

**UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

NINGDE AMPEREX TECHNOLOGY
LIMITED

Plaintiff,

v.

ZHUHAI COSMX BATTERY CO., LTD.,
CHONGQING COSMX BATTERY CO.,
LTD., ZHUHAI COSMX POWER JINWAN
SUBSIDIARY CO., LTD., ZHUHAI
COSMX POWER BATTERY CO., LTD.,
ZHUHAI COSMX POWER SUPPLY CO.,
LTD., ZHEJIANG COSMX BATTERY CO.,
LTD., ZHEJIANG COSMX POWER
SUPPLY CO., LTD., CHONGQING
COSMX POWER BATTERY CO., LTD.

Defendants.

Civil Action No.: 2:26-cv-00139

JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

1. Plaintiff Ningde AmpereX Technology Limited (“ATL” or “Plaintiff”), by and through its undersigned counsel, brings this Complaint against Zhuhai CosMX Battery Co., Ltd., Chongqing CosMX Battery Co., Ltd., Zhuhai CosMX Power Jinwan Subsidiary Co., Ltd., Zhuhai CosMX Power Battery Co., Ltd., Zhuhai CosMX Power Supply Co., Ltd., Zhejiang CosMX Battery Co., Ltd., Zhejiang CosMX Power Supply Co., Ltd., Chongqing CosMX Power Battery Co., Ltd. (collectively “CosMX”) and alleges as follows.

ACTION AND PARTIES

2. This is a civil action for infringement of U.S. Patent No. 10,916,769 (the “’769 Patent”), U.S. Patent No. 11,699,808 (the “’808 Patent”), U.S. Patent No. 12,278,330 (the “’330

Patent”), U.S. Patent No. 12,294,082 (the “’082 Patent”), U.S. Patent No. 12,334,494 (the “’494 Patent”), and U.S. Patent No. 12,374,686 (the “’686 Patent”) (collectively, “the Asserted Patents”) arising under the patent laws of the United States, 35 U.S.C. §§ 1 *et seq.*

3. ATL is a Chinese corporation with its principal place of business at No.1 Xingang Road, Zhangwan Town, Jiaocheng District, Ningde City, Fujian Province, People’s Republic of China. ATL is a wholly owned subsidiary of Amperex Technology Limited, which is a wholly owned subsidiary of TDK Corporation, a multinational electronics manufacturer listed on the Tokyo stock exchange in Japan.

4. With origins dating back to 1999, ATL is the world’s leading producer and innovator of lithium-ion batteries. ATL is known worldwide for its high-tech, high-volume prowess in developing and manufacturing high quality rechargeable lithium-ion batteries.

5. ATL is now the world’s leading lithium-ion battery manufacturer for smartphones and one of the major lithium-ion battery manufacturers for all consumer electronics. Over the past three years, ATL has manufactured over 1 billion lithium-ion batteries per year.

6. ATL has leveraged its investments in research and development into technological innovations in all aspects of battery technology, including materials, processes, structures, charging technologies, and system design. These efforts have yielded thousands of patents in the United States and around the world.

7. On information and belief, Zhuhai CosMX Battery Co., Ltd. (珠海冠宇电池股份有限公司) (“Zhuhai CosMX Battery”) is a Chinese corporation with its principal place of business at No. 209, Zhufeng Road, Doumen District, Zhuhai 519180, People’s Republic of China.

8. The below entities are manufacturing subsidiaries of Zhuhai CosMX Battery. *See* Ex. 1 (CosMX 2023 ESG Report, pg. 1).

9. On information and belief, Chongqing CosMX Battery Co., Ltd. (“Chongqing CosMX”) is a Chinese corporation with its principal place of business at Yutianbao Subzone, Pingshan Industrial Park, Wansheng Economic Development Zone, Chongqing, People’s Republic of China.

10. On information and belief, Zhuhai CosMX Power Jinwan Subsidiary Co., Ltd. (“CosMX Jinwan”) is a Chinese corporation with its principal place of business at Workshop No. 1, No. 2, No. 3 (First Floor, Second floor workshop, Third Floor, Fourth Floor, Fifth Floor), No. 4, No. 5 and dormitory 1, No. 3 Qingwan Three Road, Qingwan Industry Park, Sanzao Town, Jinwan District, Zhuhai City, Guangdong Province, People’s Republic of China.

11. On information and belief, Zhuhai CosMX Power Battery Co., Ltd. (“Zhuhai CosMX Power”) is a Chinese corporation with its principal place of business at Plant C Third Floor, No. 209, Zhufeng Road, Jingan Town, Doumen District, Zhuhai City, Guangdong Province, People’s Republic of China.

12. On information and belief, Zhuhai CosMX Power Supply Co., Ltd. (“Zhuhai CosMX Power Supply”) is a Chinese corporation with its principal place of business at Workshop No. 3 (Office one on the Second floor), No. 3 Qingwan Three Road, Qingwan Industry Park, Sanzao Town, Jinwan District, Zhuhai City, Guangdong Province, People’s Republic of China.

13. On information and belief, Zhejiang CosMX Battery Co., Ltd. (“Zhejiang CosMX”), is a Chinese corporation with its principal place of business at No. 8, Henggang Road, Baibu Town, Haiyan County, Jiaxing City, Zhejiang Province, People’s Republic of China.

14. On information and belief, Zhejiang CosMX Power Supply Co., Ltd. (“Zhejiang CosMX Power Supply”), is a Chinese corporation with its principal place of business at No. 99, Jinhang Road, Qinshan Industrial Park, Qinshan Street, Haiyan County, Jiaxing City, Zhejiang Province, People’s Republic of China.

15. On information and belief, Chongqing CosMX Power Battery Co., Ltd. (“Chongqing CosMX Power”), is a Chinese corporation with its principal place of business at No. 21, Pingshan Avenue, Pingshan Industrial Park, Wansheng Economic Development Zone, Chongqing, People’s Republic of China.

JURISDICTION AND VENUE

16. This Court has jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331 and 1338(a).

17. Venue is proper in this District pursuant to 28 U.S.C. § 1391(c)(3) because CosMX is not a resident in the United States and thus may be sued in any judicial district.

18. This Court has personal jurisdiction over CosMX pursuant to the Constitution of the United States of America and/or the Texas Long Arm Statute because CosMX has committed acts of infringement in this District, directly and/or through intermediaries, by, among other things, making, using, offering to sell, selling, and/or importing lithium-ion battery products and/or related services that infringe the Asserted Patents (the “Accused Products”), as alleged herein.

19. Upon information and belief, CosMX also regularly introduces the Accused Products into the stream of commerce through agents, customers, distributors, and intermediaries, knowing and intending that the Accused Products will ultimately be offered for sale and/or sold, or will be incorporated into other products that will ultimately be offered for sale and/or sold, to residents of the United States, including residents of this District, or such products that will be imported into the United States including into this District.

20. CosMX has stated in a complaint filed in the District Court for the Northern District of California that it “is the world leader in the lithium ion battery industry. CosMX is a top supplier of polymer lithium ion batteries and its customers include the world’s top electronics companies. CosMX technology is found in the most well-known electronic products today, including top-selling smartphones, laptops, and tablets.” *See* Complaint, Case No. 3:22-cv-04510 (N.D. Cal.) (August 4, 2022).

21. According to CosMX, it is “one of the worldwide major suppliers of consumer Li-ion batteries.” *See* Exhibit 2.¹ CosMX touts that it “has long served [the] world’s well-known customers in the field of PCs, notebooks, tablets, smart phones, smart wearables, power tools, drones and other fields.” *Id.* CosMX states that its “[b]attery products can be certified in different markets around the world according to customers’ needs,” and lists several marks indicating compliance with U.S. safety requirements, including a US UL mark and CTIA mark. *Id.*

22. For example, according to CosMX, it maintains a “Service Website” and lists San Francisco as a location. Upon information and belief, customers in this District may message the San Francisco service office with their company contact information, product requirements, and project technical specifications. *See* Exhibit 3.²

23. In its 2024 Annual Report, CosMX declared that “the company continued to deepen its cooperation with leading global computer brands such as HP, Lenovo, Dell, Apple, ASUS, Acer, Microsoft, and Amazon, maintaining a stable supply share in the notebook and tablet computer market.” Exhibit 4 at 13 (CosMX 2024 Annual Report, machine translation of Chinese

¹ About US – CosMX, <http://www.cosmx.com/html/en/html/about/about/> (last accessed January 8, 2026).

² Service Website – CosMX, <http://www.cosmx.com/html/en/html/servicessupport/customersupport/network/> (last accessed January 8, 2026).

original). Further, CosMX declared that “the company continued to deepen its cooperation with existing customers such as Apple, Xiaomi, Huawei, Honor, OPPO, Vivo, Lenovo, and ZTE.” *Id.*

24. In June 2022, ATL sued CosMX in this District for infringement of three U.S. patents. *See* No. 2:22-cv-00232-JRG (E.D. Tex.) (the “232 Action”). Then in September 2024, ATL sued CosMX again in this District for infringement of six more U.S. patents. *See* No. 2:24-cv-00728-JRG (E.D. Tex.) (the “728 Action”). CosMX did not file a motion to dismiss for lack of personal jurisdiction in either action. In the 232 Action, CosMX filed a motion to transfer the case to the Northern District of California, and this Court denied CosMX’s motion to transfer. *Id.* at Dkt. 90. In the 232 Action, CosMX also filed counterclaims for a declaratory judgment of non-infringement and invalidity of the patents asserted, thus availing itself of this Court’s jurisdiction. *Id.* at Dkt. 11.

25. Thus, upon information and belief, CosMX has knowingly and intentionally worked with various companies to design and supply lithium-ion batteries, including the Accused Products, specifically for use by each of its consumer electronics customers with the expectation that they would be incorporated into consumer electronics products intended for and sold to residents in the United States, including this District.

26. Upon information and belief, as part of this design and supply process, CosMX meets with, and directly ships sample lithium-ion battery cells, including Accused Products, to certain of its brand customers, such as Dell (Round Rock, Texas) and HP (Spring, Texas), throughout Texas and this District. CosMX seemingly does not dispute that its customers include Dell, HP, and Texas Instruments, each of which is located in Texas. *See* 232 Action, Motion to Transfer, Dkt. 15 at 3. CosMX has stated “CosMX merely places products in the stream of commerce knowing the products will likely reach both Texas and California by selling battery

cells to packing companies who ship the assembled batteries to manufacturers of brand companies.” *See* 232 Action, Reply in support of Motion to Transfer, Dkt. 32 at 1.

27. Upon further information and belief, CosMX also regularly sends battery cells to Texas Instruments in Dallas, Texas, for chemical and safety analysis and/or compatibility testing of certain Accused Products. *See* 232 Action, Reply in support of Motion to Transfer, Dkt. 32 at 2 (CosMX stating “[w]ith regard to TI, CosMX provides samples to TI at the request of CosMX’s customers, not by its own initiative.”). Upon information and belief, but for these qualification activities that take place in the United States, CosMX lithium-ion batteries could not be included in any of its domestic consumer electronics customers’ (such as Dell and HP) products sold anywhere in the world.

