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Battery module, battery pack comprising the same, and vehicle

Abstract

A battery module includes a plurality of cylindrical battery cells each having a positive electrode terminal and a negative electrode terminal on one side of each respective battery cell; a busbar including an electrically conductive material and having a plate shape; and at least two types of connecting members each including an electrically conductive material, and having an elongated body, wherein one end in a direction in which the body extends is joined to the busbar, and the other end is joined to any one of the positive electrode terminal and the negative electrode terminal, the at least two types of connecting members having different joined areas depending on a joined terminal among the positive electrode terminal and the negative electrode terminal.

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Background/Summary

TECHNICAL FIELD

(1) The present disclosure relates to a battery module, a battery pack comprising the same and a vehicle, and more particularly, to a battery module with reliability of electrical connection between internal components and improved durability of a product, a battery pack comprising the same and a vehicle.

(2) The present application claims the benefit of Korean Patent Application No. 10-2020-0080587 filed on Jun. 30, 2020 with the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND ART

(3) Recently, with the rapid increase in demand for portable electronic products such as laptop computers, video cameras and mobile phones and the extensive development of electric vehicles, accumulators for energy storage, robots and satellites, many studies are being made on high performance secondary batteries that can be repeatedly recharged.

(4) Currently, commercially available secondary batteries include nickel-cadmium batteries, nickel-hydrogen batteries, nickel-zinc batteries, lithium secondary batteries and the like, and among them,

lithium secondary batteries have hale or no memory effect, and thus they are gaining more attention than nickel-based secondary batteries for their advantages that recharging can be done whenever it is convenient, the self-discharge rate is very low and the energy density is high.

(5) Additionally, a battery module including a plurality of secondary batteries or battery cells has a serious problem with stability and operating efficiency when overvoltage, overcurrent or overheat occurs in the battery cells, so a means for detection and control is necessary. This configuration may be, for example, a Battery Management System (BMS) equipped with various types of devices.

(6) In this instance, to detect the current of the plurality of battery cells of the battery module, electrical connection is established between the plurality of battery cells using a busbar.

(7) However, the battery module applied in an environment in which strong impacts or vibration are applied such as a vehicle needs to maintain stable electrical connection between the plurality of battery cells. That is, when deformation or damage occurs in the internal components of the busbar during or after fabrication of the battery module or while the battery module is in use, the stable electrical connection between the plurality of battery cells is not maintained, causing a detection failure of the amount of current of the BMS, a calculation failure of the battery electricity capacity, or an output reduction of the battery module.

(8) Moreover, when a part of the busbar is broken by external impacts, some pieces may cause a short circuit between the plurality of battery cells.

DISCLOSURE

Technical Problem

(9) The present disclosure is designed to solve the above-described problem, and therefore the present disclosure is directed to providing a battery module with reliability of electrical connection between internal components and improved durability of a product, a battery pack comprising the same and a vehicle.

(10) These and other objects and advantages of the present disclosure may be understood by the following description, and will be apparent from the embodiments of the present disclosure. In addition, it will be readily appreciated that the objects and advantages of the present disclosure may be realized by means and combinations thereof.

Technical Solution

(11) To achieve the above-described object, a battery module according to the present disclosure includes a plurality of cylindrical battery cells having a positive electrode terminal and a negative electrode terminal on one side, a busbar including an electrically conductive material and having a plate shape, and at least two types of connecting members including an electrically conductive material, and having an elongated body, wherein one end in a direction in which the body extends is joined to the busbar, and the other end is joined to any one of the positive electrode terminal and the negative electrode terminal, the at least two types of connecting members having different joined areas depending on a joined terminal among the positive electrode terminal and the negative electrode terminal.

(12) Additionally, the positive electrode terminal may have a larger exposed outer surface area than the negative electrode terminal, the at least two types of connecting members may include a first connecting member connected to the negative electrode terminal and a second connecting member connected to the positive electrode terminal, and the joined area between the second connecting member and the positive electrode terminal may be larger than the joined area between the first connecting member and the negative electrode terminal.

