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BATTERY MODULE INCLUDING SEALING PORTION

Abstract

A battery module includes a first sub-module and a second sub-module respectively including a cell assembly formed by stacking a plurality of battery cells and a protective cover accommodating at least a portion of the cell assembly, and facing each other in a first direction, and a sealing portion provided on the protective cover and disposed on at least a portion of a peripheral surface of the protective cover. The sealing portion is formed by a plurality of sealing components separable based on the peripheral surface of the protective cover.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This patent document claims the priority and benefits of Korean Patent Application No. 10-2024-0021217 filed on Feb. 14, 2024, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The disclosure and implementations disclosed in this patent document generally relate to a battery module including a sealing portion.

BACKGROUND

[0003] Secondary batteries, unlike primary batteries, have the convenience of being able to be charged and discharged, and are thus receiving significant attention as power sources for various mobile devices and electric vehicles.

[0004] These secondary batteries may include battery cells in which an electrode assembly formed by stacking or winding positive electrode plates, negative electrode plates, and separators in a roll shape is accommodated in a case.

[0005] A plurality of battery cells may be stacked in a predetermined direction and accommodated in a battery module. A plurality of battery modules may be connected in series/parallel and aligned in a predetermined array to form a battery pack.

[0006] Meanwhile, a battery cell may experience thermal runaway, in which gas and flames are generated, due to internal short circuits, overcharge, or the like. In this case, a flame may occur in the trigger module that accommodates the battery cell, and the flame may spread to an adjacent battery module, causing a fire in the adjacent battery module, which may result in thermal propagation.

[0007] Accordingly, there is a need for a structure sealing the interior to significantly delay or prevent flames generated in a battery module from spreading to adjacent battery modules as much as possible.

SUMMARY

[0008] The present disclosure may be implemented in some embodiments to provide a battery module in which a fire originating in a battery module may be delayed or significantly reduced from spreading to adjacent battery modules.

[0009] In a battery module according to an aspect of the present disclosure, a fire occurring in one sub-module may be delayed or significantly reduced from spreading to an adjacent sub-module.

[0010] A battery module according to an aspect of the present disclosure may be widely applied to devices within green technology fields such as electric vehicles, battery charging stations, and other solar power generation and wind power generation using batteries. In addition, a battery module according to an aspect of the present disclosure may be used in eco-friendly electric vehicles, hybrid vehicles, and the like to prevent climate change by suppressing air pollution and greenhouse gas emissions.

[0011] In some embodiments of the present disclosure, a battery module includes a first sub-module and a second sub-module respectively including a cell assembly formed by stacking a plurality of battery cells and a protective cover accommodating at least a portion of the cell assembly, and facing each other in a first direction; and a sealing portion provided on the protective cover and disposed on at least a portion of a peripheral surface of the protective cover. The sealing portion is formed by a plurality of sealing components separable based on the peripheral surface of the protective cover.

[0012] The protective cover may include a center cover disposed close to a cell assembly adjacent thereto; an end cover facing the center cover; and a side cover disposed parallel to a stacking direction of the plurality of battery cells, and the sealing portion may be provided to surround at least one of the center cover, the end cover, or the side cover.

[0013] The battery module may further include an upper cover and a lower cover facing each other

in a second direction perpendicular to the first direction, with the first sub-module and the second sub-module interposed therebetween, and respectively coupled to the protective cover. The upper cover and the lower cover may be coupled to the end cover, the center cover, and the side cover and may be disposed on the first sub-module and the second sub-module.

[0014] The plurality of sealing components may include a first component provided on the upper cover and disposed to face the center cover; a second component provided on the lower cover and disposed to face the center cover; and a third component provided on the side cover and disposed to face the center cover. The upper cover, the lower cover, and the side cover may be coupled to the center cover.

[0015] The first component, the second component, and the third component may form a sealing portion disposed to surround a peripheral surface of the center cover when the upper cover, the lower cover, and the side cover are coupled to the center cover.

[0016] The end cover may have a chamfer formed at each corner, and the sealing portion may include a chamfer component provided in a shape corresponding to the chamfer.

[0017] The chamfer component may be provided on both ends of at least one of the first component, the second component, or the third component.

[0018] The upper cover and the lower cover may be provided with the first component and the second component disposed on portions thereof overlapping with distal ends of one sides of the center cover and the side cover, based on the second direction. The side cover may be provided with the third component provided on the distal end of one side thereof overlapping with the center cover based on the stacking direction.

[0019] The protective cover may be provided with a sealing groove accommodating at least a portion of the sealing portion.

