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BATTERY AND ELECTRIC APPARATUS

Abstract

A battery includes a battery pack and a reinforcing member. The battery pack includes multiple battery cells stacked along a first direction; and the reinforcing member extends along the first direction; where the reinforcing member is disposed on at least one side of the battery pack along the first direction, and the reinforcing member is connected to the battery pack.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION [0001] This application is a continuation of International Application No. PCT/CN2023/070181, filed on Jan. 3, 2023, the entire content of which is incorporated herein by reference.

TECHNICAL FIELD
[0002] This application relates to the technical field of batteries, and in particular to a battery and an electric apparatus.
BACKGROUND
[0003] The battery serves as the core power supply of an electric apparatus, and its safety and stability directly affect the use reliability and safety of the electric apparatus. When the electric apparatus is subjected to a collision impact, the battery is easily squeezed and deformed, and even the internal battery cells may be damaged and explode, thus affecting the safety of the user. Therefore, it is urgent to improve the safety and reliability of the battery under collision impact.
SUMMARY
[0004] The main technical issue resolved by this application is to provide a battery and an electric apparatus, which can resolve the issue that the battery is likely to be damaged during collision.
[0005] According to a first aspect, this application provides a battery. The battery includes a battery pack and a reinforcing member. The battery pack includes multiple battery cells stacked along a first direction; and the reinforcing member extends along the first direction; where the reinforcing member is disposed on at least one side of the battery pack along the first direction, and the reinforcing member is connected to the battery pack. Multiple battery cells are stacked into sets and the arranged battery packs are connected to a same reinforcing member, enhancing the stiffness of the battery with this structure, and making it less likely to deform when subjected to collision and compression. This also improves the vibration resistance of the battery and enhances the reliability and safety of the battery.
[0006] In some embodiments, adjacent two of the multiple battery cells along the first direction are connected using an adhesive. This design manner can keep the relative positions of two adjacent battery cells fixed, reducing the probability of separating adjacent battery cells within the battery pack, and facilitating assembly.
[0007] In some embodiments, a maximum size of the reinforcing member along the first direction is larger than a maximum size of the battery pack along the first direction. When the battery is subjected to external impact in the first direction, the reinforcing member absorbs the external compressive force, and the battery pack retracts inwards relative to the reinforcing member in the first direction. Therefore, the battery pack does not absorb the external compressive force, reducing the probability of the battery pack being squeezed and deformed. Additionally, the reinforcing member can transfer the external impact received at one end to the other end of the reinforcing member, further buffering the external impact and improving the safety of the battery.
[0008] In some embodiments, two ends of the reinforcing member along the first direction exceed the battery pack. When the battery is subjected to external impact in the first direction, the impact force first comes into contact with the reinforcing member, and the reinforcing member absorbs the external compressive force, reducing the probability of the battery pack being squeezed and deformed.
[0009] In some embodiments, multiple reinforcing members are provided, at least two of the multiple reinforcing members are respectively located on two sides of the battery pack along the

first direction, and the reinforcing members on two sides of the battery pack along the first direction are both connected to the battery pack. This design manner allows for high structural stability between the battery pack and the reinforcing member.

[0010] In some embodiments, the reinforcing member is configured to be connected to a surface with a greatest area of the battery cell. This design manner allows for a large connection area between the reinforcing member and the battery cell, enhancing the structural stability of the battery.

[0011] In some embodiments, the reinforcing member has a heat exchange chamber, and the heat exchange chamber is used for accommodating a heat exchange medium. When the reinforcing member absorbs the external compressive force to reduce the probability of the battery pack being squeezed and deformed, it also serves the heat exchange function, so that the battery does not need to be additionally provided with a heat exchange member, thereby reducing costs.

[0012] In some embodiments, the reinforcing member is adhered to the battery cell. This design manner can keep the relative positions of the reinforcing member and the battery cell fixed, reducing the probability of separating the reinforcing member and the battery cell, and facilitating assembly.

[0013] In some embodiments, multiple battery packs are provided, multiple reinforcing members are provided, the multiple battery packs are side by side along a second direction, and the second direction intersects the first direction, and one of the multiple reinforcing members is located between adjacent two of the battery packs and is connected to the two adjacent battery packs. This design manner allows for high structural stability between the battery pack and the reinforcing member.

[0014] In some embodiments, the battery further includes an end plate, the end plate is located at an end of the reinforcing member along the first direction, and the reinforcing member is connected to the end plate. The end plate is disposed at the end of the reinforcing member in the first direction, such that when the battery is squeezed and deformed in the first direction, the external impact force in the first direction is further absorbed, reducing the probability of the impact force damaging the battery pack.

[0015] In some embodiments, the battery further includes a bottom plate and a cover plate, the bottom plate and the cover plate are respectively located on two mutually parallel side surfaces of the battery pack along the first direction, the bottom plate is opposite the cover plate, and the reinforcing member is connected to at least one of the bottom plate and the cover plate. This design manner can improve the safety of the battery.

[0016] In some embodiments, the battery further includes a frame, the frame encloses a middle space, and the battery pack is located in the middle space. The battery further includes a buffer member, and along the first direction, the buffer member is located between the battery pack and an inner surface of the frame. This design manner can maintain the shape of the battery, with the battery pack placed in the frame, reducing the probability of dispersing the battery pack. When the end plate is squeezed and deformed in the first direction, the buffer member can absorb the external impact force, reducing the damage to the battery pack caused by the impact force.

[0017] In some embodiments, as multiple battery packs are provided, multiple reinforcing members are provided, the reinforcing members and the battery packs are arranged alternately, and the buffer member is sandwiched between adjacent two of the reinforcing members. This design manner can better protect the battery pack.

[0018] In some embodiments, the reinforcing member includes the heat exchange chamber, the heat exchange chamber is used for accommodating the heat exchange medium, the battery further includes a current collecting tube, and the current collecting tube is connected to an end of the reinforcing member along the first direction to communicate with the heat exchange chamber, and the buffer member includes an avoidance groove, and the avoidance groove corresponds to the current collecting tube in position. The reinforcing members are connected to form a loop via a

current collecting tube, facilitating the flow of the heat exchange medium. A buffer member is provided outside the current collecting tube, which can reduce the damage to the current collecting tube caused by the compressive force.