28. Upon information and belief, CosMX purposefully directed its activities at residents in this District by, for example, entering into agreements with Lenovo Inc. (“Lenovo”), to include CosMX lithium-ion batteries within Lenovo’s products. *See* Exhibit 5, (CosMX listed as Lenovo supplier for “Power”).³ Upon information and belief, CosMX entered into these agreements with the knowledge that such products would be imported into and sold in the United States, including in this District.

29. For example, one of the Accused Products, identified as CosMX Cell No. CA476588P-Q1, was found in Battery Part No. BN5P which was shipped to the United States in a Redmi Note 13. Other Accused Products identified as CosMX Cell No. CA-3072C5P-Q2 was found in a Gigabyte AERO X16 (EG61H) laptop which was shipped to the United States. Upon information and belief, additional laptop and phone batteries containing other Accused Products

³ https://www.lenovo.com/content/dam/lenovo/site-design/esg-document-library/global/corp-policies/gsc/List_of_Lenovo_Mfg_Sites_and_Suppliers.pdf (Lenovo Manufacturing Sites and Suppliers, April 2025 (last accessed January 8, 2026)).

are sold and distributed in this District. Upon information and belief, CosMX intentionally entered into agreements with brand customers with the knowledge that the Accused Products, including for example CosMX Cell Nos. CA3072C5P-Q2, CA476588P-Q1, and CA285388L-Q3-X2 would be sold to residents throughout the United States and including in this District through retailers such as Amazon.com and eBay. *See, e.g.*, Exhibit 6 (showing electronics purchasable in the United States containing the Accused Products).

30. The identification of exemplary CosMX Cell Nos. CA3072C5P-Q2, CA476588P-Q1, and CA285388L-Q3-X2 are intended for illustration purposes and is not intended to limit the scope of ATL's infringement allegations. Upon information and belief, similar battery cells may be in laptop and cell phone devices distributed in the United States by other OEMs. Upon information and belief, similar battery cells incorporate ATL's patented technology. Upon additional information and belief, other CosMX battery cell model types may be found in other computing devices and may have different form factors, such as a lithium-ion secondary battery used in a smartphone, tablet, or other portable computing device. Upon information and belief, other CosMX battery cell model types found in other computing devices incorporate ATL's patented technology. ATL anticipates that discovery in this action will be necessary to identify all Accused Products distributed in and to the United States and any remedy afforded should extend to all past, present, and future infringing products of CosMX regardless of model number or form factor. On information and belief, CosMX Cell Nos. CA3072C5P-Q2, CA476588P-Q1, and CA285388L-Q3-X2 are representative of additional CosMX battery models incorporated into computing devices, smartphones, tablets, and portable computing devices sold, offered for sale, and/or marketed within the United States.

31. Alternatively, as a foreign corporation, personal jurisdiction exists over CosMX at least by virtue of Federal Rule of Civil Procedure 4(k)(2) when taking into consideration all of CosMX's relevant contacts with the United States as a whole.

ASSERTED PATENTS

32. On February 9, 2021, the United States Patent Office issued U.S. Patent No. 10,916,769, titled "Cathode, electrochemical device and electronic device comprising same." The '769 Patent identifies Xinru Su, Baozhang Li, Yisong Su, and Zhiwen Xiao as the inventors. A true and correct copy of the '769 Patent is attached hereto as Exhibit 7.

33. The '769 Patent is directed to a cathode, an electrochemical device, and an electronic device that includes the cathode. '769 Patent, 1:44-57. The cathode comprises a cathode current collector, a first cathode active material layer, a second cathode active material layer, and an insulating layer. The first cathode active material layer covers a portion of the cathode current collector, while the insulating layer covers a different portion, with a gap between them to prevent overlap. One advantage of this design is that it alleviates potential issues of overlapping between the active material layer and the insulating layer, which can lead to safety failures such as fires when the device is punctured. *Id.* at 5:12-24. The '769 Patent improves the safety performance of electrochemical devices, such as lithium-ion batteries, by preventing internal short circuits when the device is pierced by an external force. The gap between the active material layer and the insulating layer enhances the mechanical safety of the device, reducing the risk that it catches fire or fails under puncture conditions. Additionally, the design maintains the energy density of the lithium-ion batteries, addressing the challenge of improving safety without compromising performance. The cathode's structure also enhances the reliability of the preparation process and reduces the likelihood of material rupture during manufacturing.

34. On July 11, 2023, the United States Patent Office issued U.S. Patent No. 11,699,808, titled “Battery.” The ’808 Patent identifies Bolin Zhou as the inventor. A true and correct copy of the ’808 Patent is attached hereto as Exhibit 8.

35. The ’808 Patent is directed to a battery that includes a battery body and a flange portion. ’808 Patent, 1:29-36. The battery body features a first side face that protrudes from its surface, while the flange portion is arranged outside the battery body and includes a protrusion segment connected to the battery body, which protrudes away from it. The design of the battery in the ’808 Patent addresses issues related to sealing reliability and space occupation by the battery. The protrusion segment and the side face of the battery body are both designed as protrusion structures, which help maintain a sufficient gap for adhesive application, thereby enhancing the adhesive force and ensuring tightness. *Id.* at 4:6-18. This design reduces the risk of the flange portion opening during transportation, use, or storage. The battery’s structure, which includes a protrusion segment and an ending segment, allows for better control of adhesive application, resulting in improved peel strength and reduced width difference after storage compared to previous designs.

36. On April 15, 2025, the United States Patent Office issued U.S. Patent No. 12,278,330, titled “Lithium-ion battery having desirable safety performance.” The ’330 Patent identifies Tao Tao and Ming Liang Mo as the inventors. A true and correct copy of the ’330 Patent is attached hereto as Exhibit 9.

37. The ’330 Patent is directed to a lithium-ion battery comprising a positive and a negative electrode, where for each electrode, its lead (or tab) is welded to a current collector recess formed from the active material of the electrode, and the electrodes have insulating glue layers (or adhesive tape) at certain places to prevent the exposed recess from coming into contact with the

active material. '330 Patent, 4:47-54. In prior lithium-ion batteries, the recess is defined at one end of the positive plate or the negative plate along a length direction thereof, which causes thickness variation around the recess to be much larger than the thickness variation of the film afar from the recess. This arrangement is prone to peeling off around the corners, especially when the negative active material adopts an expansive substance, such as silicon. This leads to a high internal resistance of the lithium-ion battery and affects the capacity of the lithium-ion battery. In addition, since there is no insulating layer provided on the positive area corresponding to the positive recess or the negative recess, internal short circuit and lithium precipitation may potentially occur in the lithium-ion battery, which will inevitably affect the safety performance of the battery. To address problems with prior batteries, the '330 Patent provides that the tabs are welded in recesses which increases the space for the active material layer and allows for the tab to be welded near the middle of the electrode, thereby increasing energy density and reducing resistance. *Id.* at 3:30-37. The '330 Patent further provides for insulating glue layers (or adhesive tape) on the portion of the other electrode opposite of the tab, thereby reducing thickness and increasing safety.

38. On May 6, 2024, the United States Patent Office issued U.S. Patent No. 12,294,082, titled "Negative electrode and electrochemical apparatus containing same, and electronic apparatus." The '082 Patent identifies Ting Yi, Hang Cui, and Yuansen Xie as the inventors. A true and correct copy of the '082 Patent is attached hereto as Exhibit 10.

39. The '082 Patent is directed to a negative electrode for use in electrochemical apparatuses, such as lithium-ion batteries. '082 Patent, 1:49-63. The negative electrode comprises a negative current collector, a first negative active material layer, and a second negative active material layer. The first negative active material layer is arranged on one side of a first portion of the negative current collector, while the second negative active material layers are arranged on two

sides of a second portion, different from the first portion of the negative current collector. The '082 Patent addresses issues related to the cycle performance of lithium-ion batteries by reducing polarization and lithium plating, which are common problems in traditional designs. *Id.* at 4:1-6. By optimizing the structure of the negative electrode, the '082 Patent improves the safety and cycle performance of the battery. The design allows for more uniform current density distribution, which helps in reducing lithium plating and improving the cycle performance of the electrochemical apparatus. The '082 Patent also provides a method to maintain high-capacity retention rates throughout the battery's cycle life.

40. On June 17, 2025, the United States Patent Office issued U.S. Patent No. 12,334,494, titled "Electrolyte and electrochemical device." The '494 Patent identifies Lilan Zhang, Chao Tang, and Jianming Zheng as the inventors. A true and correct copy of the '494 Patent is attached hereto as Exhibit 11.

41. The '494 Patent is directed to an electrochemical device that includes a positive electrode, a negative electrode, a separator, and an electrolyte. The electrolyte contains a nitrile compound, which is present in a mass percentage ranging from 0.1% to 10%. '494 Patent at 1:43-52. The negative electrode features a current collector with two regions: a first region with a negative electrode active substance layer and a second region without it. The invention improves the cycle stability of electrochemical devices, particularly under high-voltage conditions, while addressing self-discharging issues. *Id.* at 19:45-50. The inclusion of nitrile compounds in the electrolyte enhances the stability of the positive electrode, thereby improving the cycle performance of the device. However, the nitrile compounds can cause copper dissolution from the negative electrode's current collector, potentially leading to self-discharging and safety issues. The design of the negative electrode, with its specific configuration of regions and the controlled use

of nitrile compounds, mitigates these issues by maintaining that AxB is kept below a certain threshold, thus balancing performance improvements with safety and stability.

42. On July 29, 2025, the United States Patent Office issued U.S. Patent No. 12,374,686, titled “Electrochemical apparatus and electronic apparatus containing the electrochemical apparatus.” The ’686 Patent identifies Xiaojing Liu as the inventor. A true and correct copy of the ’686 Patent is attached hereto as Exhibit 12.

43. The ’686 Patent is directed to an electrochemical apparatus that includes a positive electrode, a separator, and a negative electrode. The negative electrode comprises a negative current collector, a negative active material layer, and a negative tab. ’686 Patent, 1:50-60. The negative active material layer contains a silicon-based material, and the negative tab is positioned on a side edge of the long axis of the negative current collector. The electrochemical apparatus described in the ’686 Patent offers several benefits. For example, it effectively reduces the impedance of the negative electrode and controls the temperature rise of a battery cell, thereby reducing the cycling expansion rate and improving the cycle performance of the electrochemical apparatus. *Id.* at 2:5-10. The design also improves the current density of each part in the negative electrode, reducing the thermal power generated by the internal resistance during the charging and discharging cycle, which enhances both the cycle performance and safety performance of the apparatus. Additionally, the apparatus can lower the raising temperature caused by the charging and discharging cycle process, which helps in reducing the internal impedance and polarization of the battery cell. The structural stability of the battery cell is improved, enhancing the safety and cycle performance of the electrochemical apparatus.