[0020] In some embodiments of the present disclosure, a battery module includes a first sub-module and a second sub-module respectively including a cell assembly in which a plurality of battery cells are stacked in a first direction, a side cover facing the cell assembly in the first direction, and a center cover facing the cell assembly in a second direction perpendicular to the first direction; an upper cover and a lower cover disposed with the first sub-module and the second sub-module interposed therebetween in a direction perpendicular to the first direction and the second direction; and a plurality of sealing components provided on the side cover, the upper cover and the lower cover to face the center cover. The plurality of sealing components form a sealing portion disposed to surround at least a portion of the center cover in a direction perpendicular to the first direction when the side cover, the upper cover, and the lower cover are coupled to the center cover.

[0021] The sealing portion may be disposed between a distal end of one side of the side cover, the upper cover, the lower cover, and the center cover.

[0022] The center cover may be disposed between the cell assembly of the first sub-module and the cell assembly of the second sub-module.

[0023] The above-described solution in the present disclosure is illustrative, and it should be understood that other configurations that are not mentioned are included in the present disclosure even if they are added.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0024] Certain aspects, features, and advantages of the present disclosure are illustrated by the following detailed description with reference to the accompanying drawings.

[0025] FIG. 1 is a perspective view of a battery module according to an embodiment.

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

[0027] FIG. 3 is an exploded perspective view of a sub-module according to an embodiment.

[0028] FIGS. 4A and 4B are cross-sectional views schematically illustrating flame propagation to adjacent sub-modules.

[0029] FIGS. 5A and 5B are cross-sectional views schematically illustrating flame propagation prevention to adjacent sub-modules according to an embodiment.

[0030] FIG. 6 is a drawing illustrating assembly of a sealing portion according to an embodiment.

[0031] FIG. 7 is a cross-sectional view schematically illustrating assembly of a sub-module according to an embodiment.

[0032] FIG. 8 is a cross-sectional view schematically illustrating assembly of a sealing portion according to another embodiment.

[0033] FIG. 9 is a cross-sectional view schematically illustrating assembly of a sealing portion according to another embodiment.

DETAILED DESCRIPTION

[0034] Features of the present disclosure disclosed in this patent document are described by example embodiments with reference to the accompanying drawings.

[0035] Prior to the detailed description of example embodiments, terms or words used in the descriptions below and claims should not be construed as being limited to their usual or dictionary meanings, and should be interpreted with meaning and concept consistent with the technical idea of the present disclosure, based on the principle that the inventor may appropriately define the concept of terms to explain his or her invention in the best way.

[0036] The same reference numbers or symbols in respective drawings indicate parts or components performing substantially the same function.

[0037] In the following description, singular expressions include plural expressions unless the context clearly dictates otherwise. Terms such as “include,” “configure” and the like are intended to designate the presence of features, numbers, steps, operations, components, parts, or combinations thereof described in the specification, and should be understood as not precluding the presence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[0038] In addition, in the following description, expressions such as upper side, upper portion, lower, bottom, side, front, rear, and the like are expressed based on the direction illustrated in the drawing, and it should be noted in advance that if the direction of the object is changed, it may be expressed differently.

[0039] Additionally, in the descriptions below and claims, terms including ordinal numbers such as “first,” “second,” and the like may be used to distinguish between components. These ordinal numbers are used to distinguish identical or similar components from each other, and the meaning of the term should not be interpreted limitedly due to the use of these ordinal numbers. For example, components combined with these ordinal numbers should not be interpreted as having a limited order of use or arrangement based on the number. If necessary, respective ordinal numbers may be used interchangeably.

[0040] Hereinafter, the present disclosure will be described in detail with reference to the attached drawings. However, this is merely illustrative and the present disclosure is not limited to the detailed embodiments described as examples.

[0041] First, a battery module of the present disclosure will be described with reference to FIGS. 1 to 3.

[0042] FIG. 1 is a perspective view of a battery module according to an embodiment, FIG. 2 is an exploded perspective view of a battery module according to an embodiment, and FIG. 3 is an exploded perspective view of a sub-module according to an embodiment. FIGS. 1 to 3 are merely example illustrations of the structure and shape of the sub-module 100 and the battery module 10, and it should be understood that the detailed shape of each component thereof is not limited to the drawings.

[0043] A battery module 10 may include a plurality of sub-modules 100. For example, the plurality

of sub-modules **100** may be configured by assembling a first sub-module **100a** and a second sub-module **100b** along one direction (the X-axis direction in the drawings) to form one battery module **10**. However, the battery module **10** is not limited to this structure and may include three or more sub-modules **100**.

[0044] In the following description, a direction parallel to the direction in which the first sub-module **100a** and the second sub-module **100b** face each other is referred to as the first direction.

[0045] The first sub-module **100a** and the second sub-module **100b** included in the battery module **10** may have the same structure. For example, after manufacturing a plurality of sub-modules **100** of the same type, the sub-modules may be assembled together to form the entire battery module **10**.