(13) Furthermore, the connecting member may include a first connecting member having a wire shape extending in a lengthwise direction, and a second connecting member having a strap shape extending in the lengthwise direction.

(14) Moreover, the battery module may further include a module case having an internal space in which the plurality of cylindrical battery cells is received, wherein the busbar is mounted on an

outer side of the module case, the module case having a first exposure hole through which at least part of the negative electrode terminal is exposed to outside and a second exposure hole through which at least part of the positive electrode terminal is exposed.
(15) Additionally, the module case may include a protrusion which protrude from an edge of the first exposure hole or the second exposure hole toward the connecting member, and an insertion groove provided at a part of the protrusion, into which a part of the connecting member is inserted.
(16) Moreover, the busbar may include an extended portion disposed on one side of the plurality of cylindrical battery cells and extending along a direction in which the plurality of cylindrical battery cells is arranged, and a connection portion which protrudes from the extended portion toward the positive electrode terminal or the negative electrode terminal and is configured to be joined to a part of the connecting member.
(17) Furthermore, the plurality of cylindrical battery cells may be arranged in a plurality of rows and a plurality of columns, and the busbar may extend in zigzag along the direction of the plurality of cylindrical battery cells is arranged.
(18) Moreover, the busbar may include a fixed protrusion which protrudes from a part of the connection portion.
(19) In addition, to achieve the above-described object, a battery pack of the present disclosure includes at least one battery module.
(20) Further, to achieve the above-described object, a vehicle of the present disclosure includes at least one battery module.
Advantageous Effects
(21) According to an aspect of the present disclosure, the present disclosure includes the busbar and the at least two types of connecting members having different joined areas depending on the joined terminal among the positive electrode terminal and the negative electrode terminal, thereby optimizing the joined area of the connecting member according to the outer area of the positive electrode terminal or the negative electrode terminal.
(22) That is, as opposed to connecting the busbar to the positive electrode terminal or the negative electrode terminal using the existing single connecting member, the present disclosure may differently set the joined area according to the type of the terminal to which the at least two types of connecting members are joined. That is, for example, when the area of the positive electrode terminal is larger than that of the negative electrode terminal, the present disclosure may increase the joined area by applying different types of connecting members. Accordingly, the present disclosure may effectively reduce the separation of the joined part between the connecting member and the positive electrode terminal or the negative electrode terminal. Ultimately, it is possible to effectively improve the durability of the battery module even in case that the battery module is mounted in a vehicle that is exposed to an environment in which frequent vibrations and impacts occur.
(23) Additionally, according to an aspect of the present disclosure, the present disclosure includes the extended portion and the connection portion in the busbar, thereby minimizing the extended length of the connecting member. That is, the extended portion and the connection portion are configured such that a part of the busbar is adjacent to the positive electrode terminal or the negative electrode terminal, thereby minimizing the extended length of the connecting member configured to connect the connection portion to the positive electrode terminal or the negative electrode terminal. Accordingly, the present disclosure may effectively reduce the increased material cost and increased short circuit risk caused by collision with external materials with the increasing length of the connecting member.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The accompanying drawings illustrate the preferred embodiments of the present disclosure, and together with the following detailed description, serve to provide a further understanding of the technical aspect of the present disclosure. However, the present disclosure should not be construed as being limited to the drawings.

(2) FIG. **1** is a schematic perspective view of a battery module according to an embodiment of the present disclosure.

(3) FIG. **2** is a schematic partial exploded perspective view of a battery module according to an embodiment of the present disclosure.

(4) FIG. **3** is a schematic right side view of a battery module according to an embodiment of the present disclosure.

(5) FIG. **4** is a schematic cross-sectional view of section A of FIG. **3**.

