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HOUSING FOR BATTERY CELL, BATTERY CELL, BATTERY, AND ELECTRIC DEVICE

Abstract

The disclosure provides a housing for a battery cell, a battery cell, a battery, and an electric device. A containment chamber is formed inside the housing for the battery cell for containing electrolyte, the housing includes a gas withdrawal structure, through which gases in the containment chamber can be withdrawn, and the gas withdrawal structure includes: a gas withdrawal hole arranged on the housing; and a liquid retaining structure cooperating with the gas withdrawal hole, arranged in the containment chamber, the liquid retaining structure is configured to prevent the electrolyte from being withdrawn from the gas withdrawal hole, where the liquid retaining structure includes: a first body, which is a hollow structure; and a liquid stopper arranged in the first body.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] The disclosure is a continuation of international application PCT/CN2022/103983, filed Jul. 5, 2022, which claims priority to Chinese Patent Application No. 202221235154.5 entitled “HOUSING FOR BATTERY CELL, BATTERY CELL, BATTERY, AND ELECTRIC DEVICE” filed on May 23, 2022, both of which are incorporated by reference in their entirety into this disclosure.

TECHNICAL FIELD

[0002] The present disclosure relates to the technology field of battery, and more particularly, relates to a housing for a battery cell, a battery cell, a battery, and an electric device.

BACKGROUND

[0003] With the rapid development of clean energy and the national policy support for the field of new energy, power batteries with high voltage, high energy density and long cycle life have attracted much attention. Power batteries are not only used in energy storage power supply systems such as hydropower stations, thermal power stations, wind power stations and solar power stations, but also widely used in electric transportation means such as electric bicycles, electric motorcycles and electric vehicles, as well as in military equipment and aerospace and other fields. The market demand for power batteries is also constantly increasing with the continuous expansion of the application fields.

[0004] The manufacture and production of a power battery consists of a series of processing steps, including: electrode sheet production process, battery assembly process, and processes of liquid injection, formation, aging and etc. Battery formation is a very important step in the production. The formation process is mainly the process of the initial charge of the battery after being liquid injected and rested to form a solid electrolyte interface film. With the progress of the charge, voltage rises inside the battery along with gases generation, and the generated gases need to be withdrawn immediately. But in practice, the electrolyte will also be withdrawn while the gases are withdrawn, resulting in loss of large amount of electrolyte, and seriously affecting the battery performance.

SUMMARY

[0005] This disclosure is intended to address at least one of the technical problems existing in the prior art. To this end, one object of the present disclosure is to provide a housing for a battery cell to improve the issue of electrolyte loss during the formation.

[0006] In a first aspect, the embodiments of this disclosure provide a housing for a battery cell, a containment chamber is formed inside the housing for containing electrolyte, the housing includes a gas withdrawal structure, through which gases in the containment chamber can be withdrawn, and the gas withdrawal structure includes: a gas withdrawal hole arranged on the housing; and a liquid

retaining structure cooperating with the gas withdrawal hole, arranged in the containment chamber, the liquid retaining structure is configured to prevent the electrolyte from being withdrawn from the gas withdrawal hole, where the liquid retaining structure includes: a first body, which is a hollow structure; and a liquid stopper arranged in the first body.

[0007] In the technical solutions of the embodiments of this disclosure, in case where the gases are withdrawn from the inside of the housing, the liquid retaining structure may prevent the electrolyte from being withdrawn, thereby reducing the electrolyte loss and improving the battery performance.

[0008] In some embodiments, the liquid retaining structure includes: a first body, which is a hollow structure; a first through hole and at least one second through hole arranged on the first body and in communication with inside of the first body, the first through hole being in communication with the gas withdrawal hole; and a liquid stopper arranged in the first body, the liquid stopper is configured to prevent the electrolyte, which has entered into the first body through the at least one second through hole, from being withdrawn from the gas withdrawal hole. The hollow first body, the first through hole and the second through hole may provide a passage for the gases. The liquid stopper in the first body may ensure the smooth discharge of the gases during the formation process, and prevent the electrolyte from being withdrawn, reducing the electrolyte loss and improving the battery performance.

[0009] In some embodiments, the liquid stopper may include multiple spheres, which are used to move around in random patterns within the first body to prevent the electrolyte from being withdrawn from the gas withdrawal hole. During the formation process, the gases can be withdrawn from the inside of the housing through a passage consisting of the second through hole, the hollow first body and the first through hole. The multiple spheres move around in random patterns due to the gas flow and prevent the electrolyte from being withdrawn from the gas withdrawal hole, reducing the electrolyte loss and improving the battery performance. In case where there is no gas in the housing (for example, the gases in the housing have been totally withdrawn), the spheres may block the gas withdrawal hole due to the suction force, and further prevent the electrolyte from being withdrawn.

[0010] In some embodiments, the liquid stopper may include multiple baffles arranged on two opposite side walls of the first body, wherein the first through hole is arranged on a top wall of the first body adjacent to the two side walls, and the projections of at least two baffles on a plane where the top wall is located overlap, such that the baffles can prevent the electrolyte from being withdrawn from the gas withdrawal hole, where at least two baffles are located on the two opposite side walls of the first body. During the formation process, the gases can be withdrawn from the inside of the housing through a passage consisting of the second through hole, the hollow first body and the first through hole. By arranging the multiple baffles, a bent gas passage is formed to allow the gases to pass through to be withdrawn and prevent the electrolyte from being withdrawn through the gas withdrawal hole, reducing the electrolyte loss and improving the battery performance. In case where there is no gas in the housing (for example, the gases in the housing have been totally withdrawn), the bent gas passage can also prevent the electrolyte from being withdrawn.

[0011] In some embodiments, the multiple baffles are arranged alternatively in a direction perpendicular to the top wall. The multiple baffles located on the two opposite side walls are arranged alternatively, which may increase the cooperation of the adjacent baffles in the direction perpendicular to the top wall, so as to more effectively prevent the electrolyte from being withdrawn during the formation process.