[0019] In some embodiments, the avoidance groove is located on a surface of the buffer member away from the battery cell along the first direction. This design manner ensures that the surface of the buffer member with the avoidance groove does not directly contact the battery cell, preventing stress concentration on the battery cell.

[0020] In some embodiments, the battery further includes a bottom plate, the bottom plate is connected to the frame, and a bottom of the buffer member facing the bottom plate is provided with a guiding structure. The guiding structure facilitates the operator in correctly placing the buffer member into the middle space. The buffer member can also be fixedly connected to the battery pack first, providing a guiding function when the battery pack is mounted into the middle space.

[0021] In an embodiment, the battery further includes a separating member, the separating member is located in the frame, the separating member extends along the first direction and is connected to an inner surface of the frame, so as to separate the middle space into at least two sub-spaces, and at least one of the at least two sub-spaces is used for accommodating the battery pack and the reinforcing member. This design manner can alleviate the swelling of the battery pack and enhance the stiffness of the battery.

[0022] According to a second aspect, this application provides an electric apparatus including the battery in the foregoing embodiments, where the battery is configured to supply electric energy to the electric apparatus.

[0023] The foregoing description is merely an overview of the technical solution of this application. For a better understanding of the technical means in this application such that they can be implemented according to the content of the specification, and to make the above and other objectives, features, and advantages of this application more obvious and easier to understand, the following describes specific embodiments of this application.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0024] To describe the technical solutions in the embodiments of this application more clearly, the following briefly describes the accompanying drawings required for describing the embodiments of this application. Apparently, the accompanying drawings in the following description show merely some embodiments of this application, and a person of ordinary skill in the art may still derive other drawings from the accompanying drawings without creative efforts.

[0025] FIG. **1** is a schematic structural diagram of a vehicle according to some embodiments of this application;

[0026] FIG. **2** is an exploded view of a battery according to an embodiment;

[0027] FIG. **3** is a top view of a battery in FIG. **2** after a cover plate is removed according to an embodiment.

[0028] FIG. **4** is a cross-sectional view along a section line A-A in FIG. **3** according to an embodiment.

[0029] FIG. **5** is a locally enlarged view at part B in FIG. **3** according to an embodiment.

[0030] FIG. **6** is a schematic structural view of a buffer member according to some embodiments of this application;

[0031] FIG. **7** is a right side view of the buffer member according to some embodiments of this application; and

[0032] FIG. **8** is a schematic structural view of a frame and a separating member according to some embodiments of this application.

[0033] In the accompanying drawings, the figures are not necessarily drawn to scale.

REFERENCE NUMERALS

[0034] vehicle **1000**; battery **100**; controller **200**; motor **300**; [0035] first direction X; second direction Y; third direction Z; [0036] frame **10**; end plate **11**; side plate **12**; [0037] battery pack **20**; battery cell **21**; second surface **211**; busbar **22**; output electrode base **23** [0038] reinforcing member **31**; first assembly gap **311**; buffer member **32**; first spacing **321**; first surface **322**; third surface **323**; guide surface **3231**; top abutment surface **3232**; avoidance groove **324**; [0039] bottom plate **40**; cover plate **50**; current collecting tube **60**; [0040] first separating member **70**; second separating member **80**; and notch portion **81**.

DETAILED DESCRIPTION OF EMBODIMENTS

[0041] The following further describes implementations of this application in detail with reference to the accompanying drawings and embodiments. The detailed description of the embodiments and the accompanying drawings are intended to illustrate the principle of this application, rather than to limit the scope of this application, meaning this application is not limited to the embodiments described herein.

[0042] In the description of this application, it should be noted that, unless otherwise stated, “multiple” means at least two; and the orientations or positional relationships indicated by the terms “upper”, “lower”, “left”, “right”, “inside”, “outside”, and the like are merely for ease and brevity of description of this application rather than indicating or implying that the means or components mentioned must have specific orientations or must be constructed or manipulated according to particular orientations. These terms shall therefore not be construed as limitations on this application. In addition, the terms “first”, “second”, “third”, and the like are merely for the purpose of description and shall not be understood as any indication or implication of relative importance. “Perpendicular” is not strictly perpendicular, but within the allowable range of error. “Parallel” is not strictly parallel, but within the allowable range of error.

[0043] The orientation terms appearing in the following description all are directions shown in the figures, and do not limit the specific structure of the application. In the description of this application, it should also be noted that unless otherwise specified and defined explicitly, the terms “mounting”, “connection”, and “join” should be understood in their general senses. For example, they may refer to a fixed connection, a detachable connection, or an integral connection, and may refer to a direct connection or an indirect connection via an intermediate medium. Persons of ordinary skill in the art can understand specific meanings of these terms in this application as appropriate to specific situations.

[0044] In this disclosure, unless otherwise specified, phrases like “at least one of A, B, and C” and “at least one of A, B, or C” both mean only A, only B, only C, or any combination of A, B, and C.

[0045] At present, from the perspective of market development prospects and application trends, batteries have been widely used in various fields due to their advantages of high energy density, high power density, multiple cycles of use, and long storage time. For example, they are applied to various energy storage power systems such as hydroelectric power plants, thermal power plants, wind power plants, and solar power plants, and provide power for high-power apparatus such as electric vehicles including electric bicycles, electric motorcycles, electric automobiles, and the like, and are used in many fields of, for example, military equipment and aerospace. With the continuous expansion of battery application fields, the market requirements for batteries are also constantly increasing.

[0046] Currently, it is common to use a battery composed of multiple battery cells connected in series and parallel as a power source. When the battery is used as the power source of an electric vehicle, the inventors of this application noticed that when the width direction (that is, the direction perpendicular to the length direction or driving direction of the electric vehicle) of the electric vehicle collides, the battery is squeezed and deformed. The battery cells in the battery are likely to be damaged after squeezed, leading to a leakage of an electrolyte therein, which may cause

multiple components in the battery to become electrified, thereby affecting the safety of the vehicle.