COUNT I - INFRINGEMENT OF U.S. PATENT NO. 10,916,769

44. ATL re-alleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

45. ATL is the assignee of the '769 Patent. ATL has all rights, title, and interest in the '769 Patent including the right to enforce the '769 Patent, the right to exclude others, and to sue and recover damages for past and future infringement.

46. The '769 Patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code.

47. In violation of 35 U.S.C. § 271(a), CosMX has infringed and continues to infringe at least claim 1 of the '769 Patent by, without authority, making, using, selling, offering for sale, and/or importing into the United States, including in Texas and this judicial district, the Accused Products.

48. Upon information and belief, CosMX and/or its agents manufacture the Accused Products outside of the United States and delivers the Accused Products to its customers, distributors, and/or subsidiaries in the United States. Upon information and belief, to the extent that CosMX delivers the Accused Products outside of the United States, CosMX does so with the intent and knowledge that the Accused Products are destined for the United States or are designed for products to be sold in the United States. CosMX has infringed the '769 Patent literally and/or under the doctrine of equivalents.

49. CosMX has known of the '769 Patent since the filing of the Complaint in this matter.

50. Upon information and belief, under 35 U.S.C. § 271(b), CosMX induces customers, distributors, and/or importers to use, import, purchase or sell the Accused Products that infringe at least claim 1 of the '769 Patent. Upon information and belief, CosMX with specific intent actively

aids and abets the infringement of the '769 Patent by customers, distributors, and/or importers by, inter alia, entering into supplier agreements to include the Accused Products in CosMX's customers' products to be sold in the United States, promoting CosMX's customers' products sold in the United States, advertising these agreements to promote CosMX's stock offering, creating established distribution channels for the Accused Products into the United States, manufacturing the Accused Products to conform with U.S. laws and regulations (*e.g.*, Underwriter Laboratories' standards), and/or establishing offices within the United States to provide technical and sales support.

51. Upon information and belief, CosMX has knowledge that it is directly and/or indirectly infringing at least claim 1 of the '769 Patent and has not ceased its infringing conduct. CosMX's infringing conduct has and continues to be willful and deliberate misconduct beyond typical infringement such that ATL is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the compensatory amount awarded.

52. A representative claim chart showing CosMX's infringement of the '769 Patent is attached hereto as Exhibit 13.

53. CosMX is not licensed or otherwise authorized to practice the claims of the '769 Patent.

54. By reason of CosMX's infringement, ATL has suffered and continues to suffer substantial damages.

55. ATL is entitled to recover the damages sustained as a result of CosMX's wrongful acts in an amount subject to proof at trial.

56. CosMX's infringement of the '769 Patent is exceptional and entitles ATL to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT II - INFRINGEMENT OF U.S. PATENT NO. 11,699,808

57. ATL re-alleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

58. ATL is the assignee of the '808 Patent. ATL has all rights, title, and interest in the '808 Patent including the right to enforce the '808 Patent, the right to exclude others, and to sue and recover damages for past and future infringement.

59. The '808 Patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code.

60. In violation of 35 U.S.C. § 271(a), CosMX has infringed and continues to infringe at least claim 1 of the '808 Patent by, without authority, making, using, selling, offering for sale, and/or importing into the United States, including in Texas and this judicial district, the Accused Products.

61. Upon information and belief, CosMX and/or its agents manufacture the Accused Products outside of the United States and delivers the Accused Products to its customers, distributors, and/or subsidiaries in the United States. Upon information and belief, to the extent that CosMX delivers the Accused Products outside of the United States, CosMX does so with the intent and knowledge that the Accused Products are destined for the United States or are designed for products to be sold in the United States. CosMX has infringed the '808 Patent literally and/or under the doctrine of equivalents.

62. CosMX has known of the '808 Patent at least since the filing of the Complaint in this matter.

63. Upon information and belief, under 35 U.S.C. § 271(b), CosMX induces customers, distributors, and/or importers to use, import, purchase or sell the Accused Products that infringe at

least claim 1 of the '808 Patent. Upon information and belief, CosMX with specific intent actively aids and abets the infringement of the '808 Patent by customers, distributors, and/or importers by, inter alia, entering into supplier agreements to include the Accused Products in CosMX's customers' products to be sold in the United States, promoting CosMX's customers' products sold in the United States, advertising these agreements to promote CosMX's stock offering, creating established distribution channels for the Accused Products into the United States, manufacturing the Accused Products to conform with U.S. laws and regulations (*e.g.*, Underwriter Laboratories' standards), and/or establishing offices within the United States to provide technical and sales support for the Accused Products.

64. Upon information and belief, CosMX has knowledge that it is directly and/or indirectly infringing at least claim 1 of the '808 Patent and has not ceased its infringing conduct. CosMX's infringing conduct has and continues to be willful and deliberate misconduct beyond typical infringement such that ATL is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the compensatory amount awarded.

65. A representative claim chart showing CosMX's infringement of the '808 Patent is attached hereto as Exhibit 14.

66. CosMX is not licensed or otherwise authorized to practice the claims of the '808 Patent.

67. By reason of CosMX's infringement, ATL has suffered and continues to suffer substantial damages.

68. ATL is entitled to recover the damages sustained as a result of CosMX's wrongful acts in an amount subject to proof at trial.

69. CosMX's infringement of the '808 Patent is exceptional and entitles ATL to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT III - INFRINGEMENT OF U.S. PATENT NO. 12,278,330

70. ATL re-alleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

71. ATL is the assignee of the '330 Patent. ATL has all rights, title, and interest in the '330 Patent including the right to enforce the '330 Patent, the right to exclude others, and to sue and recover damages for past and future infringement.

72. The '330 Patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code.

73. In violation of 35 U.S.C. § 271(a), CosMX has infringed and continues to infringe at least claim 11 of the '330 Patent by, without authority, making, using, selling, offering for sale, and/or importing into the United States, including in Texas and this judicial district, the Accused Products.

74. Upon information and belief, CosMX and/or its agents manufacture the Accused Products outside of the United States and delivers the Accused Products to its customers, distributors, and/or subsidiaries in the United States. Upon information and belief, to the extent that CosMX delivers the Accused Products outside of the United States, CosMX does so with the intent and knowledge that the Accused Products are destined for the United States or are designed for products to be sold in the United States. CosMX has infringed the '330 Patent literally and/or under the doctrine of equivalents.

75. CosMX has known of the '330 Patent at least since the filing of the Complaint in this matter.

76. Upon information and belief, under 35 U.S.C. § 271(b), CosMX induces customers, distributors, and/or importers to use, import, purchase or sell the Accused Products that infringe at least claim 11 of the '330 Patent. Upon information and belief, CosMX with specific intent actively aids and abets the infringement of the '330 Patent by customers, distributors, and/or importers by, inter alia, entering into supplier agreements to include the Accused Products in CosMX's customers' products to be sold in the United States, promoting CosMX's customers' products sold in the United States, advertising these agreements to promote CosMX's stock offering, creating established distribution channels for the Accused Products into the United States, manufacturing the Accused Products to conform with U.S. laws and regulations (*e.g.*, Underwriter Laboratories' standards), and/or establishing offices within the United States to provide technical and sales support for the Accused Products.

77. Upon information and belief, CosMX has knowledge that it is directly and/or indirectly infringing at least claim 11 of the '330 Patent and has not ceased its infringing conduct. CosMX's infringing conduct has and continues to be willful and deliberate misconduct beyond typical infringement such that ATL is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the compensatory amount awarded.

78. A representative claim chart showing CosMX's infringement of the '330 Patent is attached hereto as Exhibit 15.

79. CosMX is not licensed or otherwise authorized to practice the claims of the '330 Patent.

80. By reason of CosMX's infringement, ATL has suffered and continues to suffer substantial damages.

81. ATL is entitled to recover the damages sustained as a result of CosMX's wrongful acts in an amount subject to proof at trial.

82. CosMX's infringement of the '330 Patent is exceptional and entitles ATL to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT IV - INFRINGEMENT OF U.S. PATENT NO. 12,294,082

83. ATL re-alleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

84. ATL is the assignee of the '082 Patent. ATL has all rights, title, and interest in the '082 Patent including the right to enforce the '082 Patent, the right to exclude others, and to sue and recover damages for past and future infringement.

85. The '082 Patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code.

86. In violation of 35 U.S.C. § 271(a), CosMX has infringed and continues to infringe at least claim 10 of the '082 Patent by, without authority, making, using, selling, offering for sale, and/or importing into the United States, including in Texas and this judicial district, the Accused Products.

87. Upon information and belief, CosMX and/or its agents manufacture the Accused Products outside of the United States and delivers the Accused Products to its customers, distributors, and/or subsidiaries in the United States. Upon information and belief, to the extent that CosMX delivers the Accused Products outside of the United States, CosMX does so with the intent and knowledge that the Accused Products are destined for the United States or are designed for products to be sold in the United States. CosMX has infringed the '082 Patent literally and/or under the doctrine of equivalents.

88. CosMX has known of the '082 Patent at least since the filing of the Complaint in this matter.

89. Upon information and belief, under 35 U.S.C. § 271(b), CosMX induces customers, distributors, and/or importers to use, import, purchase or sell the Accused Products that infringe at least claim 10 of the '082 Patent. Upon information and belief, CosMX with specific intent actively aids and abets the infringement of the '082 Patent by customers, distributors, and/or importers by, inter alia, entering into supplier agreements to include the Accused Products in CosMX's customers' products to be sold in the United States, promoting CosMX's customers' products sold in the United States, advertising these agreements to promote CosMX's stock offering, creating established distribution channels for the Accused Products into the United States, manufacturing the Accused Products to conform with U.S. laws and regulations (*e.g.*, Underwriter Laboratories' standards), and/or establishing offices within the United States to provide technical and sales support for the Accused Products.

90. Upon information and belief, CosMX has knowledge that it is directly and/or indirectly infringing at least claim 10 of the '082 Patent and has not ceased its infringing conduct. CosMX's infringing conduct has and continues to be willful and deliberate misconduct beyond typical infringement such that ATL is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the compensatory amount awarded.

91. A representative claim chart showing CosMX's infringement of the '082 Patent is attached hereto as Exhibit 16.

92. CosMX is not licensed or otherwise authorized to practice the claims of the '082 Patent.

93. By reason of CosMX's infringement, ATL has suffered and continues to suffer substantial damages.

94. ATL is entitled to recover the damages sustained as a result of CosMX's wrongful acts in an amount subject to proof at trial.

95. CosMX's infringement of the '082 Patent is exceptional and entitles ATL to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT V - INFRINGEMENT OF U.S. PATENT NO. 12,334,494

96. ATL re-alleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

97. ATL is the assignee of the '494 Patent. ATL has all rights, title, and interest in the '494 Patent including the right to enforce the '494 Patent, the right to exclude others, and to sue and recover damages for past and future infringement.