(6) FIG. **5** is a schematic perspective view of a first connecting member of a battery module according to an embodiment of the present disclosure.

(7) FIG. **6** is a schematic perspective view of a second connecting member of a battery module according to an embodiment of the present disclosure.

(8) FIG. **7** is a schematic partial right side view of a battery module according to another embodiment of the present disclosure.

DETAILED DESCRIPTION

(9) Hereinafter, the preferred embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Prior to the description, it should be understood that the terms or words used in the specification and the appended claims should not be construed as being limited to general and dictionary meanings, but rather interpreted based on the meanings and concepts corresponding to the technical aspects of the present disclosure on the basis of the principle that the inventor is allowed to define the terms appropriately for the best explanation.

(10) Therefore, the embodiments described herein and the elements shown in the drawings are just a most preferred embodiment of the present disclosure, but not intended to fully describe the technical aspects of the present disclosure, so it should be understood that a variety of other equivalents and modifications could have been made thereto at the time that the application was filed.

(11) FIG. **1** is a schematic perspective view of a battery module according to an embodiment of the present disclosure. FIG. **2** is a schematic partial exploded perspective view of the battery module according to an embodiment of the present disclosure. Additionally, FIG. **3** is a schematic right side view of the battery module according to an embodiment of the present disclosure.

(12) Referring to FIGS. **1** to **3**, the battery module **100** according to an embodiment of the present disclosure includes a plurality of cylindrical battery cells **110**, a busbar **120** and at least two types of connecting members **130**.

(13) Specifically, as shown in FIG. **2**, each of the plurality of cylindrical battery cells **110** may include a battery can **116**, and a positive electrode terminal **111** and a negative electrode terminal **112** on one side (the right side in the positive X direction) of the body of the battery can **116**. The positive electrode terminal **111** may have a disc-shaped outer surface that is exposed to the outside. The negative electrode terminal **112** may be an edge portion disposed around the positive electrode terminal **111**. The positive electrode terminal **111** and the negative electrode terminal **112** may be spaced a predetermined distance apart from each other. The positive electrode terminal **111** and the negative electrode terminal **112** may be electrically isolated from each other. Additionally, the positive electrode terminal **111** of the cylindrical battery cell **110** may have the exposed outer surface area that is larger than the negative electrode terminal **112**.

(14) Additionally, the cylindrical battery cell **110** may include an electrode assembly (not shown) that is electrically connected to each of the positive electrode terminal **111** and the negative

electrode terminal **112** and is received in the battery can **116**. The configuration of the cylindrical battery cell **110** is widely known to those skilled in the art at the time of filing the patent application, and its detailed description is omitted herein.

(15) Further, the plurality of cylindrical battery cells **110** may be arranged in the up-down direction (Z axis direction) and the front-rear direction (Y axis direction). The plurality of cylindrical battery cells **110** may be spaced a predetermined distance apart from each other. For example, as shown in FIG. **2**, the plurality of cylindrical battery cells **110** may be arranged in the front-rear direction (Y axis direction) and the left-right direction (X axis direction). The positive electrode terminal **111** and the negative electrode terminal **112** may be provided on the right side (the positive X axis direction) of the plurality of cylindrical battery cells **110**.

(16) Additionally, the busbar **120** may include an electrically conductive material. For example, the busbar **120** may include at least one of a copper alloy, an aluminum alloy or a nickel alloy. The busbar **120** may have a plate shape. A part of the busbar **120** may be bent at least once.

(17) FIG. **4** is a schematic cross-sectional view of section A of FIG. **3**.

(18) Referring to FIG. **4** together with FIGS. **2** and **3**, each of the at least two types of connecting members **130** may include an electrically conductive material. For example, the connecting member **130** may include at least one of a copper alloy, an aluminum alloy or a nickel alloy. The connecting member **130** may have an elongated body. In other words, the body of the connecting member **130** may extend in the shape of a strap or a wire. One end of the connecting member **130** in the direction in which the body extends may be joined with the busbar **120**. Additionally, one end of the connecting member **130** may be welded to the outer surface of the busbar **120**. For example, the welding method may be ultrasonic welding.