[0047] To resolve the above technical issue that a vehicle collision damages the battery cell, the inventors have found through research that reinforcing members can be designed. The reinforcing members are spaced apart between the battery packs, and the ends of the reinforcing members are close to a frame relative to the battery packs. After the frame of the battery is squeezed and deformed, the frame contacts a reinforcing member, and the reinforcing member transfers the compressive force to the opposite frame, further alleviating the compressive force on the battery caused by the vehicle collision and reducing the probability of damaging the battery cell.

[0048] After further in-depth research, the inventors also designed a buffer member. Specifically, a space between the outermost side of the battery pack and the frame of the battery is filled with the buffer member. When the vehicle body collides, the buffer member buffers the stress generated by the frame of the battery.

[0049] The battery disclosed in the embodiments of this application can be used not only to buffer the impact on the battery cells caused by collision in the width direction of the vehicle body but also to buffer the impact on the battery cells caused by collision in the length direction of the vehicle body.

[0050] The battery cell disclosed in the embodiments of this application can be used for electric apparatuses that use a battery as a power source or various energy storage systems that use a battery as an energy storage component. The electric apparatus may be but is not limited to a mobile phone, a tablet computer, a laptop computer, an electric toy, an electric tool, an electric bicycle, an electric vehicle, a ship, and a spacecraft. The electric toy may be a fixed or mobile electric toy, for example, a game console, an electric toy car, an electric toy ship, or an electric toy airplane. The spacecraft may include an airplane, a rocket, a space shuttle, a spaceship, and the like.

[0051] For ease of description, an electric apparatus according to an embodiment of this application being a vehicle **1000** is used as an example for description of the following embodiments.

[0052] Referring to FIG. **1**, FIG. **1** is a schematic structural diagram of a vehicle **1000** according to some embodiments of this application. The vehicle **1000** may be a fossil fuel vehicle, a natural gas vehicle, or a new energy vehicle. The new energy vehicle may be a battery electric vehicle, a hybrid electric vehicle, a range-extended electric vehicle, or the like. The vehicle **1000** is provided with a battery **100** inside, and the battery **100** may be disposed at the bottom, front, or rear of the vehicle **1000**. The battery **100** may be configured to supply power to the vehicle **1000**. For example, the battery **100** may be used as an operational power supply for the vehicle **1000**. The vehicle **1000** may further include a controller **200** and a motor **300**, where the controller **200** is configured to control the battery **100** to supply power to the motor **300**, for example, to satisfy power needs of start, navigation, and driving of the vehicle **1000**.

[0053] In some embodiments of this application, the battery **100** can be used as not only the operational power source for the vehicle **1000** but also a driving power source for the vehicle **1000**, replacing or partially replacing fossil fuel or natural gas to provide driving traction for the vehicle **1000**.

[0054] The battery **100** in this application is a physical module that includes one or more battery cells for providing electric energy. The battery **100** typically includes a box configured to enclose one or more battery cells. The box can prevent liquids or other foreign matter from affecting charge or discharge of the battery cells.

[0055] Optionally, the battery cell may be a secondary battery or a primary battery, and may be a lithium-ion battery, a lithium-sulfur battery, a sodium-lithium ion battery, a sodium-ion battery, or a magnesium-ion battery, and the like, which is not limited in the embodiments of this application. The battery cell may be in the shape of a cylinder, a flat body, a cuboid, or of other shapes, and is not limited herein.

[0056] According to some embodiments of this application, referring to FIGS. **2** and **3**, FIG. **2** is an

exploded view of a battery **100** according to an embodiment, FIG. **3** is a top view of a battery **100** in FIG. **2** after a cover plate **50** is removed according to an embodiment, and FIG. **4** is a cross-sectional view along a section line A-A in FIG. **3** according to an embodiment. For convenience of description, in the general industries, the width direction of the vehicle **1000** is defined as the first direction X of the battery **100**, the driving direction or length direction of the vehicle **1000** is defined as the second direction Y of the battery **100**, and the height direction of the vehicle **1000** is defined as the third direction Z of the battery **100**. According to an embodiment of this application, a battery **100** is provided. The battery **100** includes a battery pack **20** and a reinforcing member **31**. The battery pack **20** includes multiple battery cells **21** stacked along a first direction X; and the reinforcing member **31** extends along the first direction X; where the reinforcing member **31** is disposed on at least one side of the battery pack **20** along the first direction X, and the reinforcing member **31** is connected to the battery pack **20**.

[0057] Optionally, in this embodiment, as shown in FIG. **2**, one or more battery packs **20** may be provided, and when multiple battery packs **20** are provided, the multiple battery packs **20** may be arranged sequentially along the second direction Y. In this embodiment, the electrodes between multiple battery packs **20** may be connected using well-known methods in the art. For example, the electrode plates of the battery packs **20** are welded together using busbars **22**, enabling the multiple battery packs **20** to form a series-parallel energy block. In the second direction Y, the outermost busbar **22** of the outermost battery pack **20** may be bent, and the bent busbar **22** is connected to the output electrode base **23** to form an external output interface, thereby enabling the battery **100** to supply power to the vehicle **1000**.

[0058] Optionally, as shown in FIG. **2**, being on at least one side of the battery pack **20** along the first direction X may be understood as being in the second direction Y of the battery pack **20**. Further, the position of the reinforcing member **31** may be understood as that the reinforcing member **31** is disposed on one side of the battery pack **20** in the second direction Y, or the reinforcing member **31** is disposed on the other side of the battery pack **20** in the second direction Y, or as shown in FIGS. **2** and **3**, the reinforcing member **31** is disposed on two sides of the battery pack **20** in the second direction Y. Further, the reinforcing member **31** and the adjacent battery pack **20** may be fixedly connected by welding, FlowDrill Screw (FlowDrill Screw, FDS), adhering, or other methods.

[0059] In summary, in the above technical solution, the multiple battery cells **21** are stacked into sets and the arranged battery packs **20** are connected to a same reinforcing member **31**, enhancing the stiffness of the battery **100** with this structure, and making it less likely to deform when subjected to collision and compression. This also improves the vibration resistance of the battery **100** and enhances the reliability and safety of the battery **100**.