98. The '494 Patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code.

99. In violation of 35 U.S.C. § 271(a), CosMX has infringed and continues to infringe at least claim 14 of the '494 Patent by, without authority, making, using, selling, offering for sale, and/or importing into the United States, including in Texas and this judicial district, the Accused Products.

100. Upon information and belief, CosMX and/or its agents manufacture the Accused Products outside of the United States and delivers the Accused Products to its customers, distributors, and/or subsidiaries in the United States. Upon information and belief, to the extent that CosMX delivers the Accused Products outside of the United States, CosMX does so with the intent and knowledge that the Accused Products are destined for the United States or are designed

for products to be sold in the United States. CosMX has infringed the '494 Patent literally and/or under the doctrine of equivalents.

101. CosMX has known of the '494 Patent at least since the filing of the Complaint in this matter.

102. Upon information and belief, under 35 U.S.C. § 271(b), CosMX induces customers, distributors, and/or importers to use, import, purchase or sell the Accused Products that infringe at least claim 14 of the '494 Patent. Upon information and belief, CosMX with specific intent actively aids and abets the infringement of the '494 Patent by customers, distributors, and/or importers by, inter alia, entering into supplier agreements to include the Accused Products in CosMX's customers' products to be sold in the United States, promoting CosMX's customers' products sold in the United States, advertising these agreements to promote CosMX's stock offering, creating established distribution channels for the Accused Products into the United States, manufacturing the Accused Products to conform with U.S. laws and regulations (*e.g.*, Underwriter Laboratories' standards), and/or establishing offices within the United States to provide technical and sales support for the Accused Products.

103. Upon information and belief, CosMX has knowledge that it is directly and/or indirectly infringing at least claim 14 of the '494 Patent and has not ceased its infringing conduct. CosMX's infringing conduct has and continues to be willful and deliberate misconduct beyond typical infringement such that ATL is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the compensatory amount awarded.

104. A representative claim chart showing CosMX's infringement of the '494 Patent is attached hereto as Exhibit 17.

105. CosMX is not licensed or otherwise authorized to practice the claims of the '494 Patent.

106. By reason of CosMX's infringement, ATL has suffered and continues to suffer substantial damages.

107. ATL is entitled to recover the damages sustained as a result of CosMX's wrongful acts in an amount subject to proof at trial.

108. CosMX's infringement of the '494 Patent is exceptional and entitles ATL to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT VI - INFRINGEMENT OF U.S. PATENT NO. 12,374,686

109. ATL re-alleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

110. ATL is the assignee of the '686 Patent. ATL has all rights, title, and interest in the '686 Patent including the right to enforce the '686 Patent, the right to exclude others, and to sue and recover damages for past and future infringement.

111. The '686 Patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code.

112. In violation of 35 U.S.C. § 271(a), CosMX has infringed and continues to infringe at least claim 1 of the '686 Patent by, without authority, making, using, selling, offering for sale, and/or importing into the United States, including in Texas and this judicial district, the Accused Products.

113. Upon information and belief, CosMX and/or its agents manufacture the Accused Products outside of the United States and delivers the Accused Products to its customers, distributors, and/or subsidiaries in the United States. Upon information and belief, to the extent

that CosMX delivers the Accused Products outside of the United States, CosMX does so with the intent and knowledge that the Accused Products are destined for the United States or are designed for products to be sold in the United States. CosMX has infringed literally and/or under the doctrine of equivalents.

114. CosMX has known of the '686 Patent at least since the filing of the Complaint in this matter.

115. Upon information and belief, under 35 U.S.C. § 271(b), CosMX induces customers, distributors, and/or importers to use, import, purchase or sell the Accused Products that infringe at least claim 1 of the '686 Patent. Upon information and belief, CosMX with specific intent actively aids and abets the infringement of the '686 Patent by customers, distributors, and/or importers by, inter alia, entering into supplier agreements to include the Accused Products in CosMX's customers' products to be sold in the United States, promoting CosMX's customers' products sold in the United States, advertising these agreements to promote CosMX's stock offering, creating established distribution channels for the Accused Products into the United States, manufacturing the Accused Products to conform with U.S. laws and regulations (*e.g.*, Underwriter Laboratories' standards), and/or establishing offices within the United States to provide technical and sales support for the Accused Products.

116. Upon information and belief, CosMX has knowledge that it is directly and/or indirectly infringing at least claim 1 of the '686 Patent and has not ceased its infringing conduct. CosMX's infringing conduct has and continues to be willful and deliberate misconduct beyond typical infringement such that ATL is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the compensatory amount awarded.

117. A representative claim chart showing CosMX's infringement of the '686 Patent is attached hereto as Exhibit 18.

118. CosMX is not licensed or otherwise authorized to practice the claims of the '686 Patent.

119. By reason of CosMX's infringement, ATL has suffered and continues to suffer substantial damages.

120. ATL is entitled to recover the damages sustained as a result of CosMX's wrongful acts in an amount subject to proof at trial.

121. CosMX's infringement of the '686 Patent is exceptional and entitles ATL to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

DEMAND FOR JURY TRIAL

Plaintiff, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by jury of any issues so triable.

PRAYER FOR RELIEF

A. A judgment that CosMX has directly and/or indirectly infringed the Asserted Patents;

B. A judgment that CosMX has willfully infringed the Asserted Patents;

C. A permanent injunction enjoining CosMX, together with its employees, agents, officers, directors, attorneys, successors, affiliates, subsidiaries, and assigns, and those persons in active concert or participation with them, from directly and/or indirectly infringing the Asserted Patents;

D. An award of damages adequate to compensate ATL for CosMX's infringement of the Asserted Patents pursuant to 35 U.S.C. § 284;

E. An accounting and/or an ongoing royalty as necessary to determine the amount of and award ATL any post-verdict royalties and/or lost profits;

F. An increase in the damages award up to three times the actual amount assessed, pursuant to 35 U.S.C. § 284;

G. That CosMX be ordered to pay to ATL pre-judgment and post-judgment interest;

H. A determination that this action is exceptional pursuant to 35 U.S.C. § 285, and an award to ATL of its attorneys' fees, costs, and expenses incurred in connection with this action; and

I. Such other relief as the Court deems just and equitable.

Respectfully submitted,

Dated: February 18, 2026

/s/ Sid V. Pandit

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TECHNOLOGY LIMITED***

Exhibit 9

(12) **United States Patent**
Tao et al.

(10) **Patent No.:** **US 12,278,330 B2**
(45) **Date of Patent:** **Apr. 15, 2025**

(54) **LITHIUM-ION BATTERY HAVING
DESIRABLE SAFETY PERFORMANCE**

(71) Applicant: **NINGDE AMPEREX
TECHNOLOGY LIMITED**, Ningde
(CN)

(72) Inventors: **Tao Tao**, Ningde (CN); **Ming Liang
Mo**, Ningde (CN)

(73) Assignee: **NINGDE AMPEREX
TECHNOLOGY LIMITED**, Fujian
(CN)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/532,841**

(22) Filed: **Dec. 7, 2023**

(65) **Prior Publication Data**

US 2024/0113324 A1 Apr. 4, 2024

Related U.S. Application Data

(63) Continuation of application No. 17/746,755, filed on
May 17, 2022, now Pat. No. 11,923,498, which is a
(Continued)

(30) **Foreign Application Priority Data**

Jan. 17, 2014 (CN) 201420030319.4

(51) **Int. Cl.**
H01M 10/0525 (2010.01)
H01M 4/13 (2010.01)
(Continued)

(52) **U.S. Cl.**
CPC **H01M 10/0525** (2013.01); **H01M 4/13**
(2013.01); **H01M 4/139** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H01M 50/538; H01M 50/536; H01M
50/593; H01M 50/595; H01M 50/59
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,154,993 A 10/1992 Beatty
8,309,880 B2 11/2012 Chung
(Continued)

FOREIGN PATENT DOCUMENTS

CN 102187497 A 9/2011
CN 102694148 A 9/2012
(Continued)

OTHER PUBLICATIONS

JP2014225326 English Translation. Sugita et al. Japan. Dec. 4,
2014. (Year: 2014).*

(Continued)

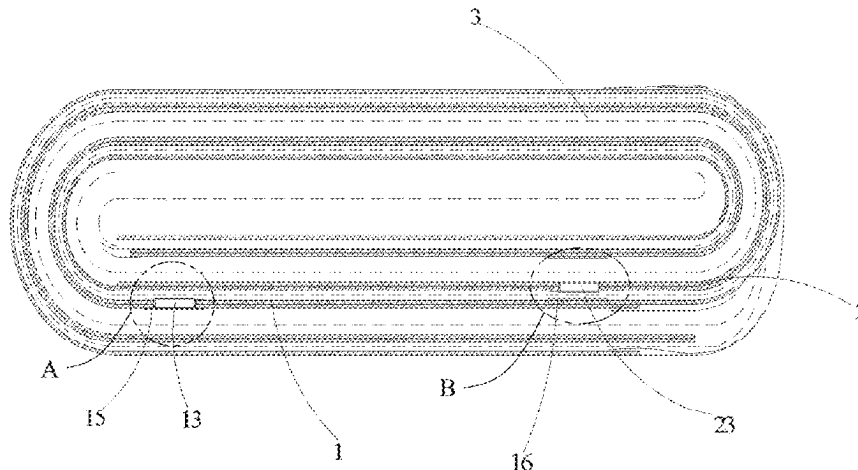
Primary Examiner — Christopher P Domone

(74) *Attorney, Agent, or Firm* — Morgan, Lewis &
Bockius LLP

(57) **ABSTRACT**

A lithium-ion battery including a positive electrode, a negative electrode, a separator disposed between the positive electrode and the negative electrode, and an electrolyte. The positive electrode includes a positive current collector and a positive electrode active material layer containing lithium cobalt oxide formed on the positive current collector. The positive electrode active material layer is provided with a first recess accommodating a positive lead coupled with the positive current collector and disposed on a surface of the positive current collector facing a center of the battery. The negative electrode includes a negative current collector and a negative electrode active material layer containing graphite or silicon formed on the negative current collector. The negative electrode active material layer is provided with a second recess accommodating a negative lead coupled with

(Continued)



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the negative current collector and disposed on a surface of the negative current collector facing away from the center of the battery.

20 Claims, 4 Drawing Sheets**Related U.S. Application Data**

continuation of application No. 17/407,081, filed on Aug. 19, 2021, which is a continuation of application No. 16/113,938, filed on Aug. 27, 2018, now abandoned, which is a continuation of application No. 14/596,873, filed on Jan. 14, 2015, now Pat. No. 10,541,441.