[0046] For example, in the following description, ‘the first sub-module **100a**’ and ‘the second sub-module **100b**’ only mean one and the other of the two sub-modules **100** assembled together, and both may be understood as sub-modules **100** having the same structure. In addition, ‘sub-module **100**’ may be understood to mean one of the ‘first sub-module **100a**’ and ‘second sub-module **100b**’ described above.

[0047] The battery module **10** may include a lower cover **300** and an upper cover **400** supporting a plurality of sub-modules **100**. One integrally formed lower cover **300** may be disposed to cover the lower surfaces of the plurality of sub-modules **100**. Alternatively, one integrally formed upper cover **400** may be disposed to cover the upper surfaces of the plurality of sub-modules **100**.

[0048] However, the structures of the lower cover **300** and the upper cover **400** are not limited to those described above. For example, a plurality of lower covers or a plurality of upper covers may be provided to cover a plurality of sub-modules **100**, respectively, and the plurality of lower covers may be mutually combined to form a single structure.

[0049] A sub-module **100** may include a cell assembly **110** including battery cells **1000** stacked in one direction and a plurality of protective covers **150**, **160** and **170** protecting the cell assembly **110**.

[0050] The cell assembly **110** may include a plurality of battery cells **1000** that are stacked side by side. The stacking direction of the plurality of battery cells **1000** and the direction in which the sub-modules **100** are disposed may be perpendicular to each other. For example, the sub-modules **100** may be disposed in a first direction (X-axis direction) on the upper surface of the lower cover **300**, and the battery cells **1000** included in each sub-module **100** may be stacked in a second direction (for example, Y-axis direction) that is perpendicular to the first direction (X-axis direction). In the following description, the ‘second direction’ may be understood as the stacking direction of the battery cells **1000**.

[0051] The plurality of battery cells **1000** may be configured to convert chemical energy into electrical energy to supply power to an external circuit, or to receive power from the outside and energy convert electrical into chemical energy to store electricity. For example, the battery cell **1000** may be composed of a nickel metal hydride (Ni-MH) battery or a lithium ion (Li-ion) battery that may be charged and discharged.

[0052] A plurality of battery cells **1000** may be respectively provided by accommodating an electrode assembly (not illustrated) formed by stacking a positive electrode plate (cathode plate) and a negative electrode plate (anode plate). The electrode assembly may be configured in a form in which the positive electrode plates and the negative electrode plates are stacked with a separator interposed therebetween so that wide surfaces thereof face each other. The separator may be configured to prevent electrical short-circuiting between the positive electrode plate and the negative electrode plate and to allow ion flow. As an example, the separator may include a porous polymer film or a porous nonwoven fabric.

[0053] In addition, the electrode assembly may be accommodated in a case in various ways, such as a stacking type, a zigzag folding type (Z-folding type), a stack-folding type, or the like, in a jelly roll type formed by winding in a predetermined direction.

[0054] The plurality of battery cells **1000** may be pouch-type, prismatic-type, or cylindrical-type

secondary batteries depending on the structure of the case. In an embodiment, each of the plurality of battery cells **1000** may be provided in a pouch type, and may be connected in series or in parallel while being stacked side by side to form one cell assembly **110**.

[0055] The protective covers **150**, **160** and **170** may include an end cover **150** and a center cover **160** that cover at least one side and the other side of the cell assembly **110**, and a plurality of side covers **170**.

[0056] The end cover **150** and the center cover **160** may be disposed to be spaced apart from each other in the first direction (X-axis direction), and the cell assembly **110** may be disposed between the end cover **150** and the center cover **160**. The end cover **150** may be disposed adjacent to the side where a terminal portion **123** is disposed in the sub-module **100**, and the center cover **160** may be disposed adjacent to the side where a sub-sensing module **130** is disposed in the sub-module **100**.

[0057] The side cover **170** may be disposed to face the wide surface of the battery cell **1000** to protect the side surface of the cell assembly **110**.

[0058] The end cover **150**, the center cover **160**, and the side cover **170** may be formed of a material (for example, a metal material such as aluminum or SUS) that has sufficient rigidity to protect the sub-module **100** from external impact.

[0059] The side cover **170** may be connected to the end cover **150** and the center cover **160**, respectively. For example, a fastening member (not illustrated) may penetrate the side cover **170** and be fastened to the end cover **150** or the center cover **160**. Alternatively, the side cover **170** may be mutually joined and fixed to the end cover **150** and the center cover **160** without a separate fastening member. In this case, a bonding method may use welding, but is not limited thereto.

[0060] Meanwhile, the side cover **170** may also be coupled to a bus bar frame **122** disposed on the inner side of the end cover **150** and the center cover **160**.

[0061] The end cover **150**, the center cover **160**, and the side cover **170** are firmly coupled to each other so that the sub-module **100** may have structural stability.

[0062] The sub-module **100** may further include a busbar assembly **120** electrically connected to the cell assembly **110**, and an insulating cover **140** coupled to the busbar assembly **120**.