[0060] According to some embodiments of this application, optionally, referring to FIGS. **2** and **3**, adjacent two of the multiple battery cells **21** along the first direction X are connected using an adhesive.

[0061] Optionally, the structure of the battery cell **21** may be a cuboid, a cylinder, or the like, and is not limited herein. When the structure of the battery cell **21** is a cuboid, the adhesive layer between two adjacent battery cells **21** along the first direction X can completely cover the surfaces of the adjacent battery cells **21**. Additionally, two adjacent battery cells **21** may be adhered using a thermally conductive structural adhesive or double-sided adhesive, and is not limited herein. In the first direction X, the adjacent end faces of the battery cells **21** in the same battery pack **20** are fixed using an adhesive. This adhesion may be completed using a thermally conductive structural adhesive or double-sided adhesive, and is not limited herein.

[0062] This design manner can keep the relative positions of two adjacent battery cells **21** fixed, reducing the probability of separating adjacent battery cells **21** within the battery pack **20**, and facilitating assembly.

[0063] According to some embodiments of this application, a maximum size of the reinforcing

member **31** along the first direction X is larger than a maximum size of the battery pack **20** along the first direction X.

[0064] Specifically, the maximum size of the reinforcing member **31** along the first direction X is larger than the maximum size of the battery pack **20** along the first direction X, which may mean that the maximum length of the reinforcing member **31** along the first direction X is greater than the maximum length of the battery pack **20** along the first direction X.

[0065] This design manner of the dimensions can make at least one end of the reinforcing member **31** along the first direction X exceed the battery pack **20**. When the battery **100** is subjected to external impact in the first direction X, the reinforcing member **31** absorbs the external compressive force, and the battery pack **20** retracts inwards relative to the reinforcing member **31** in the first direction X. Therefore, the battery pack **20** does not absorb the external compressive force, reducing the probability of the battery pack **20** being squeezed and deformed. Additionally, the reinforcing member **31** can transfer the external impact received at one end to the other end of the reinforcing member **31**, further buffering the external impact and improving the safety of the battery **100**.

[0066] In some embodiments, referring to FIG. **3** and FIG. **5**, FIG. **5** is a locally enlarged view at part B in FIG. **3** according to an embodiment. Two ends of the reinforcing member **31** along the first direction X exceed the battery pack **20**. When the battery **100** is subjected to external impact in the first direction X, the impact force first comes into contact with the reinforcing member **31**, and the reinforcing member **31** absorbs the external compressive force, reducing the probability of the battery pack **20** being squeezed and deformed.

[0067] According to some embodiments of this application, as shown in FIGS. **3** and **5**, multiple reinforcing members **31** are provided, at least two of the multiple reinforcing members **31** are respectively located on two sides of the battery pack **20** along the first direction X (that is, the second direction Y of the battery pack **20**), and the reinforcing members **31** on two sides of the battery pack **20** along the first direction X are both connected to the battery pack **20**.

[0068] Specifically, as shown in FIGS. **2** and **3**, in the second direction Y, the reinforcing members **31** may be disposed on both sides of any set of battery packs **20**, and the reinforcing members **31** may be fixedly connected to the adjacent battery packs **20**. The specific connection method may be adhesion using a thermally conductive structural adhesive or double-sided adhesive. This design manner allows for high structural stability between the battery pack **20** and the reinforcing member **31**.

[0069] According to some embodiments of this application, the reinforcing member **31** is configured to be connected to a surface with a maximum area of the battery cell **21**. This design manner allows for a large connection area between the reinforcing member **31** and the battery cell **21**, enhancing the structural stability of the battery **100**.

[0070] According to some embodiments of this application, the reinforcing member **31** has a heat exchange chamber (not shown in the figure), and the heat exchange chamber is used for accommodating a heat exchange medium.

[0071] Specifically, a heat exchange chamber is provided in the reinforcing member **31**, and one or more heat exchange chambers may be provided, which is not limited herein. For example, when it is needed to cool the battery pack **20**, the heat exchange medium may be a cold fluid. After passing through the heat exchange chamber, the cold fluid can reduce heat conduction between two adjacent sets of battery packs **20**, preventing a chain reaction caused by thermal runaway of a single battery cell **21**, thus enhancing the safety of the battery **100**.

[0072] In summary, when the reinforcing member **31** absorbs the external compressive force to reduce the probability of the battery pack **20** being squeezed and deformed, it also serves the heat exchange function, so that the battery **100** does not need to be additionally provided with a heat exchange member, thereby reducing costs.

[0073] According to some embodiments of this application, the reinforcing member **31** is adhered