- (51) **Int. Cl.**
H01M 4/139 (2010.01)
H01M 10/058 (2010.01)
H01M 50/536 (2021.01)
H01M 50/538 (2021.01)
- (52) **U.S. Cl.**
 CPC **H01M 10/058** (2013.01); **H01M 50/536** (2021.01); **H01M 50/538** (2021.01)

(56) References Cited**U.S. PATENT DOCUMENTS**

2006/0051662 A1* 3/2006 Kwak H01M 10/0431
 429/130
 2012/0052331 A1* 3/2012 Park H01M 50/528
 429/7
 2015/0171396 A1* 6/2015 Okuno B60L 58/26
 701/22

FOREIGN PATENT DOCUMENTS

CN 202423456 U 9/2012
 CN 202585621 U 12/2012
 CN 203733894 U 7/2014
 CN 104157914 A 11/2014
 CN 108352492 B 8/2021
 JP H065275 A 1/1994
 JP H0620707 A 1/1994
 JP 4380201 B2 12/2009
 JP 2014225326 * 12/2014
 WO WO2016/197382 A1 12/2016
 WO WO2017035749 A1 3/2017

OTHER PUBLICATIONS

Official filing receipt of Invalidation Request, ZL201580082766.1, Jan. 24, 2024, 10 pgs.
 Notification of forwarding documents Invalidity Request, ZL201580082766.1, Mar. 12, 2024, 77 pgs.
 Evidence document 2, Zhang Fei, Research on UV laser micromachining technology and mechanism of electronic materials, Huazhong University of Science & Technology, May 2012, 129 pgs.
 Evidence document 3, Yang Shichun, et al., Surface quality and finishing technology, 15 pgs.
 Evidence document 4, Guan Yuming, et al., Machinery Design & Manufacture, School of Mechanical and Power Engineering, East China University of Science and Technology, Shanghai, Jan. 2009, 4 pgs.
 Evidence document 13, Qi Yie, Study on Improving Non-fluid Lubrication Performance by Surface Texturing, Mar. 2014, 83 pgs.
 Evidence document 14, XiangXin et al., Influence of Dimple Texture on Tribological Behavior of Line Contact Friction Pairs, China Surface Engineering, China Surface Engineering, vol. 28, No. 4, Aug. 2015, 11 pgs.
 Evidence document 17, The prosecution history of the counterpart Chinese application 201580082766.1, provided by CNIPA, 176 pgs.
 Scientific Background on the Nobel Prize in Chemistry 2019, Lithium-Ion Batteries, The Royal Swedish Academy of Sciences, Oct. 9, 2019, 14 pgs.

* cited by examiner

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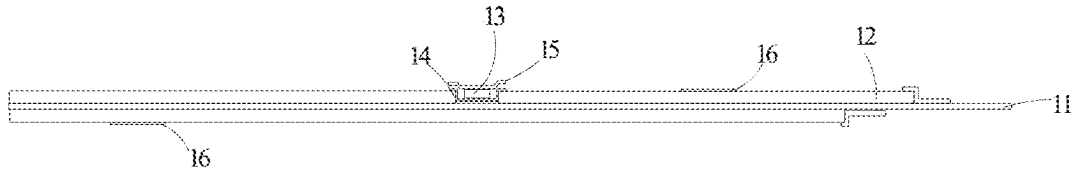


FIG. 1

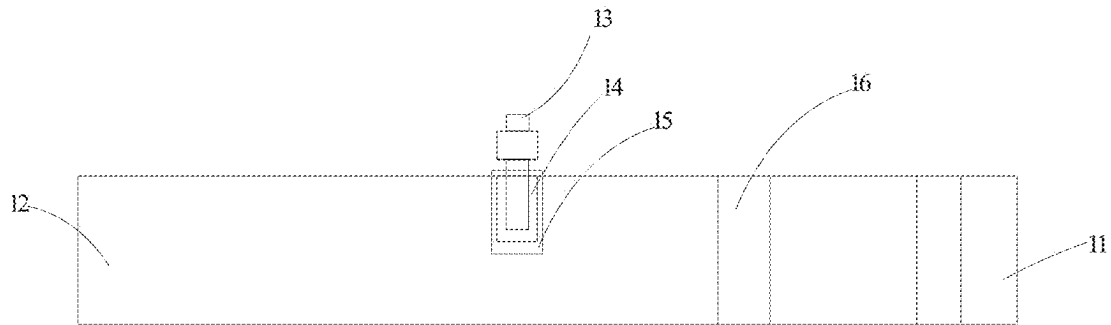


FIG. 2

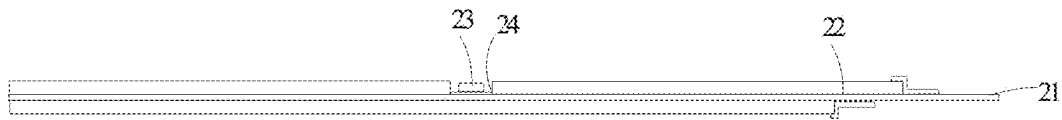


FIG. 3

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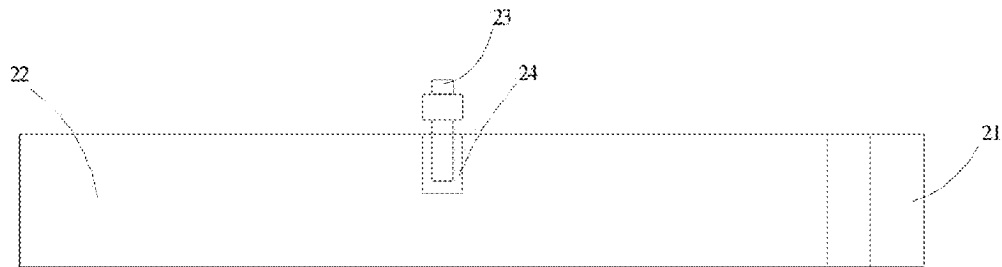


FIG. 4

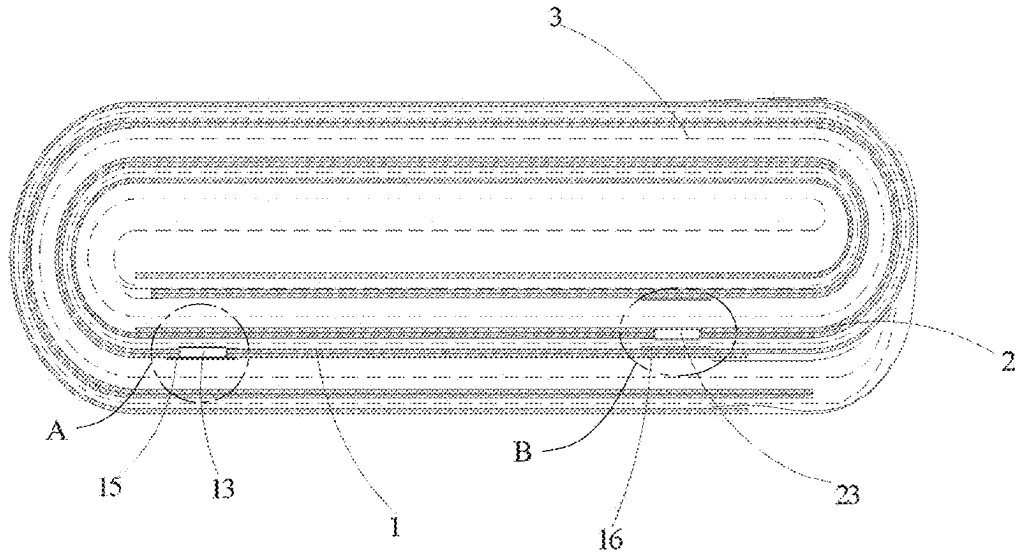


FIG. 5A

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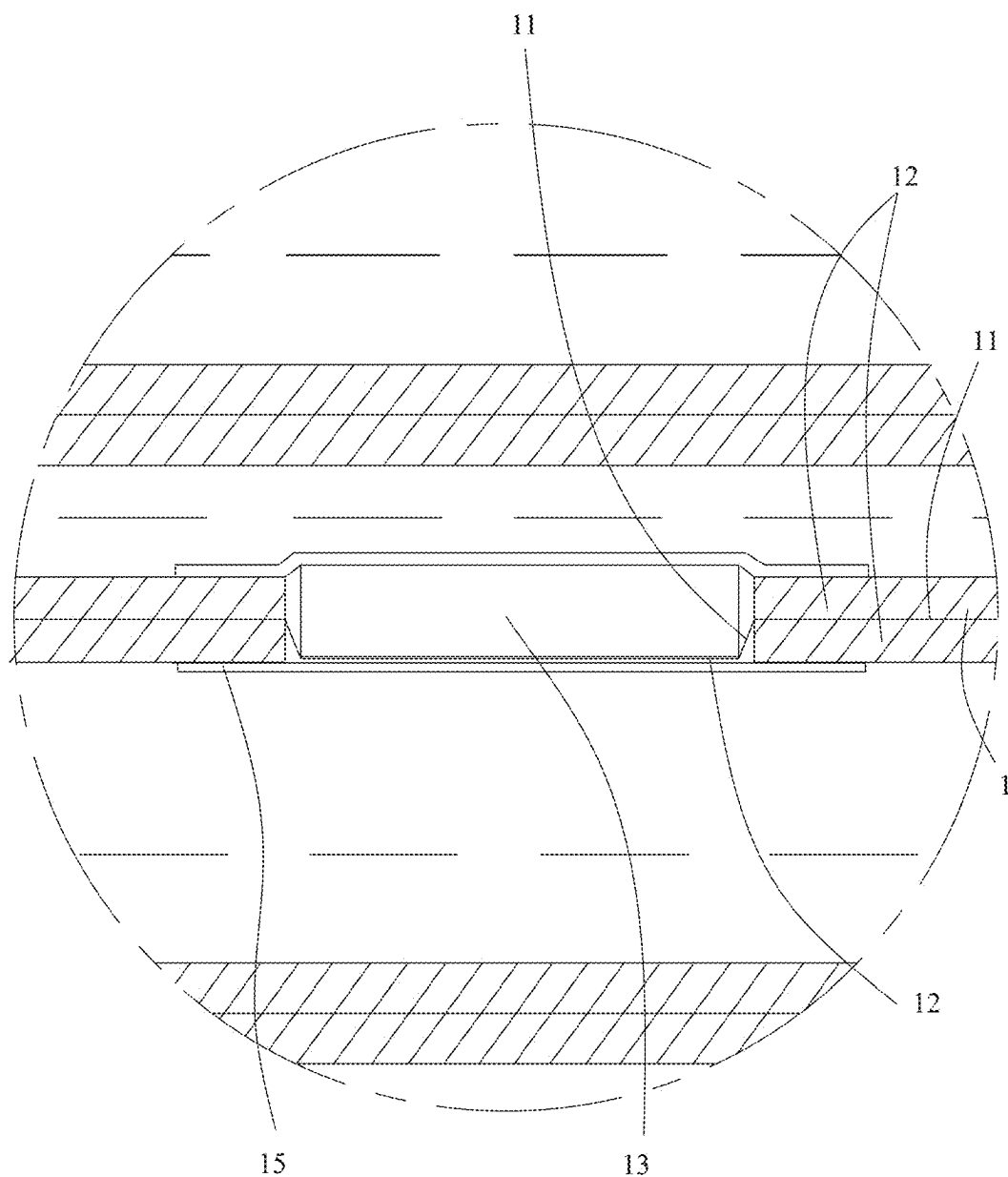