(19) Additionally, the other end of the connecting member **130** may be joined to any one of the positive electrode terminal **111** and the negative electrode terminal **112**. In this instance, the other end of the connecting member **130** may be welded to the outer surface of the positive electrode terminal **111** or the negative electrode terminal **112**. For example, the welding method may be ultrasonic welding.

(20) Further, the at least two types of connecting members **130** may have different joined areas depending on the joined terminal among the positive electrode terminal **111** and the negative electrode terminal **112**. For example, the at least two types of connecting members **130** may have different joined areas depending on the size of the exposed outer surface of the positive electrode terminal **111** and the negative electrode terminal **112**. For example, when the positive electrode terminal **111** has a larger exposed outer surface than the negative electrode terminal **112**, the joined area between the connecting member **130** and the positive electrode terminal **111** may be larger than the joined area between another connecting member **130** and the negative electrode terminal **112**.

(21) According to this configuration of the present disclosure, the present disclosure includes the busbar **120** and the at least two types of connecting members **130** having different joined areas depending on the joined terminal among the positive electrode terminal **111** and the negative electrode terminal **112**, thereby optimizing the joined area between the connecting member **130** and the positive electrode terminal **111** or the negative electrode terminal **112**.

(22) That is, as opposed to connecting the busbar **120** to the positive electrode terminal **111** or the negative electrode terminal **112** using the existing single connecting member **130**, the present disclosure may differently set the joined area depending on the type of the terminal to which the at least two types of connecting members **130** are joined. Accordingly, the present disclosure can effectively reduce the separation of the joined part between the connecting member **130** and the positive electrode terminal **111** or the negative electrode terminal **112** even in case that the battery module **100** is mounted in a vehicle that is exposed to an environment in which frequent vibrations and impacts occur. Ultimately, it is possible to effectively improve the durability of the battery module **100**.

(23) Additionally, the at least two types of connecting members **130** may include a first connecting member **131** connected to the negative electrode terminal **112** and a second connecting member **132** connected to the positive electrode terminal **111**. For example, as shown in FIG. **4**, one end of the first connecting member **131** may be joined to the busbar **120**, and the other end may be joined to the negative electrode terminal **112** of the cylindrical battery cell **110**. One end of the second connecting member **132** may be joined to the busbar **120**, and the other end may be joined to the positive electrode terminal **111** of the cylindrical battery cell **110**.
(24) Moreover, the joined area between the second connecting member **132** and the positive electrode terminal **111** may be larger than the joined area between the first connecting member **131** and the negative electrode terminal **112**.
(25) According to this configuration of the present disclosure, the present disclosure is configured such that the joined area between the second connecting member **132** and the positive electrode terminal **111** is larger than the joined area between the first connecting member **131** and the negative electrode terminal **112**, so the second connecting member **132** is joined to the positive electrode terminal **111** having a wider outer area than the negative electrode terminal **112** with a larger joined area, thereby effectively increasing the joining strength between the second connecting member **132** and the positive electrode terminal **111**. Accordingly, it is possible to effectively reduce the separation of the joined part between the second connecting member **132** and the positive electrode terminal **111** or the negative electrode terminal **112** even in case that the battery module **100** of the present disclosure is mounted in a vehicle that is exposed to an environment in which frequent vibrations and impacts occur. Ultimately, it is possible to effectively improve the durability of the battery module **100**.
(26) FIG. **5** is a schematic perspective view of the first connecting member of the battery module according to an embodiment of the present disclosure.
(27) Referring to FIG. **5** together with FIG. **4**, the first connecting member **131** may have a wire shape extending in the lengthwise direction L. For example, as shown in FIG. **4**, one end **131***a* of the wire shape of the first connecting member **131** may be joined to the busbar **120**. The other end **131***b* of the wire shape of the first connecting member **131** may be joined to the negative electrode terminal **112**. Since the wire shape has a small diameter and extends in the lengthwise direction L, when compared with the positive electrode terminal **111**, the first connecting member **131** has an optimum shape for being joined to the negative electrode terminal **112** having a narrow exposed outer surface.
(28) FIG. **6** is a schematic perspective view of the second connecting member of the battery module according to an embodiment of the present disclosure.
(29) Referring to FIG. **6**, the second connecting member **132** may have a strap shape extending in the lengthwise direction L. For example, as shown in FIG. **4**, one end **132***a* of the strap shape of the second connecting member **132** may be joined to the busbar **120**. The other end **132***b* of the strap shape of the second connecting member **132** may be joined to the positive electrode terminal **111**. The second connecting member **132** may have a rectangular plate shape on the plane. One surface of the other end **132***b* of the second connecting member **132** in contact with the positive electrode terminal **111** may be joined to the outer surface of the positive electrode terminal **111**. One surface of one end **132***a* of the second connecting member **132** in contact with the busbar **120** may be joined to the outer surface of the busbar **120**.
(30) That is, the second connecting member **132** having a strap shape has an optimum shape for being joined to the wide positive electrode terminal **111** having a wide exposed outer surface with a wider area than the negative electrode terminal **112**.
(31) Meanwhile, referring back to FIGS. **3** and **4**, the battery module **100** of the present disclosure may further include a module case **140**. The module case **140** may have an internal space in which the plurality of cylindrical battery cells **110** is received. The module case **140** may be a box-shaped case as a whole. The module case **140** may include a first case **145** and a second case **146**. The first