to the battery cell **21**.
[0074] Specifically, the adjacent side surfaces of the reinforcing member **31** and the adjacent battery cell **21** are adhered and fixed to each other. In other words, the side surface of the battery cell **21** in the second direction Y is adhered and fixed to the reinforcing member **31**. This design manner can keep the relative positions of the reinforcing member **31** and the battery cell **21** fixed, reducing the probability of separating the reinforcing member **31** and the battery cell **21**, and facilitating assembly.
[0075] This adhesion may be completed using a thermally conductive structural adhesive or double-sided adhesive, and is not limited herein.
[0076] According to some embodiments of this application, multiple battery packs **20** are provided, multiple reinforcing members **31** are provided, the multiple battery packs **20** are side by side along a second direction Y, and the second direction Y intersects the first direction X, and one of the multiple reinforcing members **31** is located between adjacent two of the battery packs **20** and is connected to the two adjacent battery packs **20**.
[0077] Specifically, referring to FIGS. **2** and **3**, in the second direction Y, a reinforcing member **31** may be disposed between any two adjacent sets of battery packs **20**, and the reinforcing members **31** may be fixedly connected to the adjacent battery packs **20**. The specific connection method may be adhesion using a thermally conductive structural adhesive or double-sided adhesive. This design manner allows for high structural stability between the battery pack **20** and the reinforcing member **31**.
[0078] According to some embodiments of this application, the battery **100** further includes an end plate **11**, the end plate **11** is located at an end of the reinforcing member **31** along the first direction X, and the reinforcing member **31** is connected to the end plate **11**.
[0079] The end plate **11** is provided at the end of the reinforcing member **31** in the first direction X, which may mean that the end plate **11** is provided at both ends of the reinforcing member **31** in the first direction X, or that the end plate **11** is provided at one of the two ends of the reinforcing member **31** in the first direction X. The reinforcing member **31** may be connected to the end plate **11** in the first direction X by welding, adhering, abutting, and the like, which is not limited herein.
[0080] Taking abutment as an example, when the end plate **11**, the battery pack **20**, and the reinforcing member **31** are assembled to form the battery **100**, the reinforcing member **31** does not contact the end plate **11**; after the battery **100** is subjected to external impact in the first direction X, the reinforcing member **31** contacts the end plate **11**, causing an abutment, and the reinforcing member **31** absorbs the external compressive force. Alternatively, the reinforcing member **31** can abut against the end plate **11** in the first direction X, which may mean that when the end plate **11**, the battery pack **20**, and the reinforcing member **31** are assembled to form the battery **100**, the reinforcing member **31** directly contacts the end plate **11** to cause an abutment, and after the battery **100** is subjected to external impact in the first direction X, the reinforcing member **31** directly absorbs the external impact force.
[0081] The end plate **11** is disposed at the end of the reinforcing member **31** in the first direction X, such that when the battery **100** is squeezed and deformed in the first direction X, the external impact force in the first direction X is further absorbed, reducing the probability of the impact force damaging the battery pack **20**.
[0082] According to some embodiments of this application, the battery **100** further includes a bottom plate **40** and a cover plate **50**, the bottom plate **40** and the cover plate **50** are respectively located on two mutually parallel side surfaces of the battery pack **20** along the first direction X, the bottom plate **40** is opposite the cover plate **50**, and the reinforcing member **31** is connected to at least one of the bottom plate **40** and the cover plate **50**.
[0083] Specifically, as shown in FIG. **2**, the battery **100** further includes a cover plate **50** and a bottom plate **40** that are spaced apart along the third direction Z, which is perpendicular to the first direction X and the second direction Y. Further, the reinforcing member **31** may be connected to the

cover plate **50**. The reinforcing member **31** may also be connected to the bottom plate **40**; or the reinforcing member **31** may be connected to both the cover plate **50** and the bottom plate **40** simultaneously. The connection may be fixed by welding, FDS (FlowDrill Screw, thermal self-tapping technology), adhering, or the like. This design can improve the safety of the battery **100**.

[0084] According to some embodiments of this application, referring to FIGS. **2** and **3**, the battery **100** further includes a frame **10**, the frame **10** encloses a middle space, and the battery pack **20** is located in the middle space. The battery **100** further includes a buffer member **32**, and along the first direction X, the buffer member **32** is located between the battery pack **20** and an inner surface of the frame **10**.

[0085] Specifically, in this embodiment, the frame **10** includes two end plates **11** and two side plates **12**, the two end plates **11** are spaced apart along the first direction X, the two side plates **12** are spaced apart along the second direction Y, and the two end plates **11** are perpendicular to the two side plates **12**, so the formed middle space may be in the shape of a rectangular box. Certainly, in other embodiments, the middle space may also be of different shapes, which is not excessively limited in this application. Further, the adjacent end plate **11** and the side plate **12**, which are adjacent to each other, are fixedly connected, and the specific connection method may be welding, FDS (FlowDrill Screw, thermal self-tapping technology), adhering, and the like. Alternatively, they may be integrally formed by casting. This design can maintain the shape of the battery **100**, with the battery pack **20** placed in the frame **10**, reducing the probability of dispersing the battery pack **20**.

[0086] Further, the cover plate **50** and the bottom plate **40** fit with the frame **10** to form a sealed middle space. This design manner can reduce the erosion of external moisture or the like on the battery pack **20** in the middle space, thereby protecting the battery pack **20**. Further, the cover plate **50**, the bottom plate **40**, and the frame **10** can be fixedly connected by welding, FDS (FlowDrill Screw, thermal self-tapping technology), adhering, and the like.

[0087] It should be noted that in the above embodiment, the frame **10** includes an end plate **11** connected to the reinforcing member **31**. In other embodiments, the end plate **11** and the frame **10** may also be independent components. That is, the frame **10** and the reinforcing member **31** are connected via an additional end plate **11**, which is not limited in this application.

[0088] In the first direction X, at least one end of the battery pack **20** has a first spacing **321** with the adjacent end plate **11**, and the buffer member **32** is located within the first spacing **321**. In the first direction X, both ends of the buffer member **32** can be connected to the end plate **11** and the battery pack **20** respectively, so that when one of the two end plates **11** is subjected to external impact, the impact force is transmitted through the battery pack **20** and the buffer member **32** to the other of the two end plates **11**, while being absorbed by the buffer member **32**. The connection methods of the buffer member **32** with the battery pack **20** and the frame **10** include welding, adhering, abutting, and the like.

[0089] Optionally, taking abutment as an example, in the first direction X, both ends of the buffer member **32** can abut against the end plate **11** and the battery pack **20** respectively, which may mean that when the buffer member **32** is mounted, both ends of the buffer member **32** do not come in contact with the end plate **11** and the battery pack **20**, and when the battery **100** is subjected to external impact, both ends of the buffer member **32** abut against the end plate **11** and the battery pack **20** respectively, while the buffer member **32** absorbs the impact force; or mean that when the buffer member **32** is mounted, both ends of the buffer member **32** directly abut against the end plate **11** and the battery pack **20**, and when the battery **100** is subjected to external impact, the buffer member **32** directly absorbs the impact force, reducing the probability of the impact force damaging the battery pack **20**.

[0090] In summary, in the first direction X, when the end plate **11** is squeezed and deformed, the buffer member **32** can absorb the external impact force, and the external impact force can also be transmitted through the reinforcing member **31** to the buffer member **32** at the other end. The buffer

members **32** at both ends can absorb the impact force, reducing the damage to the battery pack **20** caused by the impact force.