FIG. 5B

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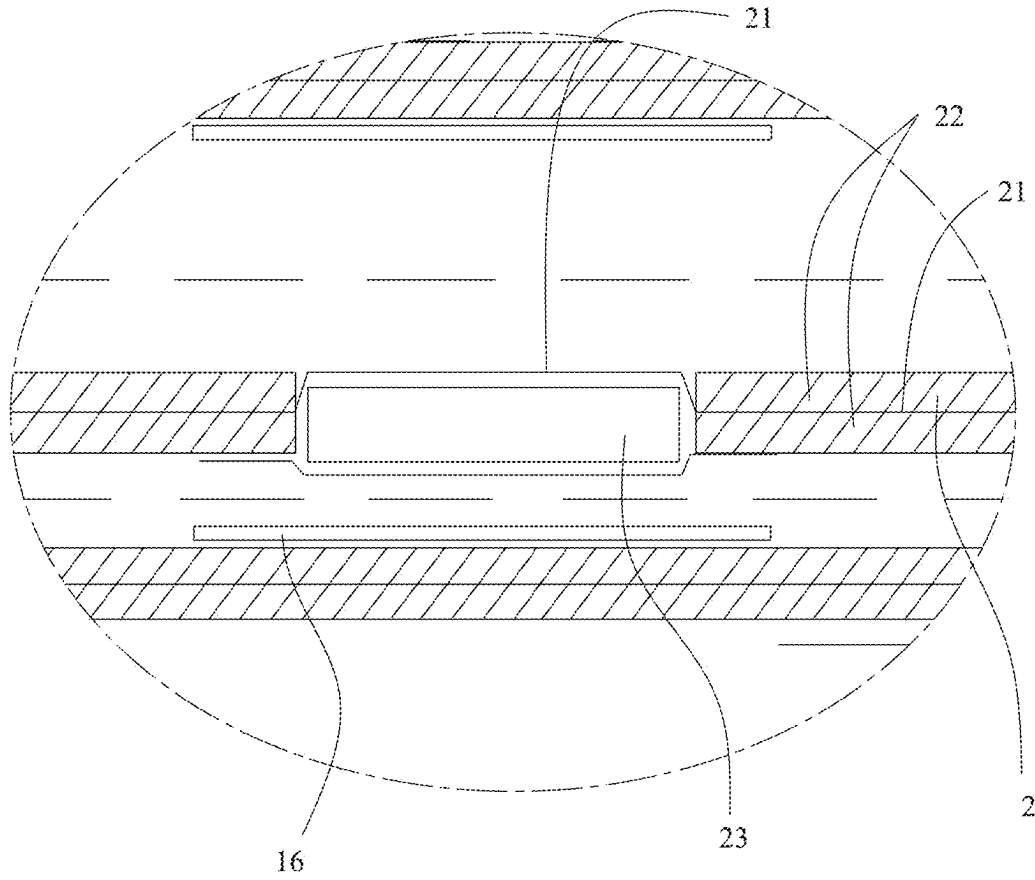


FIG. 5C

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**LITHIUM-ION BATTERY HAVING
DESIRABLE SAFETY PERFORMANCE****CROSS-REFERENCE TO RELATED
APPLICATION**

The present application is a continuation of U.S. patent application Ser. No. 17/746,755, entitled "LITHIUM-ION BATTERY HAVING DESIRABLE SAFETY PERFORMANCE", filed May 17, 2022, which is a continuation of U.S. patent application Ser. No. 17/407,081, entitled "LITHIUM-ION BATTERY HAVING DESIRABLE SAFETY PERFORMANCE", filed Aug. 19, 2021, which is a continuation of U.S. patent application Ser. No. 16/113,938, entitled "LITHIUM-ION BATTERY HAVING DESIRABLE SAFETY PERFORMANCE", filed Aug. 27, 2018, which is a continuation of U.S. patent application Ser. No. 14/596,873, entitled "LITHIUM-ION BATTERY HAVING DESIRABLE SAFETY PERFORMANCE", filed Jan. 14, 2015, which claims priority to Chinese Patent Application No. 201420030319.4, entitled "LITHIUM-ION BATTERY HAVING DESIRABLE SAFETY PERFORMANCE", filed Jan. 17, 2014, all of which are hereby incorporated by reference in their entirety.

TECHNICAL FIELD

The present disclosure generally relates to lithium-ion batteries and, more particularly, relates to a lithium-ion battery having desirable safety performance.

BACKGROUND

At present, lithium-ion batteries are required to be thinner and thinner as well as have higher and higher energy density, which demands a lithium-ion battery has as much energy as possible in a volume as small as possible.

In conventional design of a lithium-ion battery, a lead is a component soldered on a current collector to conduct current. Arrangement of the lead will increase the thickness of the lithium-ion battery no matter the lithium-ion battery adopts a Jelly-roll structure or a laminated structure. In other words, the area where the lead is soldered to the current collector has a largest thickness in the lithium-ion battery. The increased thickness due to the lead is about 1-5% of the thickness of an assembled lithium-ion battery. Therefore, increase of thickness of a lithium-ion battery due to the lead has become one of the key actors which limit the energy density of the lithium-ion battery.

Chinese patent publication numbers CN 202495523U and CN 201087907Y each discloses a lithium-ion battery which defines a recess on a positive plate and/or the negative plate to receive a lead therein. The arrangement of the recess on the positive plate and/or the negative plate can reduce the thickness of the lithium-ion battery. However, when the recess is defined at one end of the positive plate or the negative plate along a length direction thereof, thickness variation around the recess is much larger than the thickness variation of the film afar from the recess. Particularly, the arrangement of the recess may generate a number of corners. The film around the corners is readily peeled off, especially when the negative active material adopts an expansive substance, such as silicon. The structure as previously described may lead to a high internal resistance of the lithium-ion battery and affect the capacity of the lithium-ion battery. In addition, there is no insulating layer provided on the positive area corresponding to the positive recess or the

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negative recess, internal short circuit and lithium precipitation may potentially occur to the lithium-ion battery, which will inevitably affect the safety performance of the lithium-ion battery.

In view of the foregoing, what is needed, therefore, is to provide a lithium-ion battery having desirable safety performance.

SUMMARY

One object of the present disclosure is to provide a battery which has high energy density and desirable safety performance.

According to an embodiment of the present disclosure, a battery is provided and the battery includes: a first plate, comprising a first film and a first lead; a first insulating glue layer, disposed on a surface of the first lead; a second plate, comprising a second lead; in which a second insulating glue layer is disposed on a surface of the first film corresponding to the second lead.

According to an embodiment of the present disclosure, the first plate includes a first current collector, the first film and the first lead, the first film being disposed on the first current collector, the first lead being electrically connected with the first current collector, the first film includes: a first recess configured to receive the first lead; a second plate, comprising a second current collector, a second film and a second lead, the second film being disposed on the second current collector, the second lead being electrically connected with the second current collector, the second film being provided with a second recess configured to receive the second lead.

Specifically, the first plate is a positive plate, the first current collector is a positive current collector, the first film is a positive film, the first lead is a positive lead; the second plate is a negative plate, the second current collector is a negative current collector, the second film is a negative film, the second lead is a negative lead.

According to one embodiment of the present disclosure, a lithium-ion battery having desirable safety performance is provided. The lithium-ion battery includes:

a positive plate, including a positive current collector, a positive film formed on the positive current collector and a positive lead coupled to the positive current collector, the positive film being provided with a first recess and the positive lead being soldered in the first recess;

a negative plate, including a negative current collector, a negative film formed on the negative current collector and a negative lead coupled to the negative current collector, and the negative film being provided with a second recess and the negative lead being soldered in the second recess;

a separator disposed between the positive plate and the negative plate; and electrolyte,

wherein upper and lower surfaces of the positive lead each is provided with a first insulating glue layer, a surface of the positive film corresponding to the second recess is pasted with a second insulating glue layer, and the first insulating glue layer formed on the lower surface of the positive lead entirely covers the blank positive current collector in the first recess.

According to an embodiment of the present disclosure, the positive lead is entirely seated in the first recess and the negative lead is entirely seated in the second recess. Due to the arrangement of the first recess on the positive plate and the second recess on the negative plate, the positive lead and

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the negative lead can be received in the first recess and the second recess respectively. Along the thickness direction, the thickness of the positive lead (negative lead) is less than the thickness of the positive plate (negative plate). Therefore, the lead will not induce thickness increase of the positive lead or the negative lead. There will be more space for the active material, and energy density of the lithium-ion battery is improved remarkably.

According to an embodiment of the present disclosure, the first recess or the second recess is defined via mechanical solvent cleaning or laser cleaning.

According to an embodiment of the present disclosure, the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

According to an embodiment of the present disclosure, the first insulating glue layer or the second insulating glue layer is one of a green insulating glue layer, a black insulating glue layer, a white insulating glue layer or a yellow insulating glue layer.

According to an embodiment of the present disclosure, a distance between a center of the first recess and one end of the positive film is $\frac{1}{4} \sim \frac{3}{4}$ of a length of the positive film, and a distance between a center of the second recess and one end of the negative film is $\frac{1}{4} \sim \frac{3}{4}$ of a length of the negative film.

According to an embodiment of the present disclosure, the first recess and the second recess are defined in a middle portion of the positive plate and the negative plate respectively. Even though the positive plate and/or the negative plate expand, unstable bonding, large thickness variation or even abscission of the positive film or the negative film around the recess is avoided. At the same time, the internal resistance of the lithium-ion battery is reduced, and capacity and energy density of the lithium-ion battery are improved remarkably in the premise of unchanged battery cell size.

According to an embodiment of the present disclosure, a distance between a center of the first recess and one end of the positive film is half of a length of the positive film, and a distance between a center of the second recess and one end of the negative film is half of a length of the negative film.

According to an embodiment of the present disclosure, the first recess has a length 1~100 mm less than a length of the positive lead, the first recess has a width 1~10 mm larger than a width of the positive lead, the second recess has a length 1~100 mm less than a length of the negative lead, and the second recess has a width 1~10 mm larger than a width of the negative lead.

According to an embodiment of the present disclosure, the first recess has a length 1~100 mm less than a width of the positive film, and the second recess has a length 1~100 mm less than a width of the negative film.

According to an embodiment of the present disclosure, the first recess has a depth no larger than a thickness of the positive film, and the second recess has a depth no larger than a thickness of the negative film.

According to an embodiment of the present disclosure, the first recess has a depth 0.005~0.1 mm larger than a thickness of the positive lead, and the second recess has a depth 0.005~0.1 mm larger than a depth of the negative lead.