[0012] In some embodiments, the first body includes opposite first end and second end, the first through hole is arranged on the first end, and the at least one second through hole is arranged on a side wall of the first body between the first end and the second end. The at least one second through hole is arranged on the side wall of the first body, which allows the gases in the housing to be more

easily withdrawn from the inside of the housing through the passage consisting of the second through hole, the hollow first body and the first through hole, speed up the gas withdrawal and facilitate the liquid stopper to prevent the electrolyte from being withdrawn.

[0013] In some embodiments, the second end may be a closed end, or the second end may be provided with multiple third through holes. In case where the second end of the first body is a closed end, the gases are discharged from the inside of the housing through the passage consisting of the second through hole, the hollow first body and the first through hole. The second end, which functions as a closed end, and the liquid stopper prevent the electrolyte from being withdrawn together. In case where the second end is provided with multiple third through holes, the gases are discharged from the inside of the housing through the passage consisting of the second through hole, the third through holes, the hollow first body and the first through hole, which further speed up the gas withdrawal.

[0014] In some embodiments, the liquid stopper includes multiple spheres, each of which has a diameter greater than an inner diameter of the third through holes. The diameter of each sphere greater than the inner diameter of the third through holes may prevent the liquid stopper, which is the sphere, from escaping from the first body.

[0015] In some embodiments, each of the spheres has a diameter greater than an inner diameter of the second through hole. The diameter of each sphere greater than the inner diameter of the second through hole may prevent the liquid stopper, which is the sphere, from escaping from the first body.

[0016] In some embodiments, the number of the multiple spheres is 2 to 20. The number of the spheres in the first body being in a range of 2 to 20 facilitates the spheres to collide with each other due to the gas flow during the formation process, so as to move around in random patterns, preventing the electrolyte from being withdrawn, reducing the electrolyte loss, and improving the battery performance.

[0017] In some embodiments, the number of the multiple spheres is 3 to 5. The number of the spheres in the first body being in a range of 3 to 5 allows the spheres to move around in random patterns to prevent the electrolyte from being withdrawn, but not prevent the gases from being withdrawn.

[0018] In some embodiments, the diameter of each sphere is greater than the inner diameter of the gas withdrawal hole. The diameter of each sphere greater than the inner diameter of the gas withdrawal hole may prevent the liquid stopper, which is the sphere, from escaping from the first body to the outside of the housing.

[0019] In some embodiments, the housing further includes a liquid injection hole through which the electrolyte is injected into the containment chamber, the gas withdrawal hole and the liquid injection hole are a same hole on the housing in communication with the containment chamber. The gas withdrawal hole being also used as the liquid injection hole simplifies the production process of the housing and reduces the production cost of the housing. When injected from the through hole, the electrolyte may be dispersed by the first body and the liquid stopper in the first body, which thus reduces the impact on the cell assembly (such as the electrode sheets and the separator) in the housing, protects the cell assembly, and at the same time facilitates the infiltration of the electrolyte and improves the battery performance.

[0020] In some embodiments, the housing may include a housing body with an opening and an end cover covering at the opening, the containment chamber is formed between the housing body and the end cover, where the liquid retaining structure is integrated with the end cover or installed on the end cover through a fastener. The liquid retaining structure being integrated with the end cover may simplify the production process of the housing. The liquid retaining structure being installed on the end cover through a fastener may increase the flexibility in using the housing. In case where the liquid retaining structure is damaged, it can be replaced in time so as to reduce the maintenance cost.

[0021] In some embodiments, the gas withdrawal structure may further include: a second body

engaging with the end cover, installed on the end cover through a fastener, where the liquid retaining structure is integrated with the second body. In case where the liquid retaining structure is integrated with the second body, and the second body is installed on the end cover through a fastener, it is possible to replace the liquid retaining structure in time when it is damaged, reducing the maintenance cost. The liquid retaining structure cooperating with the end cover through the second body increases the operation area of the liquid retaining structure and the end cover, reduces the probability of damage at the interface between the liquid retaining structure and the end cover, and increases the service life of the housing.

[0022] In a second aspect, the embodiments of this disclosure provide a battery cell including the housing in the above embodiments.

[0023] In a third aspect, the embodiments of this disclosure provide a battery including the battery cell in the above embodiments.

[0024] In a first aspect, the embodiments of this disclosure provide an electric device including the battery in the above embodiments.

[0025] The above description is only an overview of the technical solutions of the present disclosure. For purposes of better understanding the technical means of the present disclosure, the implementation in accordance with the contents of the specification, and making the above and other purposes, features and advantages of the present disclosure more apparent, the specific implementations of the present disclosure are given below.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] In order to more clearly explain the technical solutions in the embodiments of the present disclosure, the following provides a brief description of the attached drawings necessary in the embodiments of this disclosure. Obviously, the drawings described below are only some embodiments of the present disclosure, and other drawings may also be obtained according to these drawings by those skilled in the art without paying creative labor.

[0027] In the attached drawings, unless otherwise specified, identical reference numbers throughout multiple drawings indicate identical or similar parts or elements. These drawings are not necessarily drawn to scale. It should be understood that these drawings illustrate only some of the implementations disclosed according to this disclosure and should not be regarded as limit to the scope of this disclosure.

[0028] FIG. 1 is a schematic structure diagram of a vehicle of some embodiments of this disclosure;

[0029] FIG. 2 is an explosive view of a battery of some embodiments of this disclosure;

[0030] FIG. 3 is a schematic explosive view of a battery cell of some embodiments of this disclosure;

[0031] FIG. 4A is a schematic top view of a housing for a battery cell of some embodiments of this disclosure;

[0032] FIG. 4B is a schematic partial section view along I-I' in FIG. 4A;

[0033] FIG. 5A is a schematic side view of a liquid retaining structure of some embodiments of this disclosure;

[0034] FIG. 5B is a schematic side view of a liquid retaining structure of some embodiments of this disclosure;

[0035] FIG. 6 is a schematic side view of a liquid retaining structure of some embodiments of this disclosure;

[0036] FIG. 7 is a schematic structure diagram of a liquid retaining structure of some embodiments of this disclosure;

[0037] FIG. 8 is schematic structure diagram of a liquid retaining structure of some embodiments of this disclosure;

[0038] FIG. 9 is a schematic explosive view of a gas withdrawal structure of some embodiments of this disclosure.