case **145** and the second case **146** may be configured to be connected to each other. In this instance, the first case **145** and the second case **146** may be connected by a hook coupling method. The module case **140** may include an electrically insulating material. For example, the electrically insulating material may be poly vinyl chloride or polyethylene terephthalate.

(32) Additionally, the busbar **120** may be mounted on the outer side of the module case **140**. For example, as shown in FIG. **1**, eight busbars **120** may be mounted on the right side of the module case **140**. In this instance, among the eight busbars **120**, the top and bottom busbars **120***a*, **120***b* may have different shapes from the remaining six busbars **120**. Additionally, each of the top and bottom busbars **120** may be configured to electrically connect only the positive electrode terminal **111** or the negative electrode terminal **112** of the plurality of cylindrical battery cells **110**. The remaining six busbars **120** will be described in more detail below.

(33) Moreover, the module case **140** may include a first exposure hole **141** and a second exposure hole **142**. Specifically, the first exposure hole **141** may be configured to expose at least part of the negative electrode terminal **112**. That is, the first exposure hole **141** may be configured to allow the first connecting member **131** connected to the negative electrode terminal **112** of the cylindrical battery cell **110** received in the module case **140** to pass therethrough.

(34) Additionally, the second exposure hole **142** may be configured to expose at least part of the positive electrode terminal **111**. That is, the second exposure hole **142** may be configured to allow the second connecting member **132** connected to the positive electrode terminal **111** of the cylindrical battery cell **110** received in the module case **140** to pass therethrough.

(35) Further, the first exposure hole **141** and the second exposure hole **142** may be spaced a predetermined distance apart from each other. An outer wall W of the module case **140** may be disposed between the first exposure hole **141** and the second exposure hole **142**.

(36) According to this configuration of the present disclosure, the battery module **100** of the present disclosure includes the module case **140** having the first exposure hole **141** and the second exposure hole **142**, thereby easily connecting the connecting members **131**, **132** to the negative electrode terminal **112** and the positive electrode terminal **111** of the cylindrical battery cell **110** through the first exposure hole **141** and the second exposure hole **142** respectively.