[0091] In a specific embodiment, the material of the buffer member **32** may be, but is not limited to, foam, ceramic fiber, and other thermally insulating and deformable materials. When there are multiple buffer members **32** adjacent to the same end plate **11** in the first direction X, the multiple buffer members **32** may be independently formed and mounted in the corresponding first spacings **321** respectively. Alternatively, the multiple buffer members **32** may also be connected to each other and formed integrally, and mounted in the corresponding first spacing **321** simultaneously.

[0092] According to some embodiments of this application, referring to FIGS. **3** and **4**, as the multiple battery packs **20** and the multiple reinforcing members **31** are provided, the reinforcing members **31** and the battery packs **20** are arranged alternately, and the buffer member **32** is sandwiched between adjacent two of the reinforcing members **31**.

[0093] In the first direction X, a first assembly gap **311** is present between the end of the reinforcing member **31** and the adjacent end plate **11**, and the size of the first spacing **321** along the first direction X is larger than the size of the first assembly gap **311** along the first direction X.

[0094] From the assembly perspective, the reinforcing member **31** does not fully contact the end plates **11** at both ends, and a small gap, that is, the first assembly gap **311** is present between the reinforcing member **31** and the frame **10**, making it convenient for the operator to place the reinforcing member **31** into the frame **10** during mounting of the battery **100**. To ensure that after the end plate **11** is squeezed and deformed, the reinforcing member **31** can abut against the end plate **11** to buffer the impact stress, and thus the size of the first assembly gap is smaller than the size of the first spacing. After the frame **10** deforms as the battery **100** is subjected to compressive force, the first assembly gap **311** between the frame **10** and the reinforcing member **31** is eliminated, and the frame **10** contacts the reinforcing member **31**, releasing stress and reducing the probability of the frame **10** damaging the battery pack **20**.

[0095] In the first direction X, the stiffness of the reinforcing member **31** is greater than the stiffness of the buffer member **32**. The buffer member **32** is made of a thermally insulating and deformable material such as foam or ceramic fiber, and the reinforcing member **31** is made of a metal material such as alloy. Due to the high stiffness of the reinforcing member **31**, the probability of deformation of the reinforcing member **31** when the impact stress is buffered is low, allowing for high stability of the overall structure formed by the reinforcing member **31** and the battery pack **20**. Due to the low stiffness of the buffer member **32**, it can buffer stress through deformation and other means, reducing the stress on the side of the battery pack **20** facing the end plate **11**.

[0096] In the first direction X, both ends of the battery pack **20** have first spacings **321** with the two end plates **11**, and buffer members **32** are arranged in the first spacings **321**.

[0097] In the first direction X, the end plate **11**, the buffer member **32**, the battery pack **20**, the buffer member **32**, and the end plate **11** are sequentially arranged to form the battery **100**. The buffer members **32** are arranged in the both first spacings **321**. When both sides of the battery **100** collide, the buffer members **32** at both ends can absorb the impact force. When one side of the battery **100** collides, the buffer member **32** at one end absorbs the impact force, while the reinforcing member **31** transmits the impact force to the buffer member **32** at the other end, and the buffer member **32** at the other end can also absorb the impact force. In this way, the buffer members **32** at both ends can absorb the impact force, better protecting the battery pack **20**.

[0098] According to some embodiments of this application, referring to FIG. **6**, the reinforcing member **31** includes the heat exchange chamber, the heat exchange chamber is used for accommodating the heat exchange medium, the battery **100** further includes a current collecting tube **60**, and the current collecting tube **60** is connected to an end of the reinforcing member **31** along the first direction X to communicate with the heat exchange chamber, and the buffer member **32** includes an avoidance groove **324**, and the avoidance groove **324** corresponds to the current collecting tube **60** in position.

[0099] Specifically, the two ports of the heat exchange chamber in the reinforcing member **31** are connected to the two current collecting tubes **60** outside the reinforcing member **31**, and the two current collecting tubes **60** pass through the frame **10** to be connected to the outside of the battery **100**. The current collecting tubes **60** deliver the external heat exchange medium to the heat exchange chamber. The heat exchange medium flows inside the heat exchange chamber to cool the battery pack **20**, and after cooling, it enters another current collecting tube **60** and is delivered to the outside of the battery **100**. The two current collecting tubes **60** pass through the frame **10**. Specifically, two openings may be provided on the second side plate **12**, and the current collecting tubes **60** pass through the openings to be connected to an external storage apparatus of the heat exchange medium. The heat exchange medium may be condensate water.

[0100] In the first direction X, two ports are respectively arranged at both ends of the reinforcing member **31**. The current collecting tube **60** passes through the buffer member **32** and the port adjacent to the buffer member **32** along the second direction Y. That is, in this case, the current collecting tube **60** is arranged between the reinforcing member **31** and the end plate **11** and extends along the second direction Y. The two ports of the current collecting tube **60** are respectively connected to both ends of the reinforcing member **31**, thus forming a loop between the reinforcing members **31** through the current collecting tube **60**, facilitating the flow of the heat exchange medium. A buffer member **32** is provided outside the current collecting tube **60**, which can reduce the damage to the current collecting tube **60** caused by the compressive force.

[0101] According to some embodiments of this application, referring to FIG. **2**, FIG. **6**, and FIG. **7**. FIG. **6** and FIG. **7** are respectively a schematic structural diagram and a right side view of the buffer member **32** according to some embodiments of this application. The avoidance groove **324** is located on the surface of the buffer member **32** away from the battery cell **21** along the first direction X.

[0102] In the first direction X, the buffer member **32** includes a first surface **322** facing the battery pack **20**. The outermost battery cell **21** of the battery pack **20** includes a second surface **211** facing the buffer member **32**. The first surface **322** is identical to the adjacent second surface **211**, and the first surface **322** is adhered to the second surface **211** via a second adhesive layer.

[0103] When the battery cell **21** is a cuboid, the second surface **211** of the battery cell **21** is a rectangular plane, and the first surface **322** of the buffer member **32** is a rectangular plane identical to the second surface **211** of the battery cell **21**. When the battery cell **21** is a cylinder, the second surface **211** of the battery cell **21** is a curved surface, and the first surface **322** of the buffer member **32** is a complete curved surface wrapping the second surface **211** of the battery cell **21**. When the battery cell **21** is of another shape, it is only needed to change the contact surface of the buffer member **32** with the battery cell **21** to the shape of the side surface of the battery cell **21**.