[0039] The reference numbers are as follows: [0040] vehicle **10**; [0041] battery **100**, controller **200**, motor **300**; [0042] box **110**, battery cell **120**, first part **110A**, second part **110B**; [0043] housing **1000**, cell assembly **2000**; [0044] end cover **1100**, housing body **1200**, containment chamber **1300**, gas withdrawal structure **1400**; [0045] gas withdrawal hole **1410**, liquid retaining structure **1420**, second body **1430**, [0046] first body **1421**, first through hole **1422**, second through hole **1423**, liquid stopper **1424**, [0047] first end **1421A**, second end **1421B**, third through hole **1425**.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0048] The embodiments of the technical solutions of this disclosure will be described in detail in combination with the attached drawings below. The following embodiments and drawings are intended only to more clearly describe the technical solutions of the present disclosure and are therefore used as examples only and cannot be used to limit the scope of protection of the present disclosure. The drawings are indicative only of the parts relating to the technical solutions of the disclosure, which do not represent the actual structure of the product as such.

[0049] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as those generally understood by those skilled in the technical field of this disclosure. The terms used herein are for the purpose of describing specific embodiments only and are not intended to limit the disclosure. The terms “including” and “having” and any variations thereof in the specification, claims and the above description of the drawings of this disclosure are intended to cover non-exclusive inclusion.

[0050] In the description of the embodiments of this disclosure, the technical terms “first”, “second”, and etc., are used only to distinguish between different objects and are not to be construed as indicating or implying relative importance or as implicitly indicating the quantity, particular order or priorities of the indicated technical features. In the description of the embodiments of this disclosure, “multiple” means more than two, similarly, “multiple sets” means more than two sets (including two sets), and “multiple pieces” means more than two pieces (including two pieces).

[0051] Reference to “embodiments” herein means that a particular feature, structure or characteristic described in conjunction with an embodiment may be included in at least one embodiment of this disclosure. The presence of the phrase at various positions in the specification does not necessarily refer to a same embodiment, nor is it an independent or alternative embodiment mutually exclusive with other embodiments. It is understood, both explicitly and implicitly, by those skilled in the art that the embodiments described herein may be combined with other embodiments.

[0052] In the description of the embodiments of this disclosure, the term “and/or” is merely an associative relationship describing associated objects, indicating that there can be three relationships, for example, A and/or B can indicate the following three cases: A alone, both A and B, and B alone. In addition, the character “/” herein generally means that the associated objects are in an “or” relationship.

[0053] In the description of the embodiments of this disclosure, the technical terms “center”, “longitudinal”, “lateral”, “length”, “width”, “thickness”, “up”, “down”, “front”, “back”, “left”, “right”, “vertical”, “horizontal”, “top”, “bottom”, “inside”, “outside”, “clockwise”, “anticlockwise”, “axial”, “radial”, “circumferential” and etc. indicates a location or position relationship which is the location or position relationship shown in the drawings. They are used only for the convenience of describing and simplifying the description of the embodiments of this disclosure, and not to indicate or imply that the device or element referred to must have a specific orientation, or be constructed and operated in a specific orientation, and therefore cannot be construed as a limitation

of the embodiments of this disclosure.

[0054] In the description of the embodiments of this disclosure, unless otherwise expressly specified and limited, the technical terms “installation”, “connection”, “linkage”, “fixation” and etc. shall be construed in a broad sense, for example, it may be a fixed connection, or a detachable connection, or an one-piece integration; it may be a mechanical connection or an electrical connection; it may be a direct connection, also may be an indirect connection through an intermediate medium, and it may be the connection within two components or an interaction between two components. For those skilled in the art, the specific meaning of the above terms in the embodiments of this disclosure may be understood on a case-by-case basis.

[0055] As mentioned above, in the processing steps of the production of the battery (for example, the battery formation process), gases will be generated inside the battery, and the generated gases need to be withdrawn immediately, otherwise the gases will react with the electrolyte, which will seriously affect the battery performance.

[0056] The applicant has noted that in practice, the electrolyte will also be withdrawn while the gases are withdrawn, which results in loss of large amount of electrolyte. Therefore, the electrolyte must be replenished after the gases have been withdrawn, which reduces the production efficiency. Further, although the electrolyte may be replenished to compensate the loss, the infiltration of the electrolyte on the electrode sheets might be affect if the electrolyte has not been replenished in time, and it will adversely affect the performance and service life of the battery.

[0057] In order to alleviate the loss of electrolyte in the formation process, the applicant has found that the housing of the battery cell may be designed to include a liquid retaining structure, and by arranging the liquid retaining structure at the gas withdrawal hole, it is possible that the gases in the housing can be smoothly discharged through the liquid retaining structure in the formation process while the electrolyte is blocked by the liquid retaining structure and falls back inside the housing.

[0058] In a battery cell including such housing, loss of large amount of electrolyte may be avoided in the battery production process due to the liquid retaining structure, which not only improves the production efficiency, but also ensures the performance and service life of the battery.

[0059] The housing for a battery cell, the battery cell including the housing and the battery disclosed in the embodiments of the present disclosure may, but is not limited to, be used in electric devices such as vehicles, ships or aircrafts. It is possible to use the housing for a battery cell, the battery cell including the housing and the battery disclosed in this disclosure, and others to assembly a power supply system of the electric device, which facilitates alleviating the adverse effects on the performance of the battery resulted from the loss of electrolyte during the production process of the battery and improving the stability and life of the battery.

