depend, Applicant respectfully disagrees and notes that it is each claim, taken as a whole, that is patentable. For dependent claims, their additional limitations may also provide additional reasons for patentability. Accordingly, Applicant submits that each of the allowed claims is allowable because the prior art does not teach or suggest the combination of features

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 application's disclosure. Accordingly, reviewers of this or any child or related prosecution history shall not reasonably infer that the Applicant has made any disclaimers, disavowals, or abandonments of any subject matter supported by the present application, and any prior or alleged disclaimers, disavowals, or abandonments are hereby rescinded.

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 11, 2020

By: /Xiaoyu Wang/

Xiaoyu Wang
Registration No. 75,640
Registered Practitioner
Customer No. 20995
(212) 849-3000

Electronic Patent Application Fee Transmittal

Application Number:	16000597			
Filing Date:	05-Jun-2018			
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY			
First Named Inventor/Applicant Name:	Chaowang Lin			
Filer:	Xiaoyu Wang/Priya Patel			
Attorney Docket Number:	DHNG001.004AUS			
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	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt

EFS ID:	39400575
Application Number:	16000597
International Application Number:	
Confirmation Number:	8334
Title of Invention:	ELECTRODE AND LITHIUM-ION BATTERY
First Named Inventor/Applicant Name:	Chaowang Lin
Customer Number:	20995
Filer:	Xiaoyu Wang/Wendi Manzanares
Filer Authorized By:	Xiaoyu Wang
Attorney Docket Number:	DHNG001.004AUS
Receipt Date:	11-MAY-2020
Filing Date:	05-JUN-2018
Time Stamp:	13:58:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1000
RAM confirmation Number	E20205AD58544216
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	Issue Fee Payment (PTO-85B)	Issue_Fee_DHNG001.pdf	201782	no	1
			e4c33ae4e1b096e8f252f979aa40416586b87ade		
Warnings:					
Information:					
2	Post Allowance Communication - Incoming	Comments.pdf	22106	no	2
			1297c03cc741e7fde113e8a85d96851f4e722bff		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30441	no	2
			44691364b3fc8f3fdc738080e49018117cedecd0		
Warnings:					
Information:					
Total Files Size (in bytes):			254329		
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 NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/000,597	06/23/2020	10693181	DHNG001.004AUS	8334

20995 7590 06/03/2020

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

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 88 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 Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Chaowang Lin, Ningde, CHINA;
Ningde Amperex Technology Limited, Ningde, CHINA;
Fan Yang, Ningde, CHINA;
Yisong Su, Ningde, CHINA;
Huawei Zhong, Ningde, CHINA;
Changming Qu, Ningde, CHINA;
Xiaozhen Zhang, 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.