(37) Moreover, the outer wall W of the module case **140** between the first exposure hole **141** and the second exposure hole **142** may prevent the connecting member **130** from moving to the adjacent terminal of the opposite polarity when a short circuit occurs between the connecting member **130** and the positive electrode terminal **111** or the negative electrode terminal **112**.

(38) Additionally, when compared with the conventional module case **140** having the open side of the cylindrical battery cell **110**, the first exposure hole **141** and the second exposure hole **142** of the present disclosure exposes only at least part of the positive electrode terminal **111** and the negative electrode terminal **112**, which makes it possible to minimize the exposed area and minimize the likelihood of contact with an external conductive material, thereby effectively improving the safety of the battery module **100**.

(39) FIG. **7** is a schematic partial right side view of a battery module according to another embodiment of the present disclosure.

(40) Referring to FIG. **7**, when compared with the module case **140** of FIG. **3**, the module case **140**A of the battery module **100** according to another embodiment of the present disclosure may further include a protrusion **143** and an insertion groove G. The components other than the module case **140**A of the battery module **100** of FIG. **7** has the same components as the battery module **100** of FIG. **3**, and description of such components is omitted herein.

(41) Additionally, the protrusion **143** may extend from the edge of the first exposure hole **141** or the second exposure hole **142** to the connecting member **130**. The protrusions **143** may have different shapes depending on the first connecting member **131** or the second connecting member **132** that is inserted into the insertion groove G. For example, as shown in FIG. **7**, the first exposure hole **141** may have the first protrusion **143** that protrudes toward the first connecting member **131** of a wire

shape. The second exposure hole **142** may have two second protrusions **143** that protrude from two sides of the edge toward the second connecting member **132** of a strap shape.
(42) Specifically, the insertion groove G may be provided at a part of the protrusion **143**, into which a part of the connecting member **130** is inserted. For example, as shown in FIG. **7**, one protrusion **143** may have the insertion groove G into which a part of the first connecting member **131** of a wire shape is inserted. The other protrusion **143** may have the insertion groove G into which a part of the second connecting member **132** of a strap shape is inserted.
(43) Referring back to FIGS. **2** and **4**, the busbar **120** of the battery module **100** according to an embodiment of the present disclosure may have an extended portion **121** and a connection portion **122**. Specifically, the extended portion **121** may be a body portion of the busbar **120**. The extended portion **121** may be disposed on one side where the positive electrode terminal **111** and the negative electrode terminal **112** of the plurality of cylindrical battery cells **110** are disposed. The extended portion **121** may be spaced a predetermined distance apart in a more outward direction than the plurality of cylindrical battery cells **110**.
(44) For example, as can be seen from FIGS. **1** and **2**, the busbar **120** may be mounted on the right side of the module case **140**. That is, the busbar **120** may be disposed opposite to the plurality of cylindrical battery cells **110** with the module case **140** interposed between.
(45) Additionally, the extended portion **121** may extend along a direction in which the plurality of cylindrical battery cells **110** is arranged. That is, the extended portion **121** may be disposed on one side where the positive electrode terminal **111** and the negative electrode terminal **112** of the plurality of cylindrical battery cells **110** are disposed. This may be configured such that the extended portion **121** is disposed adjacent to the positive electrode terminal **111** and the negative electrode terminal **112** of the plurality of cylindrical battery cells **110**.
(46) Moreover, the connection portion **122** may protrude from the extended portion **121** toward the positive electrode terminal **111** or the negative electrode terminal **112**. Additionally, the connection portion **122** may be configured to be joined to a part of the first connecting member **131** or the second connecting member **132**. For example, referring to FIG. **4**, the busbar **120** may have the extended portion **121** extending in zigzag in the vertical direction (in the Z axis direction in FIG. **1**), and the connection portion **122** protruding from the extended portion **121** toward the positive electrode terminal **111** or the negative electrode terminal **112**. The connection portion **122** may be joined to the end of the first connecting member **131** or the second connecting member **132**.
(47) According to this configuration of the present disclosure, the busbar **120** of the present disclosure has the extended portion **121** and the connection portion **122**, thereby minimizing the extended length of the connecting member **130**. That is, the extended portion **121** and the connection portion **122** are configured such that a part of the busbar **120** is as close to the positive electrode terminal **111** or the negative electrode terminal **112** as possible, thereby minimizing the extended length of the connecting member **130** configured to connect the connection portion **122** to the positive electrode terminal **111** or the negative electrode terminal **112**. Accordingly, the present disclosure may effectively reduce the increased material cost and increased short circuit risk caused by collision with external materials with the increasing length of the connecting member **130**.
(48) Additionally, the plurality of cylindrical battery cells **110** may be arranged in a plurality of rows and a plurality of columns. For example, as shown in FIG. **2**, the plurality of cylindrical battery cells **110** may be arranged in the row direction (Y axis direction) and column direction (Z axis direction).
(49) Among the plurality of cylindrical battery cells **110**, the plurality of cylindrical battery cells **110** arranged in each row may be spaced apart in the column direction. For example, the plurality of cylindrical battery cells **110** arranged in a row may be spaced apart in the upward or downward direction with respect to the center in the vertical direction.
(50) In this instance, the extended portion **121** of the busbar **120** may extend in zigzag along the direction in which the plurality of cylindrical battery cells **110** is arranged. For example, as shown