[0060] The embodiments of this disclosure provide an electric device using a battery as a power supply. The electric device may be but not limited to a mobile phone, a tablet, a laptop computer, an electric toy, an electric tool, an electric vehicle, an electric car, a ship, a spacecraft, etc. Among them, electric toys can include fixed or movable electric toys, such as game consoles, electric car toys, electric ship toys and electric aircraft toys, spacecrafts can include aircrafts, rockets, space shuttles and spacecrafts, etc.

[0061] For the convenience of illustration, the following embodiments explain in an example where the electric device of some embodiments of this disclosure is a vehicle **10**.

[0062] Please refer to FIG. **1**, which is a schematic structure diagram of a vehicle **10** provided in some embodiments of this disclosure. The vehicle **10** may be a fuel vehicle, a gas vehicle or a new energy vehicle, and the new energy vehicle may be a pure electric vehicle, a hybrid electric vehicle or an extended-range electric vehicle, etc. Inside the vehicle **10** a battery **100** is arranged, and the battery **100** may be arranged at the bottom, the head or the rear of the vehicle **10**. The battery **100** may be used to power the vehicle **10**, for example, the battery **100** may be used as an operational power supply of the vehicle **10**. The vehicle **10** may also include a controller **200** and a motor **300**, where the controller **200** is used to control the battery **100** to power the motor **300**, for example, for

supplying power necessary during the starting, the navigation and the travel of the vehicle **10**.

[0063] In some embodiments of this disclosure, the battery **100** may be used not only as an operational power supply of the vehicle **10**, but also as a drive power supply of the vehicle **10**, to provide drive power to the vehicle **10** in place or partly in place of fuel or natural gas.

[0064] Please refer to FIG. 2, which is an explosive view of a battery **100** provided in some embodiments of this disclosure. The battery **100** includes a box **110** and a battery cell **120**, where the battery cell **120** is contained in the box **110**. In this case, the box **110** is used to provide a containment space for the battery cell **120**, and the box **110** may adopt a variety of structures. In some embodiments, the box **110** may include a first part **110A** and a second part **110B**, where the first part **110A** and the second part **110B** engage with each other, and the first part **110A** and the second part **110B** define the containment space together for containing the battery cell **120**. The second part **110B** may be a hollow structure with an opening at one side, the first part **110A** may be a plate structure, and the first part **110A** covers the opening side of the second part **110B**, so that the first part **110A** and the second part **110B** define the containment space together. The first part **110A** and the second part **110B** each may also be a hollow structure with an opening at one side, and the opening side of the first part **110A** covers the opening side of the second part **110B**. Of course, the box **110** formed by the first part **110A** and the second part **110B** may have a variety of shapes of, for example a cylinder, cuboid and so on.

[0065] In the battery **100**, there may be multiple battery cells **120**. The multiple battery cells **120** may be connected in series or in parallel or in series-parallel, where battery cells being connected in series-parallel refers to that the multiple battery cells **120** are series-connected in some parts and parallel in others. The multiple battery cells **120** may be directly connected in series or in parallel or in series-parallel together, and then the whole structure formed by the multiple battery cells **120** is contained in the box **110**. Of course, the battery **100** may also be a whole structure formed by connecting in series or in parallel or in series-parallel multiple battery modules each formed by multiple battery cells **120** connected in series or in parallel or in series-parallel, and contained in the box **110**. The battery **100** may also include other structures, for example, the battery **100** may also include a bus component for realizing the electrical connection among the multiple battery cells **120**.

[0066] In this case, each battery cell **120** may be a secondary battery or a primary battery; may also be a lithium sulfur battery, a sodium ion battery or a magnesium ion battery, but is not limited to this. The battery cell **120** may be cylindrical, flat, cuboid or in other shapes.

[0067] Please refer to FIG. 3, which is a schematic explosive view of a battery cell **120** provided in some embodiments of this disclosure. The battery cell **120** refers to the smallest unit that forms a battery. As shown in FIG. 3, the battery cell **120** may include a housing **1000** consisting of an end cover **1100** and a housing body **1200**, a cell assembly **2000**, and other functional components.

[0068] The end cover **1100** means a component which covers at the opening of the housing body **1200** to isolate the internal environment of the battery cell **120** from the external environment. Unlimitedly, the shape of the end cover **1100** may be adapted to the shape of the housing body **1200** to engage with the housing body **1200**. In some embodiments, the end cover **1100** may be made of a material with a certain hardness and strength (such as aluminum alloy), so that the end cover **1100** is not prone to deformation when squeezed and collided, so that the battery cell **120** may have higher structural strength and the safety performance may also be improved. The end cover **1100** may be provided with functional components such as electrode terminals. The electrode terminals may be used for the electrical connection with the cell assembly **2000** to output or input electrical power of the battery cells **120**. In some embodiments, the end cap **1100** may also be provided with a pressure relief mechanism for releasing internal pressure when the internal pressure or temperature of the battery cell **120** reaches a threshold value. The end cover **1100** may also be made of a variety of materials, such as copper, iron, aluminum, stainless steel, aluminum alloy, plastic, etc. There is no special limitation on it in the embodiments of this disclosure. In some

embodiments, the inner side of the end cover **1100** may also be provided with an insulation part, which may be used to isolate the electrical connection parts in the housing body **1200** from the end cover **1100** to reduce the risk of short circuit. For example, the insulation part may be plastic, rubber, etc.

[0069] The housing body **1200** is a component for engaging with the end cover **1100** to form the internal environment of the battery cell **120**, where the formed internal environment may be used to contain the cell assembly **2000**, the electrolyte, and other components. The housing body **1200** and the end cover **1100** may be separate components, and it is possible to arrange an opening at the housing body **1200** and cover the end cover **1100** at the opening to form the internal environment of the battery cell **120**. Unlimitedly, it is also possible to integrate the end cover **1100** with the housing body **1200**. Specifically, the end cover **1100** and the housing body **1200** may form a common connection surface before the other components are put into the housing, and the end cover **1100** is allowed to cover the housing body **1200** when it is necessary to enclose the interior of the housing body **1200**. The housing body **1200** may have a variety of shapes and sizes, such as rectangular shape, cylindrical shape, hexagonal prism shape and so on. In particular, the housing body **1200** may be shaped according to the specific shape and size of the cell assembly **2000**. The material of the housing body **1200** may be various, such as copper, iron, aluminum, stainless steel, aluminum alloy, plastic, and etc. The embodiments of this disclosure do not limit on this.