[0063] The busbar assembly **120** may include a plurality of conductive members (busbars, **121**) electrically connected to the battery cells **1000**, and a busbar frame **122** supporting the busbars **121**. Some of the plurality of busbars **121** may be connected to a terminal portion **123** that may be connected to an external electrical circuit. The terminal portion **123** may include a positive electrode terminal and a negative electrode terminal.

[0064] Referring to FIG. 3, the busbar assembly **120** may include a first busbar assembly **120a** disposed on one side of the cell assembly **110** and a second busbar assembly **120b** disposed on the other side of the cell assembly **110**. One of the first busbar assembly **120a** and the second busbar assembly **120b** may have a pair of terminal portions **123** disposed, and the other thereof may not have a terminal portion **123**. For example, the first busbar assembly **120a** having a pair of terminal portions **123** may be disposed between the end cover **150** and the cell assembly **110**, and the second busbar assembly **120b** not having a terminal portion **123** may be disposed between the center cover **160** and the cell assembly **110**. The terminal portion **123** of the first busbar assembly **120a** may be disposed adjacent to the end cover **150** and exposed to the outside of the battery module **10**. According to this structure, the terminal portions **123** may be disposed spaced apart in the second direction (Y-axis direction) along one edge of the sub-module **100**.

[0065] A first insulating cover **141** may be disposed between the first busbar assembly **120a** and the end cover **150**, and a second insulating cover **142** may be disposed between the second busbar assembly **120b** and the center cover **160**. The first insulating cover **141** and the second insulating cover **142** may be coupled to the first busbar assembly **120a** and the second busbar assembly **120b**, respectively. The first insulating cover **141** and the second insulating cover **142** may include an insulating material to prevent the end cover **150** and the center cover **160** from being electrically

short-circuited with the busbar **121**.

[0066] The terminal portion **123** may be disposed adjacent to one edge of the sub-module **100**. For example, the terminal portion **123** may be disposed in the first bus bar assembly **120a** disposed between the end cover **150** and the cell assembly **110**. For example, the terminal portion **123** included in each sub-module **100** may be disposed on the outer side of the battery module **10**.

[0067] In addition, the first sub-module **100a** and the second sub-module **100b** may be assembled so that the center covers **160** face each other.

[0068] In the drawing, the first sub-module **100a** and the second sub-module **100b** are illustrated as including the center covers **160a** and **160b**, respectively (see FIG. 4A), but the present disclosure is not limited thereto, and may be provided with a structure in which one center cover **160** is disposed between the first sub-module **100a** and the second sub-module **100b**.

[0069] In detail, as one center cover **160** is disposed between the cell assembly **110** of the first sub-module **100a** and the cell assembly **110** of the second sub-module, the first sub-module **100a** and the second sub-module **100b** may share one center cover **160** with each other.

[0070] In the process of assembling the two sub-modules **100**, the side covers **170** included in respective sub-modules **100** may be joined to each other. For example, the side cover **170** of the first sub-module **100a** and the side cover **170** of the second sub-module **100b** may be joined to each other while facing each other in the first direction (X-axis direction). The joining of the side cover **170** of the first sub-module **100a** and the side cover **170** of the second sub-module **100b** may be performed by welding, but is not limited thereto.

[0071] The upper and lower portions of the first sub-module **100a** and the second sub-module **100b** may be covered by the upper cover **400** and the lower cover **300**, respectively.

[0072] The lower cover **300** may be coupled to the first sub-module **100a** and the second sub-module **100b**. For example, a fastening member **310** may be fastened to the center cover **160** by penetrating through the lower cover **300**, and thus the first sub-module **100a** and the second sub-module **100b** may be fixed to the lower cover **300**. In addition, another fastening member **320** may be fastened to the end cover **150** by penetrating through the lower cover **300**.

[0073] The upper cover **400** may be coupled to the first sub-module **100a** and the second sub-module **100b**. For example, a fastening member **410** may be fastened to the center cover **160** by penetrating the upper cover **400**, and thus the first sub-module **100a** and the second sub-module **100b** may be fixed to the lower cover **300**. In addition, another fastening member **420** may be fastened to the end cover **150** by penetrating the upper cover **400**.

[0074] In a state where the upper cover **400** and the lower cover **300** are coupled to the sub-modules **100**, the end cover **150** of the sub-module **100** may be disposed adjacent to one edge of the upper cover **400** and the lower cover **300**. In addition, the center cover **160** may be disposed in the first direction (X-axis direction) central region of the upper cover **400** and the lower cover **300**.

[0075] The lower cover **300** and the upper cover **400** may be respectively joined to the side cover **170** of the sub-module **100**. For example, in a state where the sub-modules **100** are secured to the lower cover **300**, the side covers **170** may be in contact with the lower cover **300** and may be mutually joined along the contacted portion. Likewise, when the upper cover **400** is disposed on the upper portion of the sub-module **100**, the side covers **170** may be in contact with the upper cover **400** and may be mutually joined along the contacted portion.