in FIG. **2**, the extended portion **121** may extend in the row direction (Y axis direction), and may extend in the upward and downward direction in an alternating manner. That is, the extended portion **121** may extend in zigzag in the front-rear direction.
(51) According to this configuration of the present disclosure, the busbar **120** of the present disclosure extends in zigzag in the direction in which the plurality of cylindrical battery cells **110** is arranged, thereby minimizing the extended length of the connecting member **130**. That is, a part of the busbar **120** extends in zigzag adjacent to the positive electrode terminal **111** or the negative electrode terminal **112**, thereby minimizing the extended length of the connecting member **130**. Accordingly, the present disclosure may effectively reduce the increased material cost and increased short circuit risk caused by collision with external materials with the increasing length of the connecting member **130**.
(52) Referring back to FIG. **7**, when compared with the busbar **120** shown in FIG. **4**, the busbar **120** of the battery module **100** according to another embodiment of the present disclosure may further include a fixed protrusion P in the connection portion **122**. The other components of the busbar **120** are the same as the busbar **120** shown in FIG. **4**, and its description is omitted herein.
(53) Specifically, the fixed protrusion P may be configured to be disposed around the end of the first connecting member **131**. The fixed protrusion P may protrude out of a part of the connection portion **122**. The fixed protrusion P may be configured to be disposed around at least one side of the end of the first connecting member **131**. For example, as shown in FIG. **7**, the busbar **120** may include the fixed protrusion P configured to be disposed around three sides of the end of the first connecting member **131**. The fixed protrusion P may protrude toward the cylindrical battery cell **110** (outwards).
(54) According to this configuration of the present disclosure, the present disclosure includes the fixed protrusion P protruding from a part of the connection portion **122** of the busbar **120**, thereby preventing the end of the first connecting member **131** joined to the connection portion **122** from being separated by external impacts. That is, the fixed protrusion P may prevent the separation by collision with external materials at the joined part between the end of the first connecting member **131** and the connection portion **122**. Accordingly, the present disclosure may minimize the poor connection between the busbar **120** and the connecting member **130**, thereby effectively enhancing the durability.
(55) Meanwhile, a battery pack (not shown) according to an embodiment of the present disclosure may include at least one battery module **100** and a BMS electrically connected to the busbar **120** of the battery module **100**. The BMS may include various types of circuits or devices to control the charge/discharge of the plurality of battery cells.
(56) Meanwhile, a vehicle (not shown) according to an embodiment of the present disclosure may include at least one battery module **100** and a receiving space in which the battery module **100** is received. For example, the vehicle may be an electric vehicle, an electric scooter, an electric wheelchair or an electric bike.
(57) Meanwhile, the terms indicating directions as used herein such as upper, lower, left, right, front and rear are used for convenience of description only, and it is obvious to those skilled in the art that the term may change depending on the position of the stated element or an observer.
(58) While the present disclosure has been hereinabove described with regard to a limited number of embodiments and drawings, the present disclosure is not limited thereto and it is obvious to those skilled in the art that various modifications and changes may be made thereto within the technical aspects of the present disclosure and the equivalent scope of the appended claims.