[0070] The cell assembly **2000** is a component of the battery cell **120** where electrochemical reaction takes place. One or more cell components **2000** may be contained within the housing body **1200**. The cell assembly **2000** is mainly formed by winding or stacking the positive and negative electrode sheets, with usually a separator disposed therebetween. The parts with the active substance in the positive and negative electrode sheets constitute the main part of the cell assembly, and the parts without the active substance in the positive and negative electrode sheets respectively constitute the tabs. The positive and negative electrode tabs may be all located at one end of the body part or respectively located at the two ends of the body part. During the charging and discharging of the battery, the positive and negative electrode active substances react with the electrolyte, and the tabs connect the electrode terminals to form current loops.

[0071] Please refer to FIG. 4A and FIG. 4B. FIG. 4A is a schematic top view of a housing **1000** for a battery cell provided in some embodiments of this disclosure, and FIG. 4B is a schematic partial section view along I-I' in FIG. 4A. Some embodiments of the present disclosure provide a housing **1000** for a battery cell. A containment chamber **1300** is formed inside the housing **1000** for containing the electrolyte. The housing **1000** includes a gas withdrawal structure **1400**, through which the gases in the containment chamber **1300** can be withdrawn. The gas withdrawal structure **1400** includes: a gas withdrawal hole **1410** arranged on the housing **1000**; a liquid retaining structure **1420** cooperating with the gas withdrawal hole **1410**, arranged in the containment chamber **1300**, and the liquid retaining structure **1420** is configured to prevent the electrolyte from being withdrawn from the gas withdrawal hole **1410**.

[0072] The housing **1000** is a component that insulates the internal environment of the battery cell from the external environment. The housing **1000** may be in various shapes (e.g. rectangular shape, cylindrical shape, hexagonal shape, etc.) and various sizes. The gas withdrawal hole **1410** of the gas withdrawal structure **1400** is in communication with the containment chamber **1300** for discharging the excess gases from the housing **1000** to the outside during the formation process. The liquid retaining structure **1420** may be arranged under the gas withdrawal hole **1410**, and the liquid retaining structure **1420** may be made of a lightweight, corrosion-resistant polymer material.

[0073] It should be understood that the electrolyte in the containment chamber **1300** may be blocked and not withdrawn with the gas flow due to the liquid retaining structure **1420** arranged under the gas withdrawal hole **1410** when the gases are withdrawn from inside of the housing **1000**, which reduces the electrolyte loss.

[0074] Please refer to FIGS. 5A, 5B and 6, which are schematic side views of a liquid retaining

structure **1420** provided in some embodiments of this disclosure. According to some embodiments of this disclosure, the liquid retaining structure **1420** may include: a first body **1421**, which is a hollow structure; a first through hole **1422** and at least one second through hole **1423**, which are arranged on the first body **1421** and in communication with the inside of the first body **1421**, and in which the first through hole **1422** is in communication with the gas withdrawal hole **1410**; and a liquid stopper **1424**, arranged in the first body **1421**, where the liquid stopper **1424** is configured to prevent the electrolyte, which has entered into the first body **1421** through at least one second through hole **1423**, from being withdrawn from the gas withdrawal hole **1410**.

[0075] The shape of the first body **1421** may be but is not limited to cuboid, cube or round shape, etc. In some embodiments, in case where the first body **1421** is cuboid or cube shape, the side length of the first body **1421** may be greater than or equal to 3 millimeters (mm) and less than or equal to 30 mm; in case where the first body **1421** is round in shape, the radius of the first body **1421** may be greater than or equal to 3 mm and less than or equal to 30 mm. In some embodiments, in case where the shape of the first body **1421** is cuboid or cube, the side length of the first body **1421** may be greater than or equal to 5 mm and less than or equal to 10 mm; in case where the first body **1421** is round in shape, the radius of the first body **1421** may be greater than or equal to 5 mm and less than or equal to 10 mm. The second through hole **1423**, the hollow first body **1421**, and the first through hole **1422** may provide a passage for the gases.

[0076] In some embodiments, the number of the second through holes is multiple. The multiple second through holes may be arranged in a grid pattern, or may be arranged in other pattern or irregularly arranged. The first through hole **1422** and the second through hole **1423** may have, but are not limited to, circular shape, polygonal shape, regular grid shape, or irregular grid shape.

[0077] The liquid stopper **1424** may be connected or not connected with the first body **1421**. In some embodiments, the liquid stopper **1424** may include multiple liquid sub-stoppers which may be configured to cooperate with each other to block the electrolyte from being withdrawn or to block the gas withdrawal hole **1410** in case where there is no gas inside the housing **1000** (for example, the gases have been totally withdrawn).

[0078] The liquid stopper **1424** may be made of a lightweight, corrosion-resistant polymer material.

[0079] During the formation process, the liquid stopper **1424** in the first body **1421** may prevent the electrolyte from being withdrawn and allow it to fall back into the containment chamber **1300**, which reduces the electrolyte loss and improves the battery performance. The liquid stopper **1424** may also block the gas withdrawal hole **1410** in case where there is no gas inside the housing **1000** (for example, the gases have been totally withdrawn) to further prevent the electrolyte loss.

[0080] Please refer to FIG. 6. According to some embodiments of this disclosure, the liquid stopper **1424** includes multiple spheres, which are used to move around in random patterns within the first body **1421** to prevent the electrolyte from being withdrawn from the gas withdrawal hole.