Compared with the prior art, due to the arrangement of the first insulating glue layer formed on the upper and lower surfaces of the positive lead and the second insulating glue layer pasted on the surface of the positive film corresponding to the second recess, occurrence of internal short circuit and lithium precipitation in the lithium-ion battery is

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remarkably reduced, and safety performance of the lithium-ion battery is improved remarkably in the premise of desirable energy density.

Other advantages and novel features will be drawn from the following detailed description of preferred embodiments with the attached drawings. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the present disclosure and, together with a general description of the disclosure given above, and the detailed description of the embodiments given below, serve to explain the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts an exemplary front view of a positive plate of a lithium-ion battery according to one embodiment of the present disclosure;

FIG. 2 depicts an exemplary front view of a negative plate of a lithium-ion battery according to one embodiment of the present disclosure;

FIG. 3 depicts an exemplary top view of a positive plate of a lithium-ion battery according to one embodiment of the present disclosure;

FIG. 4 depicts an exemplary top view of a negative plate of a lithium-ion battery according to one embodiment of the present disclosure;

FIG. 5A depicts an exemplary cross-sectional view of a lithium-ion battery according to one embodiment of the present disclosure; FIG. 5B shows an enlarged view of a portion A of FIG. 5A according to one embodiment of the present disclosure; and FIG. 5C shows an enlarged view of a portion B of FIG. 5A according to one embodiment of the present disclosure.

DETAILED DESCRIPTION

Example embodiments of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the disclosure are shown. Indeed, the disclosure may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout.

According to an embodiment of the present disclosure, a battery is provided and the battery includes: a first plate, comprising a first film and a first lead; a first insulating glue layer, disposed on a surface of the first lead; a second plate, comprising a second lead; in which a second insulating glue layer is disposed on a surface of the first film corresponding to the second lead.

According to an embodiment of the present disclosure, the first plate includes a first current collector, the first film and the first lead, the first film being disposed on the first current collector, the first lead being electrically connected with the first current collector, the first film includes: a first recess configured to receive the first lead; a second plate, comprising a second current collector, a second film and a second lead, the second film being disposed on the second current collector, the second lead being electrically connected with the second current collector, the second film being provided with a second recess configured to receive the second lead.

Specifically, the first plate is a positive plate, the first current collector is a positive current collector, the first film

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is a positive film, the first lead is a positive lead; the second plate is a negative plate, the second current collector is a negative current collector, the second film is a negative film; the second lead is a negative lead.

Example 1

Referring to FIG. 1 to FIG. 5C, a lithium-ion battery according to one embodiment of the present disclosure includes a positive plate 1, a negative plate 2, a separator 3 disposed between the positive plate 1 and the negative plate 2, and electrolyte (not shown). The positive plate 1 includes a positive current collector 11, a positive film 12 provided on the positive current collector 11, and a positive lead 13. The negative plate 2 includes a negative current collector 21, a negative film 22 provided on the negative current collector 21, and a negative lead 23. The positive film 12 defines a first recess 14. The positive lead 13 is soldered and seated in the first recess 14. The negative film 22 defines a second recess 24. The negative lead 23 is soldered and seated in the second recess 24. An upper surface and a lower surface of the positive lead 13 each is formed with a first insulating glue layer 15. A surface of the positive film 12 corresponding to the second recess 24 is pasted with a second insulating glue layer 16.

The second insulating glue layer 16 has a width larger than a width of the second recess 24. The second insulating glue layer 16 has a length larger than a length of the second recess 24.

The first insulating glue layer 15 and the second insulating glue layer 16 are green insulating glue layers.

The distance between the center of the first recess 14 and one end of the positive film 12, i.e. one end of the positive film 12 perpendicular to a length direction of the positive current collector 11 and formed no blank positive current collector 11, is half of a length of the positive film 12. The distance between the center of the second recess 24 and one end of the negative film 22, i.e. one end of the negative film 12 perpendicular to a length direction of the negative current collector 21 and formed no blank negative current collector 21, is half of a length of the negative film 22.

The first recess 14 has a length 25 mm less than a length of the positive lead 13. The first recess 14 has a width 4 mm larger than a width of the positive lead 13. The second recess 24 has a length 25 mm less than a length of the negative lead 23. The second recess has a width 4 mm larger than a width of the negative lead 23.

The first recess 14 has a length 55 mm less than a width of the positive film 13. The second recess 24 has a length 57 mm less than a width of the negative film 22.

The first recess 14 has a depth less than a thickness of the positive film 12. The second recess 24 has a depth less than a thickness of the negative film 22.

The first recess 14 has a depth 0.02 mm larger than a thickness of the positive lead 13. The second recess 24 has a depth 0.02 mm larger than a thickness of the negative lead 23.

A method for manufacturing a lithium-ion battery according to one embodiment of the present disclosure will be described in detail in view of a 303482 square lithium-ion battery (a lithium-ion battery having a thickness of 3.0 mm, a width of 34 mm and a length of 82 mm). The method for manufacturing a lithium-ion battery includes the steps of:

Preparation of the positive plate:

- 1) adding 95 wt % positive active material LiCoO_2 , 2 wt % binder PVDF and 3 wt % conductive agent

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graphite into solvent NMP, obtaining a positive slurry having a viscosity of 3000-6000 pa·s after fully stirring;

- 2) coating the positive slurry on an aluminum foil having a thickness of 12 μm , and obtaining a positive plate 1 having a compacted density of 4.1 g/cm^3 and a length of 277 mm a width of 75 mm, a thickness of 0.114 mm after drying and cold pressing;
- 3) removing the positive film 12 at a center of the positive plate 1 (at a middle portion along a length direction of the positive plate 1) via, laser cleaning to define a first recess 14 having a thickness of 0.1 mm, a width of 10 mm and a length of 20 mm;
- 4) coupling a positive lead 13 having a thickness of 0.08 mm, a width of 6 mm and a length of 45 mm in the first recess 14 via laser welding, the positive lead 13 extending out of the positive plate 1 of about 15 mm;
- 5) providing green insulating glue layers on upper and lower surfaces of the positive lead 13, and pasting green insulating glue layer on the positive film 12 corresponding to the second recess 24 in winding, ensuring the green insulating glue layer on the lower surface of the positive lead 13 entirely covering the blank positive current collector 11 in the first recess 14.

Preparation of the negative plate:

- 1) adding 95 wt % negative active material graphite, 2 wt % bonding agent SBR, 1 wt % thickener CMC and 2 wt % conductive agent graphite in solvent deionized water, and obtaining negative slurry having a viscosity of 1000-3000 pa·s after fully stirring;
- 2) coating the negative slurry on a copper foil having a thickness of 6 μm , after drying and cold pressing, obtaining a negative plate having a compaction density of about 1.6 g/cm^3 and a length of 28.5 mm, a width of 77 mm, a thickness of 0.135 mm;
- 3) removing the negative active material at a center of the negative plate 2 (at a middle portion along a length direction of the negative plate 2) via mechanical cleaning to define a second recess 24, the second recess 24 having a thickness of 0.10 mm, a width of 10 mm and a length of 20 mm;
- 4) providing a negative lead 23 having a thickness of 0.08 mm, a width of 6 mm and a length of 45 mm, soldering the negative lead 23 in the second recess 24, with the negative lead 23 extending out of the negative plate 2 of 15 mm.

Preparation of the electrolyte: fully mixing a mixture of methyl ethyl carbonate (EMC), diethyl carbonate (DEC), ethylene carbonate (EC) and propylene carbonate (PC) having a weight ratio of 1:1:0:5:0:5; adding LiPF_6 as solute and obtaining a base electrolyte containing 1 M LiPF_6 adding 0.5 wt % of two fluorine lithium oxalate borate and 1 wt % of adiponitrile in the base electrolyte, and obtaining electrolyte for use in a lithium-ion battery after fully dissolving.

Preparation of the lithium-ion battery: coiling the positive plate 1 and the negative plate 2 with a separator polyethylene film 3 having a thickness of 0.013 mm interposed between the positive plate 1 and the negative plate 2 and obtaining a bared battery cell, with main portion of the bared battery cell having an average thickness of about 2.78 mm; obtaining a final lithium ion battery after drying the bared battery cell, pouring the electrolyte and packaging.

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Example 2

Example 2 is almost the same as Example 1, except that:

The distance between a center of the first recess **14** and one end of the positive film **12** (one end of the positive film **12** perpendicular to a length direction of the positive current collector **11** and formed no blank positive current collector **11**) is about $\frac{1}{4}$ of the length of the positive film **12**.

The distance between a center of the second recess **24** and one end of the negative film **22** (one end of the negative film **22** perpendicular to a length direction of the negative current collector **21** and formed no blank negative current collector **21**) is about $\frac{1}{4}$ of the length of the negative film **12**.

The first recess **14** has a length 75 mm less than a length of the positive lead **13**. The first recess **14** has a width 2 mm larger than a width of the positive lead **13**. The second recess **24** has a length 75 mm less than a length of the negative lead **23**. The second recess **24** has a width 2 mm larger than a width of the negative lead **23**.

The first recess **14** has a length 30 mm less than a width of the positive film **12**. The second recess **24** has a length 33 mm less than a width of the negative film **22**.

The first recess **14** has a depth 0.08 mm larger than a thickness of the positive lead **13**. The second recess **24** has a depth 0.08 mm larger than a thickness of the negative lead **23**.

The negative active material is silicon.

The first insulating glue layer **15** and the second insulating glue layer **16** are black insulating glue layers.

Other features of Example 2 are the same as have described in Example 1 and will not be detailed further.

Example 3

Example 3 is almost the same as Example 1, except that:

The distance between a center of the first recess **14** and one end of the positive film **12** (one end of the positive film **12** perpendicular to a length direction of the positive current collector **11** and formed no blank positive current collector **11**) is about $\frac{3}{4}$ of the length of the positive film **12**.

The distance between a center of the second recess **24** and one end of the negative film **22** (one end of the negative film **22** perpendicular to a length direction of the negative current collector **21** and formed no blank negative current collector **21**) is about $\frac{3}{4}$ of the length of the negative film **12**.

The first recess **14** has a length 50 mm less than a length of the positive lead **13**. The first recess **14** has a width 8 mm larger than a width of the positive lead **13**. The second recess **24** has a length 50 mm less than a length of the negative lead **23**. The second recess **24** has a width 8 mm larger than a width of the negative lead **23**.

The first recess **14** has a length 70 mm less than a width of the positive film **12**. The second recess **24** has a length 73 mm less than a width of the negative film **22**.

The first recess **14** has a depth 0.05 mm larger than a thickness of the positive lead **13**. The second recess **24** has a depth 0.05 mm larger than a thickness of the negative lead **23**.

The negative active material is silicon.

The first insulating glue layer **15** and the second insulating glue layer **16** are white insulating glue layers.

Other features of Example 3 are the same as have described in Example 1 and will not be detailed further.