[0076] In this manner, the upper cover **400** and the lower cover **300** may be combined with the sub-modules **100** to form the entire battery module **10**.

[0077] In the battery module **10**, the end cover **150** and the side cover **170** of each sub-module **100** may be exposed to the outside of the battery module **10**. For example, the upper surface of the battery module **10** may be formed by the upper cover **400**, the lower surface thereof may be formed by the lower cover **300**, and the side surface thereof may be formed by the end cover **150** and the side cover **170**. In this case, the center covers **160** of respective sub-modules **100** face each other inside the battery module **10** and may not be exposed to the outside of the battery module **10** by

being covered by the upper cover **400**, the lower cover **300**, and the side cover **170**.

[0078] In this manner, the battery module **10** according to an embodiment of the present disclosure may include a plurality of sub-modules **100**. The plurality of sub-modules **100** have the advantage of improving the efficiency of the assembly process and energy efficiency by simplifying the connection and assembly relationship between the sub-modules **100**.

[0079] However, if a flame occurs in one of the plurality of sub-modules **100** and becomes a so-called trigger sub-module, the trigger sub-module may be vulnerable to heat propagation in which heat and flame are propagated to the adjacent sub-module **100**.

[0080] FIGS. **4A** and **4B** are cross-sectional views schematically illustrating flame propagation to adjacent sub-modules. FIGS. **4A** and **4B** illustrate that the first sub-module **100a** functions as a trigger sub-module by way of example.

[0081] The flame may pass through the gap between any two of the plurality of protective covers **150**, **160** and **170**, the upper cover **400**, and the lower cover **300**.

[0082] Referring to the arrows in FIGS. **4A** and **4B**, when a fire occurs in the cell assembly **110** of the first sub-module **100a**, it can be seen that the flame spreads toward the second sub-module **100b** through the gap between at least one of the upper cover **400**, the lower cover **300** and the side cover **170**, and the center cover **160**. In this manner, since the first sub-module **100a** and the second sub-module **100b** are assembled adjacently, if a fire occurs in one sub-module **100**, the heat and flames may be relatively easily propagated to the other sub-module **100**.

[0083] Meanwhile, FIG. **4A** and FIG. **4B** is an example illustrating the propagation of flames, and as described above, a flame occurring in one sub-module **100** may be discharged through a gap between at least two adjacent members among the end cover **150**, the center cover **160**, the side cover **170**, the upper cover **400**, and the lower cover **300**. In this case, unlike FIG. **4A** and FIG. **4B**, there is a risk of fire spreading between the battery module **10** and the adjacent other battery module **10**.

[0084] Accordingly, according to an embodiment of the present disclosure, a sealing portion **200** is provided in the protective covers **150**, **160** and **170**, so that a flame generated in one sub-module **100** among the plurality of sub-modules **100** may be prevented from spreading to another sub-module **100** or an adjacent battery module **10**.

[0085] FIGS. **5A** and **5B** are cross-sectional views schematically illustrating prevention of flame from spreading to an adjacent sub-module according to an embodiment. FIG. **6** is a drawing illustrating assembly of a sealing portion according to an embodiment.

[0086] Referring to FIGS. **5A**, **5B** and **6**, the battery module **10** according to an embodiment the present disclosure may further include a sealing portion **200** disposed to surround the protective covers **150**, **160** and **170**, to block a gap between the protective covers **150**, **160** and **170** and at least one of the upper cover **400** or the lower cover **300**.

[0087] The sealing portion **200** may include an elastic material to seal the gap. In addition, the sealing portion **200** may include a heat-resistant material to be prevented from being deformed or melted by heat of the flame generated from the battery cell **1000**.

[0088] Hereinafter, the structure of the sealing portion **200** of the present disclosure will be described with reference to the drawings. Meanwhile, for the convenience of understanding, the sealing portion **200** is described as being provided while surrounding the center cover **160**, but may also be provided in the end cover **150** and the side cover **170**, of course.

[0089] Referring to FIGS. **5A** and **5B**, the battery module **10** according to an embodiment of the present disclosure may be provided with a sealing portion **200** on a center cover **160** of at least one of a plurality of sub-modules **100**.

[0090] The sealing portion **200** may be disposed between members adjacent to the center cover **160**, for example, the side cover **170**, the upper cover **400** and the lower cover **300**, and the center cover **160**. Therefore, flames may be prevented from spreading through the gap between the center cover **160** and the adjacent members.