[0081] The spheres may be made of a lightweight, corrosion-resistant polymer material, and capable of moving around in random patterns due to the gas flow during the gas withdrawal to prevent the electrolyte from being withdrawn from the gas withdrawal hole and to allow the gases to be withdrawn from the gas withdrawal hole. In case where there is no gas in the containment chamber or where the gases have been totally withdrawn, the continuous gas withdrawal will make the electrolyte to flow to the gas withdrawal hole and drive the multiple spheres to block the gas withdrawal hole, thereby reducing the electrolyte loss.

[0082] The shape of the sphere may include a round sphere or a spheroid (for example, a rugby-shaped sphere). The shapes and dimensions of the multiple spheres may be same with or different from each other.

[0083] The multiple spheres may move around in random patterns due to the gas flow during the formation process, which may not only ensure the smooth discharge of the gases, but also block the electrolyte that is withdrawn together, change the movement direction of the electrolyte, so as to

prevent the electrolyte from being withdrawn from the gas withdrawal hole **1410**. In case where there is no gas in the housing **1000** (for example, the gases have been totally withdrawn), the small spheres will gather at the gas withdrawal hole **1410** due to the suction force, and further prevent the electrolyte from being withdrawn.

[0084] Please refer to FIG. 5A and FIG. 5B. According to some other embodiments of this disclosure, the liquid stopper **1424** includes multiple baffles arranged on two opposite side walls of the first body **1421**, where the first through hole is arranged on the top wall of the first body **1421** adjacent to the two side walls, and the projections of at least two baffles on the plane where the top wall is located overlap, such that the baffles can prevent the electrolyte from being withdrawn from the gas withdrawal hole **1410**, and in this case at least two baffles are located on the two opposite side walls of the first body **1421**.

[0085] One end of the baffle may be connected with the first body **1421**, and the other end may be a free end. The shape of the baffles may be, but is not limited to, a regular or irregular sheet. The baffles may be disposed at an angle (FIG. 5A) or horizontally (FIG. 5B). Being horizontal means being parallel to the plane where the top wall of the first body **1421** is located, and being at an angle means that the angle between it and the plane where the top wall of the first body **1421** is located is greater than zero. The multiple baffles may form a bent gas passage to allow the gases to be withdrawn therethrough and prevent the electrolyte from being withdrawn through the gas withdrawal hole, or to block the gas withdrawal hole **1410** due to the suction force in case where there is no gas in the housing **1000** (for example, the gases have totally been withdrawn).

[0086] The multiple baffles may form a bent gas passage, which may not only allow the gases to be discharged smoothly, but also block the electrolyte from being withdrawn together, or block the gas withdrawal hole **1410** due to the suction force in case where there is no gas in the housing **1000** (for example, the gases have totally been withdrawn), to further prevent the electrolyte loss.

[0087] Please refer to FIG. 5A and FIG. 5B. According to some embodiments of this disclosure, the multiple baffles are arranged alternatively in a direction perpendicular to the top wall.

[0088] The multiple baffles being arranged alternatively means that two adjacent baffles in the direction perpendicular to the top wall are located on different side walls.

[0089] The multiple baffles located on the two opposite side walls are arranged alternatively, which may increase the cooperation of the adjacent baffles in the direction perpendicular to the top wall, so as to more effectively prevent the electrolyte from being withdrawn during the formation process.

[0090] Please refer to FIGS. 7 and 8, which are schematic structure diagrams of a liquid retaining structure of some embodiments of this disclosure. According to some embodiments of this disclosure, the first body **1421** includes opposite first end **1421A** and second end **1421B**, the first through hole **1422** is arranged on the first end **1421A**, and at least one second through hole **1423** is arranged on the side wall of the first body **1421** between the first end **1421A** and the second end **1421B**.

[0091] In FIGS. 7 and 8, the multiple through holes **1423** are shown to be arranged in a grid, but the shape of the multiple second through holes **1423** is not limited thereto.

[0092] The first end **1421A** may be either an open end or a closed end. In the example illustrated in the figure, the first end **1421A** is an open end, forming the first through hole **1422**.

[0093] In case where the gas withdrawal hole **1410** is also used as the injection hole for injection of the electrolyte, the second through hole **1423** is arranged on the side wall to prevent the impact of the electrolyte on the cell assembly.

[0094] Since at least one second through hole **1423** is located on the side wall of the first body **1421**, the gas generated during the battery production may rise to around the liquid retaining structure **1420**, which facilitates preventing the electrolyte from being withdrawn, and may be easily discharged from the inside of the housing body through a passage consisting of the second through hole **1423**, the hollow first body **1421** and the first through hole **1422**.

[0095] According to some embodiments of this disclosure, the second end **1421B** is a closed end, or the second end **1421B** is provided with multiple third through holes **1425**.

[0096] The shape of the third through holes **1425** may be, but is not limited to, a circular shape, polygon shape, regular or irregular grid shape, etc.

[0097] In case where the second end **1421B** of the first body **1421** is a closed end, the gases are discharged from the inside of the housing through the passage consisting of the second through hole **1423**, the hollow first body **1421** and the first through hole **1422**. The second end **1421B**, which functions as a closed end, and the liquid stopper **1424** prevent the electrolyte from being withdrawn together. In case where the second end **1421B** is provided with multiple third through holes **1425**, the gases are discharged from the inside of the housing body through the passage consisting of the second through hole **1423**, the third through holes **1425**, the hollow first body **1421** and the first through hole **1422**, which further speed up the gas withdrawal.

[0098] According to some embodiments of this disclosure, the liquid stopper **1424** includes multiple spheres, each of which has a diameter greater than the inner diameter of the third through holes **1425**.

[0099] In some embodiments, the inner diameter of the third through holes **1425** may be greater than or equal to 0.5 mm and less than or equal to 10 mm. In some other embodiments, the diameter of the third through hole **1425** may be greater than or equal to 1 mm and less than or equal to 3 mm. In some embodiments, the diameter of the spheres may be greater than or equal to 1 mm and less than or equal to 10 mm. In some other embodiments, the diameter of the spheres may be greater than or equal to 1.5 mm and less than or equal to 3.5 mm.