[0104] The first surface **322** of the buffer member **32** and the second surface **211** of the battery cell **21** are completely fitted and connected via the second adhesive layer. The first surface **322** is identical to the adjacent second surface **211**, which can disperse the compressive force and reduce stress concentration. The first surface **322** is adhered to the second surface **211** via the second adhesive layer, reducing the probability of separation between the buffer member **32** and the battery pack **20**.

[0105] The buffer member **32** is provided with an avoidance groove **324** on the side facing the adjacent end plate **11**. The current collecting tube **60** passes through the avoidance groove **324** and is in contact with at least part of the inner wall of the avoidance groove **324**.

[0106] The avoidance groove **324** of the buffer member **32** matches the structure of the current collecting tube **60**, allowing the buffer member **32** to wrap around the current collecting tube **60**, fixing and protecting the position of the current collecting tube **60**, and reducing the movement of the current collecting tube **60**. The side of the buffer member **32** facing the adjacent battery cell **21** is a complete plane, ensuring that the surface of the buffer member **32** with the avoidance groove **324** does not directly contact the battery cell **21**, thereby preventing stress concentration on the

battery cell **21**.
[0107] In some embodiments of this application, the battery **100** further includes a bottom plate **40**, the bottom plate **40** is connected to the frame **10**, and a bottom of the buffer member **32** facing the bottom plate **40** is provided with a guiding structure.
[0108] The buffer member **32** is provided with a guide surface **3231** on the side facing the adjacent end plate **11**. The guide surface **3231** is configured to interfere with the end plate **11** when the buffer member **32** is placed into the middle space along the third direction Z perpendicular to the first direction X and the second direction Y, thereby guiding the buffer member **32** into the middle space.
[0109] In the first direction X, the buffer member **32** includes a third surface **323** facing the adjacent end plate **11**; and in the direction of the cover plate **50** pointing to the bottom plate **40**, the third surface **323** includes a top abutment surface **3232** and a guide surface **3231** interconnected to each other. The top abutment surface **3232** abuts against the adjacent end plate **11**, and the guide surface **3231** gradually leaves the adjacent end plate **11**. The guide surface **3231** is a slope. During the process of placing the buffer member **32** into the middle space, the initial contact size is small, and as it enters the middle space, the size gradually increases until the entire buffer member **32** is placed into the middle space.
[0110] The guiding structure facilitates the operator in correctly placing the buffer member **32** into the middle space. The buffer member **32** can also be fixedly connected to the battery pack **20** first, providing a guiding function when the battery pack **20** is mounted into the middle space.
[0111] After the battery **100** is mounted, the buffer member **32** may come in contact with and abut against the bottom plate **40**, or the buffer member **32** may come in contact with and abut against the cover plate **50**, or the buffer member **32** may come in contact with and abut against both the bottom plate **40** and the cover plate **50**. In the third direction Z, the height of the buffer member **32** is equal to the height of the frame **10**, the height of the frame **10** is greater than the height of the battery pack **20**, and the height of the battery pack **20** is greater than or equal to the height of the buffer member **32**. The above design manner allows the stress absorbed by the buffer member **32** to be transmitted to the bottom plate **40** and/or the cover plate **50** abutting against it, thereby further reducing the impact on the battery pack **20**.
[0112] According to some embodiments of this application, still refer to FIG. **3** and FIG. **8**. FIG. **8** is a schematic structural diagram of the frame **10** and the separating member according to some embodiments of this application. The battery **100** further includes a separating member, the separating member is located in the frame **10**, the separating member extends along the first direction X and is connected to an inner surface of the frame **10**, so as to separate the middle space into at least two sub-spaces, and at least one of the at least two sub-spaces is used for accommodating the battery pack **20** and the reinforcing member **31**.
[0113] Specifically, the separating member includes a first separating member **70** and a second separating member **80**. The first separating member **70** and the second separating member **80** are arranged in the middle space and are spaced apart between the two second side plates **12** along the second direction Y. The first separating member **70** and the second separating member **80** are further bridged between the two end plates **11** along the first direction X. Multiple battery packs **20** are elastically clamped between the first separating member **70** and the second separating member **80** along the second direction Y.
[0114] During assembly of the battery **100**, the battery packs **20** are first adhered using the reinforcing member **31**, to form an integral module. The module is assembled into a rectangular frame composed of the first separating member **70**, the second separating member **80**, and the two end plates **11** by pressing with tooling. After the tooling is removed, the battery pack **20** rebounds and tightly presses against the first separating member **70** and the second separating member **80**. The battery packs **20** form an entity through the compressive force of the reinforcing member **31**, the first separating member **70**, the second separating member **80**, the cover plate **50**, and the top

plate, enhancing the overall stiffness of the battery **100**. This eliminates the need for additional separating members, saving the space and weight.

[0115] The first separating member **70** and the second separating member **80** may be connected to the end plate **11** by welding or bolts, and connected to the bottom plate **40** by welding, FDS, or adhering, or may be integrally formed by casting.

[0116] In the second direction Y, the first separating member **70** and the second separating member **80** are respectively spaced apart from the adjacent second side plates **12**. Gaps are present between the first separating member **70** and the second separating member **80** and the adjacent second side plates **12**. When the battery **100** is subjected to compressive force, the first separating member **70** and the second separating member **80** alleviate the swelling of the battery pack **20**, while enhancing the stiffness of the battery **100** in the second direction Y. The gap between the first separating member **70** and the second side plate **12** may be used for placing some control chips and other components, while the gap between the second separating member **80** and the second side plate **12** may be an assembly gap. Therefore, in the second direction Y, the gap size between the second separating member **80** and the second side plate **12** may be smaller than the gap size between the first separating member **70** and the second side plate **12**.

[0117] The second separating member **80** is provided with a notch portion **81**, and the current collecting tube **60** passes through the notch portion **81**.