Claims

1. A battery module, comprising: a plurality of cylindrical battery cells each having a positive electrode terminal and a negative electrode terminal on one side of each respective battery cell; a

busbar including an electrically conductive material and having a plate shape; at least two types of connecting members each including an electrically conductive material, and having an elongated body, wherein one end in a direction in which the elongated body extends is joined to the busbar, and the other end is joined to one of the positive electrode terminal and the negative electrode terminal, the at least two types of connecting members having different joined areas depending on a joined terminal among the positive electrode terminal and the negative electrode terminal; and a module case having an internal space in which the plurality of cylindrical battery cells is received, wherein: the plurality of cylindrical battery cells includes a particular cylindrical battery cell; the module case has a first exposure hole and a second exposure hole; at least part of the negative electrode terminal of the particular cylindrical battery cell is exposed to an outside of the battery module through the first exposure hole; and at least part of the positive electrode terminal of the particular cylindrical battery cell is exposed to the outside of the battery module through the second exposure hole different from the first exposure hole.

2. The battery module according to claim 1, wherein the positive electrode terminal has a larger exposed outer surface area than the negative electrode terminal, wherein the at least two types of connecting members include a first connecting member connected to the negative electrode terminal and a second connecting member connected to the positive electrode terminal, and wherein the joined area between the second connecting member and the positive electrode terminal is larger than the joined area between the first connecting member and the negative electrode terminal.

3. The battery module according to claim 1, wherein the connecting members include: a first connecting member having a wire shape extending in a lengthwise direction; and a second connecting member having a strap shape extending in the lengthwise direction.

4. The battery module according to claim 1, wherein the busbar is mounted on an outer side of the module case.

5. The battery module according to claim 4, wherein the module case includes: a protrusion that protrudes from an edge of the first exposure hole or the second exposure hole toward a connecting member; and an insertion groove at a part of the protrusion, into which a part of the connecting member is inserted, wherein the connecting member is one of the connecting members.

6. The battery module according to claim 1, wherein the busbar includes: an extended portion disposed on one side of the plurality of cylindrical battery cells and extending along a direction in which the plurality of cylindrical battery cells is arranged; and a connection portion that protrudes from the extended portion toward the positive electrode terminal or the negative electrode terminal and is configured to be joined to a part of a connecting member, wherein the connecting member is one of the connecting members.

7. The battery module according to claim 6, wherein the plurality of cylindrical battery cells is arranged in a plurality of rows and a plurality of columns, and wherein the busbar extends in zigzag along the direction in which the plurality of cylindrical battery cells is arranged.

8. The battery module according to claim 6, wherein the busbar includes a fixed protrusion that protrudes from a part of the connection portion.

9. A battery pack comprising at least one battery module according to claim 1.

10. A vehicle comprising at least one battery module according to claim 1.

11. The battery module according to claim 1, wherein the first and second exposure holes corresponding to the negative and positive electrode terminals of the particular cylindrical battery cell are spaced apart from each other.

12. The battery module according to claim 1, wherein an outer wall of the module case is disposed between the first and second exposure holes corresponding to the negative and positive electrode terminals of the particular cylindrical battery cell.