[0091] Referring to FIG. 6, the battery module **10** according to an embodiment of the present disclosure may be provided with a sealing groove SG into which the sealing portion **200** may be at least partially inserted, in a portion thereof where the sealing portion **200** is disposed. For example, the sealing groove SG may be formed while surrounding the edge surface of the center cover **160**, and the sealing portion **200** may be disposed to surround the center cover **160** while being inserted into the sealing groove SG.

[0092] FIG. 7 is a cross-sectional view schematically illustrating the assembly of a sub-module according to an embodiment. Referring to FIG. 7, the battery module **10** of the present disclosure may be provided in which the upper cover **400**, the lower cover **300**, and the side cover **170** are coupled to the center cover **160** having the sealing portion **200** provided thereon.

[0093] Meanwhile, when assembling adjacent parts while the sealing portion **200** is disposed on an assembled body, for example, the center cover **160** as illustrated in FIG. 7, a gap may be created or assembly may be difficult even after the assembly is completed, due to deformation of the sealing portion **200** during the assembly process, assembly tolerance, or the like.

[0094] For example, when the side cover **170** fastens the center cover **160** to the upper cover **400** or the lower cover **300** by the fastening member **310** or **410**, the sealing portion **200** may be partially deformed by elasticity due to the fastening force between the side cover **170** and the center cover **160**. In this state, when the upper cover **400** and the lower cover **300** are combined, the cover part that is combined last may be difficult to combine due to the deformation of the sealing portion **200**, or the sealing portion **200** may deviate from a preset position and not be able to completely close the gap.

[0095] Accordingly, according to another embodiment of the present disclosure described below, a sealing portion **200** may include a plurality of sealing components **201**, **202** and **203** that are coupled to adjacent cover members.

[0096] FIG. 8 is a cross-sectional view schematically illustrating the assembly of the sealing portion according to another embodiment. Referring to FIG. 8, adjacent cover members equipped with the sealing components **201**, **202** and **203** may be combined to form a single sealing portion **200**.

[0097] In detail, a battery module **10** according to an embodiment may include a cell assembly **110a** formed by stacking a plurality of battery cells, and protective covers **150**, **160** and **170** that accommodate at least a portion of the cell assembly **110a**, and may include a first sub-module **100a** and a second sub-module **100b** facing each other in a first direction and a sealing portion **200** provided on the protective covers **150**, **160** and **170** to surround the peripheral surfaces of the protective covers **150**, **160** and **170**. In this case, the sealing portion **200** may be formed of a plurality of sealing components **201**, **202** and **203** that may be separated based on the peripheral surface of the protective covers **150**, **160** and **170**.

[0098] Meanwhile, in this specification, the “peripheral surface of the protective cover **150**, **160**, **170**” may mean a surface through which a fluid such as gas passes, and in detail, may mean at least one surface that faces respective components of the protective covers **150**, **160** and **170** and does not face the cell assembly **110a**.

[0099] For example, the “peripheral surface of the protective cover **150**, **160**, **170**” may mean the peripheral surface of at least one of the end cover **150**, the center cover **160**, or the side cover **170**.

[0100] In this case, the “peripheral surface of the end cover **150**” may refer to at least one of the upper surface, the lower surface (the surface facing the Z-axis direction), or the side surface (the surface facing the Y-axis direction) of the end cover **150**. In addition, the “peripheral surface of the center cover **160**” may refer to at least one of the upper surface, the lower surface (the surface facing the Z-axis direction), or the side surface (the surface facing the Y-axis direction) of the center cover **160**. In addition, the “peripheral surface of the side cover **170**” may refer to at least one of the upper surface, the lower surface (the surface facing the Z-axis direction), or the side surface (the surface facing the X-axis direction) of the side cover **170**.

[0101] For example, the “peripheral surface of the protective cover **150, 160, 170**” may mean at least one surface (a portion) of the circumference surfaces of the protective covers **150, 160** and **170** described above.

[0102] The sealing portion **200** may include a plurality of sealing components **201, 202** and **203** provided on other cover members adjacent to the assembly body.

[0103] The plurality of sealing components **201, 202** and **203** may include a first component **201** provided on the upper cover **400**, a second component **202** provided on the lower cover **300**, and a third component **203** provided on the side cover **170**.

[0104] Through this structure, the plurality of sealing components **201, 202** and **203** may form a sealing portion **200** that is disposed on the center cover **160** in a direction perpendicular to the first direction when the side cover **170**, the upper cover **400**, and the lower cover **300** are combined with the protective covers **150, 160** and **170**, in detail, the center cover **160**.

[0105] In this case, the sealing portion **200** may be disposed on at least a portion of the peripheral surface of the center cover **160**. For example, the sealing portion **200** may be disposed to wrap at least a portion of the center cover **160**. In this specification, ‘wrap’ does not mean enclosing all parts of the peripheral surface of the center cover **160**, but rather means being disposed on at least partial surface (a portion) of the peripheral surface of the center cover **160**.