[0118] The first separating member **70** is provided with a notch matching the output electrode base **23** for placing the output electrode base **23**, and the output electrode base **23** is fixedly connected to the first separating member **70**. The second separating member **80** is provided with a notch portion **81** matching the current collecting tube **60**. The notch portion **81** may be at both ends of the second separating member **80**, and the notch portion **81** can fix the current collecting tube **60** on the second separating member **80**, reducing the movement of the current collecting tube **60**.

[0119] Finally, in a specific application scenario, as shown in FIG. **2**, the battery **100** includes the battery pack **20**, the reinforcing member **31**, the bottom plate **40**, the cover plate **50**, the frame **10**, the buffer member **32**, the current collecting tube **60**, and the separating member. The frame **10**, the bottom plate **40**, and the separating member may be integrally connected by welding, FDS, adhering, or the like, or may be integrally formed by casting. In the first direction X, two adjacent battery cells **21** are connected using an adhesive. The two sides of the reinforcing member **31** are adhered to the surfaces with the maximum area of the adjacent battery cells **21**. The two ends of the reinforcing member **31** extend beyond the battery pack **20** in the first direction X, so that all battery cells **21** are adhered to the reinforcing member **31** to form one integral large module. The large module is pressed by tooling and assembled into a rectangular frame formed by the first separating member **70** and the second separating member **80**. After the tooling is removed, the battery pack **20** of the battery **100** rebounds and tightly presses against the separating members. The bottom of the battery pack **20** is fixed to the bottom plate **40** by adhesion. The battery packs **20** form an entity through the compressive force of the reinforcing member **31** as well as the separating members, and the cover plate **50**, enhancing the overall stiffness of the battery **100**, and saving the space and weight. The reinforcing member **31** has a heat exchange chamber, and the heat exchange chamber is connected to the current collecting tube **60**, facilitating the flow of the heat exchange medium. The buffer member **32** wraps around the current collecting tube **60** between the battery pack **20** and the frame **10**. In the first direction X, when the battery **100** is squeezed and deformed, the frame **10** is squeezed and deformed. The buffer member **32** can absorb the external impact force, and the external impact force may also be transmitted through the reinforcing member **31** to the buffer member **32** at the other end. The buffer member **32** at two ends can absorb the impact force, reducing the stress on the battery pack **20** and lowering the risk of damage, liquid leakage, or fire caused by compressive force on the battery pack **20**.

[0120] Although this application has been described with reference to some embodiments, various modifications to this application and replacements of the components therein with equivalents can

be made without departing from the scope of this application. In particular, as long as there is no structural conflict, the various technical features mentioned in the implementations can be combined in any manner. This application is not limited to the specific embodiments disclosed in this specification but includes all technical solutions falling within the scope of the claims.

Claims

1. A battery, comprising: a battery pack comprising multiple battery cells stacked along a first direction; and a reinforcing member extending along the first direction; wherein the reinforcing member is disposed on at least one side of the battery pack along the first direction, and the reinforcing member is connected to the battery pack.
2. The battery according to claim 1, wherein adjacent two of the multiple battery cells along the first direction are connected to each other through an adhesive.
3. The battery according to claim 1, wherein a maximum size of the reinforcing member along the first direction is larger than a maximum size of the battery pack along the first direction.
4. The battery according to claim 3, wherein two ends of the reinforcing member along the first direction exceed the battery pack.
5. The battery according to claim 1, wherein multiple reinforcing members are provided, at least two of the multiple reinforcing members are respectively located on two sides of the battery pack along the first direction, and the reinforcing members on two sides of the battery pack along the first direction are both connected to the battery pack.
6. The battery according to claim 1, wherein the reinforcing member is configured to be connected to a surface with a greatest area of the battery cell.
7. The battery according to claim 1, wherein the reinforcing member has a heat exchange chamber, and the heat exchange chamber is configured to accommodate a heat exchange medium.
8. The battery cell according to claim 7, wherein the reinforcing member is adhered to the battery cell.
9. The battery according to claim 1, wherein: multiple battery packs are provided, multiple reinforcing members are provided, the multiple battery packs are side by side along a second direction, and the second direction intersects the first direction, and one of the multiple reinforcing members is located between adjacent two of the battery packs and is connected to the two adjacent battery packs.
10. The battery according to claim 1, further comprising: an end plate, located at an end of the reinforcing member along the first direction; wherein the reinforcing member is connected to the end plate.
11. The battery according to claim 10, further comprising: a bottom plate and a cover plate, respectively located on two mutually parallel side surfaces of the battery pack along the first direction, wherein the bottom plate is opposite the cover plate; wherein the reinforcing member is connected to at least one of the bottom plate and the cover plate.
12. The battery according to claim 1, further comprising: a frame, wherein the frame encloses a middle space, and the battery pack is located in the middle space; and a buffer member, wherein along the first direction, the buffer member is located between the battery pack and an inner surface of the frame.
13. The battery according to claim 12, wherein multiple battery packs are provided, multiple reinforcing members are provided, the reinforcing members and the battery packs are arranged alternately, and the buffer member is sandwiched between adjacent two of the reinforcing members.
14. The battery according to claim 13, further comprising: a current collecting tube; wherein: the reinforcing member comprises a heat exchange chamber, and the heat exchange chamber is configured to accommodate a heat exchange medium; the current collecting tube is connected to an

end of the reinforcing member along the first direction to communicate with the heat exchange chamber; and the buffer member comprises an avoidance groove, and the avoidance groove corresponds to the current collecting tube in position.

15. The battery according to claim 14, wherein the avoidance groove is located on a surface of the buffer member away from the battery cell along the first direction.

16. The battery according to claim 14, further comprising: a bottom plate, wherein the bottom plate is connected to the frame, and a bottom of the buffer member facing the bottom plate is provided with a guiding structure.

17. The battery according to claim 12, further comprising: a separating member, located in the frame, wherein the separating member extends along the first direction and is connected to an inner surface of the frame, so as to separate the middle space into at least two sub-spaces, and at least one of the at least two sub-spaces is used for accommodating the battery pack and the reinforcing member.

18. An electric apparatus, comprising the battery according to claim 1, wherein the battery is configured to supply electric energy for the electric apparatus.