[0100] The diameter of each sphere is greater than the inner diameter of the third through hole **1425** to prevent the liquid stopper **1424**, which is the sphere, from escaping from the first body **1421**.

[0101] According to some embodiments of this disclosure, the diameter of each sphere is greater than the inner diameter of the second through hole **1423**.

[0102] In some embodiments, the inner diameter of the second through hole **1423** may be greater than or equal to 0.5 mm and less than or equal to 10 mm. In some other embodiments, the inner diameter of the second through hole **1423** may be greater than or equal to 1 mm and less than or equal to 3 mm. In some embodiments, the diameter of the spheres may be greater than or equal to 1 mm and less than or equal to 10 mm. In some other embodiments, the diameter of the spheres may be greater than or equal to 1.5 mm and less than or equal to 3.5 mm.

[0103] The diameter of each sphere greater than the inner diameter of the second through hole **1423** prevents the liquid stopper **1424**, which is the sphere, from escaping from the first body **1421**.

[0104] According to some embodiments of this disclosure, the number of the multiple spheres is 2 to 20.

[0105] The number of the multiple spheres being 2 to 20 means that the number of the spheres is greater than or equal to 2 and less than or equal to 20.

[0106] The number of the spheres in the first body **1421** is in a range of 2 to 20, which facilitates the spheres to collide with each other due to the gas flow during the formation process, so as to move around in random patterns, preventing the electrolyte from being withdrawn, reducing the electrolyte loss, and improving the battery performance.

[0107] According to some embodiments of this disclosure, the number of the multiple spheres is 3 to 5.

[0108] The number of the multiple spheres being 3 to 5 means that the number of the spheres is greater than or equal to 3 and less than or equal to 5.

[0109] The number of the spheres in the first body **1421** is in a range of 3 to 5, so that the spheres may move around in random patterns to prevent the electrolyte from being withdrawn, but not prevent the gases from being withdrawn.

[0110] According to some embodiments of this disclosure, the diameter of each sphere is greater

than the inner diameter of the gas withdrawal hole **1410**.

[0111] In some embodiments, the inner diameter of the gas withdrawal hole **1410** may be greater than or equal to 1 mm and less than or equal to 3 mm. In some other embodiments, the inner diameter of the gas withdrawal hole **1410** may be 2 mm. In some embodiments, the diameter of the spheres may be greater than or equal to 1 mm and less than or equal to 10 mm. In some other embodiments, the diameter of the spheres may be greater than or equal to 1.5 mm and less than or equal to 3.5 mm.

[0112] The diameter of each sphere greater than the inner diameter of the gas withdrawal hole **1410** may prevent the liquid stopper **1424**, which is the sphere, from escaping from the first body **1421** to the outside of the housing **1000**.

[0113] According to some embodiments of the present disclosure, the housing **1000** further includes a liquid injection hole through which the electrolyte is injected into the containment chamber **1300**. The gas withdrawal hole **1410** and the liquid injection hole may be the same hole on the housing **1000** in communication with the containment chamber **1300**.

[0114] The gas withdrawal hole **1410** is also used as a liquid injection hole, which simplifies the production process of the housing **1000** and reduces the production cost. When injected from the through hole, the electrolyte may be dispersed by the first body **1421** and the liquid stopper **1424** in the first body **1421**, which thus reduces the impact on the cell assembly (such as the electrode sheets and the separator) in the containment chamber **1300**, protects the cell assembly, and at the same time facilitates the infiltration of the electrolyte and improves the battery performance.

[0115] Please refer to FIG. 4B. According to some embodiments of this disclosure, the housing **1000** includes a housing body **1200** with an opening and an end cover **1100** covering at the opening. A containment chamber **1300** is formed between the housing body **1200** and the end cover **1100**. In this case, the liquid retaining structure **1420** is integrated with the end cover **1100** or installed on the end cover **1100** through a fastener.

[0116] The fastener may be, but are not limited to, an adhesive layer, a snap structure or a screw structure, etc.

[0117] The liquid retaining structure **1420** being integrated with the end cover **1100** may simplify the production process of the housing **1000**. The liquid retaining structure **1420** being installed on the end cover **1100** through a fastener may increase the flexibility in using the housing **1000**. In case where the liquid retaining structure **1420** is damaged, it can be replaced in time so as to reduce the maintenance cost.

[0118] Please refer to FIG. 9, which is a schematic explosive view of a gas withdrawal structure **1400** of some embodiments of this disclosure. According to some embodiments of this disclosure, the gas withdrawal structure **1400** further includes: a second body **1430** engaging with the end cover **1100**, installed on the end cover **1100** through a fastener. In this case, the liquid retaining structure **1420** is integrated with the second body **1430**.

[0119] The second body **1430** may be, but not limited to, plastic. The fastener may be, but not limited to an adhesive layer, a snap structure or a screw structure, etc.

[0120] The liquid retaining structure **1420** is integrated with the second body **1430**, and the second body **1430** is installed on the end cover **1100** through a fastener. It is possible to replace the liquid retaining structure **1420** in time when it is damaged, reducing the maintenance cost. The liquid retaining structure **1420** cooperates with the end cover **1100** through the second body **1430**, which increases the operation area of the liquid retaining structure **1420** and the end cover **1100**, reduces the probability of damage at the interface between the liquid retaining structure **1420** and the end cover **1100**, and increases the service life of the housing **1000**.