[0106] In detail, if the sealing portion **200** is positioned at a position where it may at least partially block the flow of fluid flowing in the gap between the components of the protective covers **150, 160** and **170**, it may be referred to as the sealing portion **200** of the present disclosure, and it does not necessarily have to be positioned to surround the entire circumference. Meanwhile, in the drawing, the plurality of sealing components **201, 202** and **203** are illustrated as having a total of four, including one first component **201** and one second component **202**, and two third components **203**, but the present disclosure is not limited thereto. For example, the number of the plurality of sealing components **201, 202** and **203** may correspond to the number of circumferences of the assembly (center cover; **160** in the drawing).

[0107] For example, if the upper cover **400** and the lower cover **300** are not combined with the center cover **160**, the sealing portion **200** may be provided as two third components. In addition, although each sealing component is provided in a straight line shape in the drawing, the present disclosure is not limited thereto, and one of the plurality of sealing components may be provided in a “L” shape and the other may be provided in an “I” shape. In addition, at least one of the plurality of sealing components may be provided in an shape and may be respectively disposed on two sides of the center cover **160**.

[0108] For example, if the sealing portion **200** of the present disclosure includes two or more sealing components that are separable from each other, it may be said that they all belong to the present disclosure.

[0109] In addition, when the sealing portion **200** is formed of a plurality of separable sealing components **201, 202** and **203**, it should be understood that it is included in the present disclosure even if the sealing portion is provided to surround at least a portion of the circumferences of the protective covers **150, 160** and **170**. For example, it is sufficient even if at least one of the first component, the second component, or the third component is only disposed on a portion of the circumference of the center cover **160**.

[0110] The upper drawing of FIG. **8** illustrates the state before the cover members (side cover; **170**, upper cover; **400**, lower cover; **300**) adjacent to the center cover **160** are assembled. At this time, the sealing portion **200** is provided in a state where the plurality of sealing components **201, 202** and **203** are separated.

[0111] The lower drawing of FIG. **8** illustrates the state in which the aforementioned adjacent cover members are assembled to the center cover **160**. At this time, a plurality of sealing components **201, 202** and **203** may form a single sealing portion **200** by surrounding the periphery of the center cover **160**. The plurality of sealing components **201, 202** and **203** may form the sealing portion **200**

only when adjacent cover members are assembled. For example, the sealing portion **200** may be formed only when the battery module **10** is assembled and the adjacent cover members and the center cover **160** are combined, and when the cover members are separated, the sealing portion **200** may be separated into a plurality of sealing components **201**, **202** and **203**. Accordingly, the sealing portion **200** may also be referred to as a sealing component assembly formed by assembling multiple sealing components.

[0112] Through this structure, deformation of the sealing portion **200** during the assembly process of the battery module **10** may be prevented significantly, and the problem of cover members being difficult to assemble due to assembly tolerance during the assembly process may be reduced.

[0113] FIG. **9** is a cross-sectional view schematically illustrating the assembly of a sealing portion according to another embodiment.

[0114] Since the center cover **160** is coupled to the side covers **170** on both sides and coupled to the upper cover **400** and the lower cover **300** on the upper and lower sides, respectively, assembly may be difficult due to minor tolerances during the assembly process. For example, when the lower cover **300** is assembled last while the side cover **170** and the upper cover **400** are coupled to the center cover **160**, even if it is provided as in FIG. **8**, the assembly of the lower cover **300** may become difficult depending on the thickness of the sealing portion **200**, or even if assembled, stress may be concentrated only on the lower cover **300**, which may deteriorate the durability of the battery module **10**.

[0115] Accordingly, according to another embodiment of the present disclosure, a chamfer component **205** may be further included, in which a chamfer cp is formed at the corner of the center cover **160** and a plurality of sealing components are provided in a shape corresponding to the chamfer cp. The chamfer component **205** may be provided in at least one of the plurality of sealing components **201**, **202** and **203**.

[0116] Among the upper drawings of FIG. **9**, the left drawing is a drawing illustrating that the third component **203** is provided with the chamfer component **205**, and among the upper drawings of FIG. **9**, the right drawing is a drawing illustrating that the first and second components **201** and **202** are provided with the chamfer components **205**.

[0117] Through this structure, referring to the lower drawing of FIG. **9**, the gap between the center cover **160** on which the chamfer cp is formed and the adjacent cover members (side cover; **170**, upper cover; **400**, lower cover; **300**) may be filled. As a result, the assembly reliability when assembling the adjacent cover members described above to the center cover **160** may be further improved.

[0118] Meanwhile, the embodiments described above in FIGS. **8** and **9** are described based on the fact that a plurality of sealing components **201**, **202** and **203** are provided on the cover members (side cover; **170**, upper cover; **400**, lower cover; **300**) adjacent to the center cover **160**, respectively, and the cover members adjacent to the center cover **160** are combined with the center cover **160** so that the first to third components **201**, **202** and **203** form the sealing portion **200**.