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Example 4

Example 4 is almost the same as Example 2, except that:

The distance between a center of the first recess **14** and one end of the positive film **12** (one end of the positive film **12** perpendicular to a length direction of the positive current collector **11** and formed no blank positive current collector **11**) is about $\frac{1}{6}$ of the length of the positive film **12**.

The distance between a center of the second recess **24** and one end of the negative film **22** (one end of the negative film **22** perpendicular to a length direction of the negative current collector **21** and formed no blank negative current collector **21**) is about $\frac{1}{6}$ of the length of the negative film **12**.

The first insulating glue layer **15** and the second insulating glue layer **16** are yellow insulating glue layer.

Other features of Example 4 are the same as have described in Example 2 and will not be detailed further.

Example 5

Example 5 is almost the same as Example 3, except that:

The distance between a center of the first recess **14** and one end of the positive film **12** (one end of the positive film **12** perpendicular to a length direction of the positive current collector **11** and formed no blank positive current collector **11**) is about $\frac{4}{5}$ of the length of the positive film **12**.

The distance between a center of the second recess **24** and one end of the negative film **22** (one end of the negative film **22** perpendicular to a length direction of the negative current collector **21** and formed no blank negative current collector **21**) is about $\frac{4}{5}$ of the length of the negative film **12**.

Other features of Example 5 are the same as have described in Example 3 and will not be detailed further.

Comparative Example 1

The Comparative Example 1 is almost the same as Example 1, except that, upper and lower surfaces of the positive lead **13** have no first insulating glue layer **15** formed thereon. The surface of the positive film **12** corresponding to the second recess **24** has no second insulating glue layer **16** pasted thereon.

Other features of Comparative Example 1 are the same as have described in Example 1 and will not be detailed further.

Comparative Example 2

The Comparative Example 2 is almost the same as Example 1, except that, the positive lead **13** is soldered to the blank positive current collector **11**, the positive film **12** does not have a first recess **14**, the negative lead **23** is soldered to the blank negative current collector **21**, the negative film **22** does not have a second recess **24**. Other features of Comparative Example 2 are the same as have described in Example 1 and will not be detailed further.

10 lithium-ion batteries are randomly selected from lithium-ion batteries according to Example 1, Example 2, Example 3 and Comparative Example 1 respectively. Each lithium-ion battery is carried out a cycle performance test of 300 cycles. Number of the lithium-ion batteries occurring short circuit is calculated and the testing result is shown in Table 1.

10 lithium-ion batteries are randomly selected from lithium-ion batteries according to Example 1, Example 2, Example 3 and Comparative Example 1 respectively. Each lithium-ion battery is carried out a cycle performance test of 100 cycles. Each lithium-ion battery is disassembled to

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observe lithium precipitation on the negative plate 2. Number of lithium-ion batteries whose negative plate 2 occurs lithium precipitation is calculated and the testing result is shown in Table 2.

TABLE 1

Short circuit and lithium precipitation on the negative plate occurs to lithium-ion batteries according to Examples 1 to 3 and Comparative Example 1 after cycle test		
Group	Number of batteries occurring short circuit after 300 cycles	Number of batteries occurring lithium precipitation on the negative plate after 100 cycles
Example 1	0	0
Example 2	0	1
Example 3	1	0
Comparative Example 1	5	7

As clearly shown in Table 1, due to the first insulating glue layer 15 formed on the upper and lower surfaces of the positive lead 13 and the second insulating glue layer 16 pasted on the surface of the positive film 12 corresponding to the second recess 24, the safety performance of the lithium-ion battery can be improved remarkably.

Capacity test, internal resistance test and volumetric energy density test are carried out to the lithium-ion batteries according to Example 1 and Comparative Example 2. The test result is shown in Table 2. The capacity test and internal resistance test are carried out on hang machine at 25° C., the discharge capacity is 0.2 C, the internal resistance is impedance under 1000 Hz, and the volumetric energy density=minimum capacity×platform voltage/maximum volume.

TABLE 2

Capacity, internal resistance and volumetric energy density of lithium-ion batteries according to Example 1 and Comparative Example 2				
Group	DC resistance (mΩ)	Average capacity (mAh)	Average thickness (mm)	Average volumetric energy density(Wh/L)
Example 1	55	1180	2.78	563
Comparative Example 2	62	1170	2.84	546

As clearly shown in Table 2, the structure of the positive plate and negative plate according to the present disclosure can overcome uneven thickness of the battery cell, so as to efficiently utilize the space of the lithium-ion battery, improve the capacity and the volumetric energy density of the lithium-ion battery, and reduce the internal resistance of the lithium-ion battery.

Charging and discharging cycle tests are carried out to lithium-ion batteries in accordance with Examples 2 to 5, in which for the sake of illustration, the negative active material in Example 1 is substituted by silicon and referenced as Example 6. The lithium-ion batteries are disassembled after 50 cycles. Abscission of active material at the edge of the second recess 24 is shown in Table 3.

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TABLE 3

Abscission of active material at the edge of the second recess after charging and discharging cycle test of lithium-ion batteries according to Examples 2 to 6					
	Example 4	Example 2	Example 6	Example 3	Example 5
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10	Abscission of active material at the second recess after 50 cycles	Obvious abscission of active material	No obvious abscission of active material	No abscission of active material	Obvious abscission of active material

As clearly shown in Table 3, if the negative active material for use in the negative plate 2 is apt to serious volume expansion, such as silicon, the first recess 14 in the center of the positive plate 1 and the second recess 24 in the center of the negative plate 2 can effectively reduce abscission of active material at the edge of the second recess 24. The negative plate 2 adopting silicon as active material undertakes serious volume expansion, which may cause the negative plate 2 defining the second recess at one end thereof, cannot bear the uneven force at the second recess. However, the second recess 24 as describe in Examples 2, 3 and 6 each is located in the center of the negative plate 2. Two ends of the negative plate 2 bear almost the same forces and, therefore, abscission of active material at the edge of the second recess 24 can be improved remarkably.

Many modifications and other embodiments of the disclosure set forth herein will come to mind to one skilled in the art to which these disclosure pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the disclosure are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe example embodiments, it should be appreciated that alternative embodiments without departing from the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A lithium-ion battery, comprising:
 - a positive electrode comprising a positive current collector and a positive electrode active material layer containing lithium cobalt oxide, wherein the positive electrode active material layer is formed on the positive current collector, and the positive electrode active material layer is provided with a first recess accommodating a positive lead being coupled with the positive current collector;
 - a negative electrode comprising a negative current collector and a negative electrode active material layer containing graphite or silicon, wherein the negative electrode active material layer is formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector; and the negative lead is disposed on a surface of the negative current collector facing away from the center of the battery; and a portion of the negative current collector where the negative lead is disposed extends towards the center of the battery;

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a separator disposed between the positive electrode and the negative electrode; and an electrolyte.

2. The lithium ion battery of claim 1, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is $\frac{1}{4}$ - $\frac{3}{4}$ of a length of the positive electrode active material layer; and a distance between a center of the second recess and one end of the negative electrode active material layer is $\frac{1}{4}$ - $\frac{3}{4}$ of a length of the negative electrode active material layer.

3. The lithium ion battery of claim 1, wherein, the positive lead is disposed on a surface of the positive current collector facing a center of the battery; and a portion of the positive current collector where the positive lead is disposed extends away from the center of the battery.

4. The lithium ion battery of claim 2, wherein the first recess has a length of 1-100 mm less than a length of the positive lead, the first recess has a width of 1-10 mm larger than a width of the positive lead, the second recess has a length of 1-100 mm less than a length of the negative lead, and the second recess has a width of 1-10 mm larger than a width of the negative lead.

5. The lithium ion battery of claim 1, wherein the first recess has a length of 1-100 mm less than a width of the positive electrode active material layer, and the second recess has a length of 1-100 mm less than a width of the negative electrode active material layer.

6. The lithium ion battery of claim 1, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.

7. The lithium ion battery of claim 1, wherein a length of a portion of the positive lead in the first recess is less than a width of a remaining portion of the positive electrode active material layer from an edge of a first insulating glue layer covering the positive electrode active material layer to an edge of the positive electrode active material layer opposite to the first recess.

8. The lithium ion battery of claim 1, wherein a width of a portion of the positive lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.

9. The lithium ion battery of claim 1, wherein a surface of the positive current collector corresponding to the positive lead is covered with a third insulating glue layer.

10. The lithium ion battery of claim 1, wherein a top surface of the positive lead is provided with a first insulating glue layer, a surface of the positive electrode active material layer corresponding to the second recess is pasted with a second insulating glue layer, the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

11. A lithium ion battery, comprising:

a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector, wherein the positive electrode active material layer is provided with a first recess accommodating a positive lead being coupled with the positive current collector;

a negative electrode, comprising a negative current collector and a negative electrode active material layer being formed on the negative current collector, wherein

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the negative electrode active material layer is provided with a second recess accommodating a negative lead being coupled with the negative current collector; and the negative lead is disposed on a surface of the negative current collector facing away from the center of the battery; and a portion of the negative current collector where the negative lead is disposed extends towards the center of the battery;

a separator disposed between the positive electrode and the negative electrode; and an electrolyte.

12. The lithium ion battery of claim 11, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is $\frac{1}{4}$ - $\frac{3}{4}$ of a length of the positive electrode active material layer, and a distance between a center of the second recess and one end of the negative electrode active material layer is $\frac{1}{4}$ - $\frac{3}{4}$ of a length of the negative electrode active material layer.

13. The lithium ion battery of claim 11, wherein the positive lead is disposed on a surface of the positive current collector facing a center of the battery; and a portion of the positive current collector where the positive lead is disposed extends away from the center of the battery.

14. The lithium ion battery of claim 11, wherein the first recess has a length of 1-100 mm less than a length of the positive lead, the first recess has a width of 1-10 mm larger than a width of the positive lead, the second recess has a length of 1-100 mm less than a length of the negative lead, and the second recess has a width of 1-10 mm larger than a width of the negative lead.

15. The lithium ion battery of claim 11, wherein the first recess has a length of 1-100 mm less than a width of the positive electrode active material layer, and the second recess has a length of 1-100 mm less than a width of the negative electrode active material layer.

16. The lithium ion battery of claim 11, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.

17. The lithium ion battery of claim 11, wherein a length of a portion of the positive lead in the first recess is less than a width of a remaining portion of the positive electrode active material layer from an edge of a first insulating glue layer covering the positive electrode active material layer to an edge of the positive electrode active material layer opposite to the first recess.

18. The lithium ion battery of claim 11, wherein a width of a portion of the positive lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.

19. The lithium ion battery of claim 11, wherein a first location of a top surface of the positive lead is provided with a first insulating glue layer; a second location of a surface of the positive electrode active material layer corresponding to the second recess is pasted with a second insulating glue layer; and a third location of a surface of the positive current collector corresponding to the positive lead is covered with a third insulating glue layer.

20. The lithium ion battery of claim 19, wherein the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

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