[0121] Please refer to FIG. 7 and FIG. 8. In specific embodiments, the liquid retaining structure **1420** may be a rectangular structure with side lengths greater than or equal to 5 mm and less than or equal to 10 mm. The first through hole **1422** may be located at the first end **1421A**, the second through hole **1423** may be located on a side wall of the second end **1421B** and the first end **1421A**,

and the second end **1421B** may be a closed end (FIG. 7) or provided with a third through hole **1425** (FIG. 8). The first through hole **1422** is in communication with the gas withdrawal hole. The second through hole **1423** and the third through hole **1425** may be in the shape of a regular grid, and the size of each grid may be greater than or equal to 1 mm and less than or equal to 3 mm. Multiple small spheres may be contained inside the first body **1421**, the number of the small spheres may be 3 to 5, the diameter of the spheres may be greater than the inner diameters of the second through hole **1423** and of the third through hole **1425**, and may be greater than or equal to 1.5 mm and less than or equal to 3.5 mm. The small spheres are made of a lightweight, corrosion-resistant polymer material.

[0122] In case where the gases are withdrawn from the inside of the housing **1000**, during the discharge of the gases through the passage consisting of the second through hole **1423**, the first body **1421** and the first through hole **1422**, or through the passage consisting of the second through hole **1423**, the third through hole **1425**, the first body **1421** and the first through hole **1422**, the gas flow will drive the small spheres to move around in random patterns in the first body **1421**. When the suction force is strong, the electrolyte in the containment chamber **1300** will also be sucked and move towards the gas withdrawal hole **1410** until the electrolyte hits the small spheres which are moving around in random patterns at a high speed, thereby the electrolyte will change its movement direction to spread out, and finally fall back into the containment chamber **1300**. When the gases in the housing **1000** have been totally withdrawn, the small spheres will gather at the gas withdrawal hole due to the suction force, further preventing the electrolyte from being withdrawn, thereby reducing the amount of the electrolyte loss in the formation process.

[0123] Some embodiments of this disclosure provide a battery cell including the housing for a battery cell in the above embodiments.

[0124] Some embodiments of this disclosure provide a battery including the battery cell of the above embodiments.

[0125] Some embodiments of this disclosure provide an electric device including the battery of the above embodiment, where the battery is used to supply electrical power to the electric device.

[0126] Finally, it should be noted that the above embodiments are used only to illustrate the technical solutions of the present disclosure, rather than limit it. Although the detailed description of the present disclosure has been provided with reference to the above embodiments, it should be understood by those skilled in the art that it is possible to modify the technical solutions recited in the above embodiments, or make equivalent replacement of some or all of the technical features thereof. While such modification or replacement shall not make the essence of the corresponding technical solutions depart from the scope of the technical solutions of the respective embodiments of the present disclosure, which shall be covered in the scope of the claims and specification of the present disclosure. In particular, the technical features referred to in the various embodiments may be combined in any manner, provided that there is no structural conflict. This disclosure is not limited to the specific embodiments disclosed herein, but includes all technical solutions falling within the scope of the claims.

Claims

1. A housing for a battery cell, wherein a containment chamber is formed inside the housing for containing electrolyte, the housing comprises a gas withdrawal structure, through which gases in the containment chamber are withdrawn, and the gas withdrawal structure comprises: a gas withdrawal hole arranged on the housing; and a liquid retaining structure cooperating with the gas withdrawal hole, arranged in the containment chamber, the liquid retaining structure being configured to prevent the electrolyte from being withdrawn from the gas withdrawal hole, wherein the liquid retaining structure comprises: a first body, which is a hollow structure; and a liquid stopper arranged in the first body.

2. The housing according to claim 1, wherein the liquid retaining structure further comprises: a first through hole and at least one second through hole arranged on the first body and in communication with inside of the first body, the first through hole being in communication with the gas withdrawal hole, wherein the liquid stopper is configured to prevent the electrolyte, which has entered into the first body through the at least one second through hole, from being withdrawn from the gas withdrawal hole.
 3. The housing according to claim 2, wherein the liquid stopper comprises multiple spheres, which are used to move around in random patterns within the first body to prevent the electrolyte from being withdrawn from the gas withdrawal hole.
 4. The housing according to claim 2, wherein the liquid stopper comprises multiple baffles arranged on two opposite side walls of the first body, wherein the first through hole is arranged on a top wall of the first body adjacent to the two side walls, and projections of at least two of the baffles on a plane where the top wall is located overlap, such that the baffles can prevent the electrolyte from being withdrawn from the gas withdrawal hole, wherein at least two of the baffles are located on the two opposite side walls of the first body.
 5. The housing according to claim 4, wherein the multiple baffles are arranged alternatively in a direction perpendicular to the top wall.
 6. The housing according to claim 2, wherein the first body comprises opposite first end and second end, the first through hole is arranged on the first end, and the at least one second through hole is arranged on a side wall of the first body between the first end and the second end.
 7. The housing according to claim 6, wherein the second end is a closed end, or the second end is provided with multiple third through holes.
 8. The housing according to claim 7, wherein the liquid stopper is multiple spheres, each of which has a diameter greater than an inner diameter of the third through holes.
 9. The housing according to claim 3, wherein each of the spheres has a diameter greater than an inner diameter of the second through holes.
 10. The housing according to claim 3, wherein number of the multiple spheres is 2 to 20.
 11. The housing according to claim 10, wherein the number of the multiple spheres is 3 to 5.
 12. The housing according to claim 3 wherein each of the spheres has a diameter greater than an inner diameter of the gas withdrawal holes.
 13. The housing according to claim 1, wherein the housing further comprises a liquid injection hole through which the electrolyte is injected into the containment chamber, the gas withdrawal hole and the liquid injection hole are a same hole on the housing in communication with the containment chamber.
 14. The housing according to claim 1, wherein the housing comprises a housing body with an opening and an end cover covering at the opening, the containment chamber is formed between the housing body and the end cover, wherein the liquid retaining structure is integrated with the end cover or installed on the end cover through a fastener.
 15. The housing according to claim 14, wherein the gas withdrawal structure further comprises: a second body engaging with the end cover, installed on the end cover through a fastener, wherein the liquid retaining structure is integrated with the second body.
 16. A battery cell comprising the housing according to claim 1.
 17. A battery comprising the battery cell according to claim 16.
 18. An electric device comprising the battery according to claim 17, wherein the battery is used to supply electrical power.
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