[0119] However, the present disclosure is not limited thereto, and the sealing portion **200** may be formed on one or more of the protective covers **150**, **160** and **170**.

[0120] For example, unlike the drawing, a plurality of sealing components may be provided on the cover members (end cover; **150**, upper cover; **400**, lower cover; **300**) adjacent to the side cover **170**, respectively, and when the cover members adjacent to the side cover **170** are combined with the side cover **170**, the plurality of sealing components may form a sealing portion **200**.

[0121] For example, in the present disclosure, the sealing portion **200** may be provided on at least one of the protective covers **150**, **160** and **170**, and the sealing portion **200** may be formed when adjacent cover members provided with a plurality of sealing components of the battery module **10** are assembled with each other.

[0122] As set forth above, according to an embodiment, a battery module in which a fire occurring in a battery module may be delayed or minimized from spreading to an adjacent battery module

may be provided.

[0123] According to an embodiment, a battery module may be provided in which a fire occurring in one sub-module may be delayed or minimized from spreading to an adjacent sub-module.

[0124] Only specific examples of implementations of certain embodiments are described.

Variations, improvements and enhancements of the disclosed embodiments and other embodiments may be made based on the disclosure of this patent document. In the above-described embodiments, some components may be deleted and implemented, and respective embodiments may be implemented in combination with each other.

[0125] The contents described above are merely examples of applying the principles of the present disclosure, and other configurations may be further included without departing from the scope of the present disclosure.

Claims

1. A battery module comprising: a first sub-module and a second sub-module respectively including a cell assembly having a plurality of battery cells and a protective cover accommodating at least a portion of the cell assembly, and facing each other in a first direction; and a sealing portion provided on the protective cover and disposed on at least a portion of a peripheral surface of the protective cover, wherein the sealing portion is formed by a plurality of sealing components separable based on the peripheral surface of the protective cover.
2. The battery module of claim 1, wherein the sealing portion is formed of a plurality of sealing components separable based on the peripheral surface of the protective cover.
3. The battery module of claim 2, wherein the protective cover includes: a center cover disposed close to a cell assembly adjacent thereto; an end cover facing the center cover; and a side cover disposed parallel to a stacking direction of the plurality of battery cells, and the sealing portion is provided to cover at least one of the center cover, the end cover, or the side cover.
4. The battery module of claim 3, further comprising an upper cover and a lower cover facing each other in a second direction perpendicular to the first direction, with the first sub-module and the second sub-module interposed therebetween, and respectively coupled to the protective cover, wherein the upper cover and the lower cover are coupled to the end cover, the center cover, and the side cover and are disposed on the first sub-module and the second sub-module.
5. The battery module of claim 4, wherein the plurality of sealing components include: a first component provided on the upper cover and disposed to face the center cover; a second component provided on the lower cover and disposed to face the center cover; and a third component provided on the side cover and disposed to face the center cover, and the upper cover, the lower cover, and the side cover are coupled to the center cover.
6. The battery module of claim 5, wherein the first component, the second component, and the third component form a sealing portion disposed to cover a peripheral surface of the center cover when the upper cover.
7. The battery module of claim 6, wherein the end cover has a chamfer formed at each corner, and the sealing portion includes a chamfer component provided in a shape corresponding to the chamfer.
8. The battery module of claim 7, wherein the chamfer component is provided on both ends of at least one of the first component, the second component, or the third component.
9. The battery module of claim 5, wherein the upper cover and the lower cover are provided with the first component and the second component disposed on portions thereof overlapping distal ends of one sides of the center cover and the side cover, based on the second direction, and the side cover is provided with the third component provided on the distal end of one side thereof overlapping the center cover, based on the stacking direction.
10. The battery module of claim 1, wherein the protective cover is provided with a sealing groove

accommodating at least a portion of the sealing portion.

11. A battery module comprising: a first sub-module and a second sub-module respectively including a cell assembly in which a plurality of battery cells are stacked in a first direction, a side cover facing the cell assembly in the first direction, and a center cover facing the cell assembly in a second direction perpendicular to the first direction; an upper cover and a lower cover disposed with the first sub-module and the second sub-module interposed therebetween in a direction perpendicular to the first direction and the second direction; and a plurality of sealing components provided on the side cover, the upper cover and the lower cover to face the center cover, wherein the plurality of sealing components form a sealing portion disposed to cover at least a portion of the center cover in a direction perpendicular to the first direction when the side cover, the upper cover, and the lower cover are coupled to the center cover.

12. The battery module of claim 11, wherein the sealing portion is disposed between a distal end of one side of the side cover, the upper cover, the lower cover, and the center cover.

13. The battery module of claim 12, wherein the center cover is disposed between the cell assembly of the first sub-module and the cell assembly of the second sub-module.
