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(54) **BATTERY MODULE ASSEMBLY AND A METHOD OF ASSEMBLING SAME**

(71) Applicants: **HYUNDAI MOTOR COMPANY**, Seoul (KR); **KIA CORPORATION**, Seoul (KR)

(72) Inventors: **Jun Ho Suh**, Gwacheon-si (KR); **June Ho Lee**, Goheung-gun (KR); **Yoon Hyuk Kang**, Seoul (KR); **Hyun Woo Yoon**, Gimpo-si (KR)

(73) Assignees: **HYUNDAI MOTOR COMPANY**, Seoul (KR); **KIA CORPORATION**, Seoul (KR)

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(57) **ABSTRACT**

A battery module assembly includes: a battery module formed by staking a plurality of battery cells that respectively include electrode tabs, a cooling plate positioned adjacent to the battery module, and at least one bus bar positioned on a lateral surface of the battery module and electrically connecting the plurality of battery cells to each other. and the battery module also includes a sensing cover positioned to be spaced a predetermined distance from the bus bar and covering the battery module. In particular, a heat dissipation layer is formed between the bus bar and the sensing cover, and the heat dissipation layer is positioned in contact with the cooling plate and dissipates heat occurring in the battery module and the bus bar.

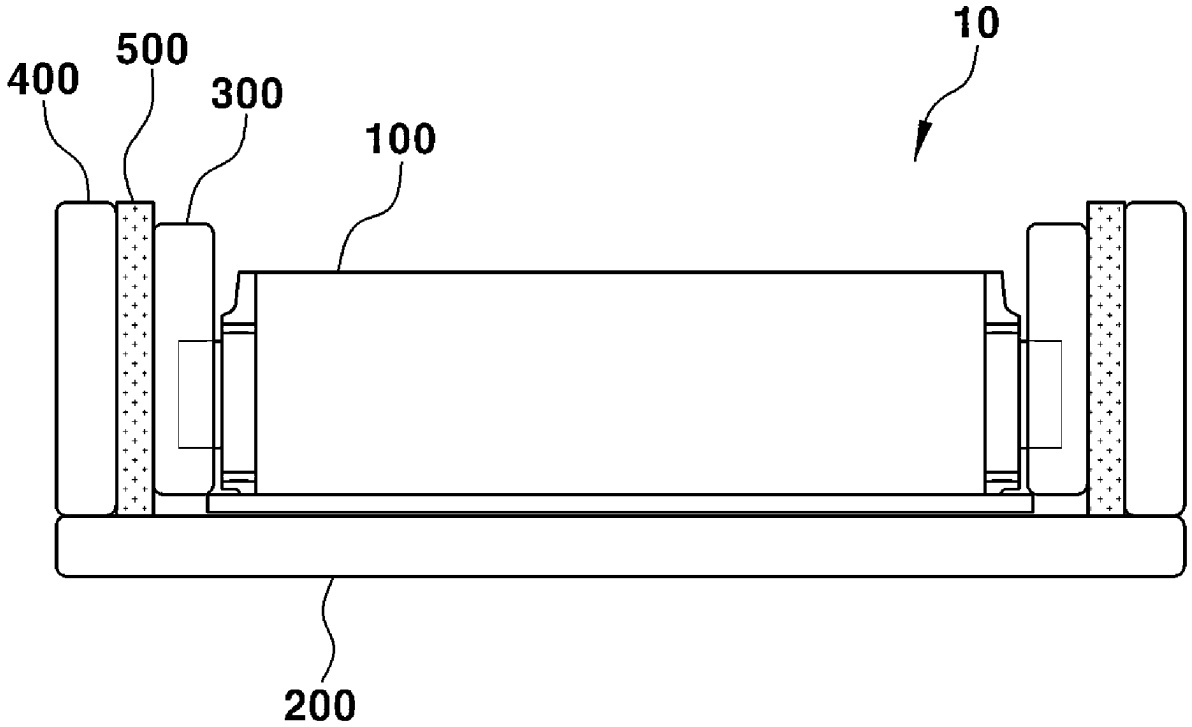


FIG. 1

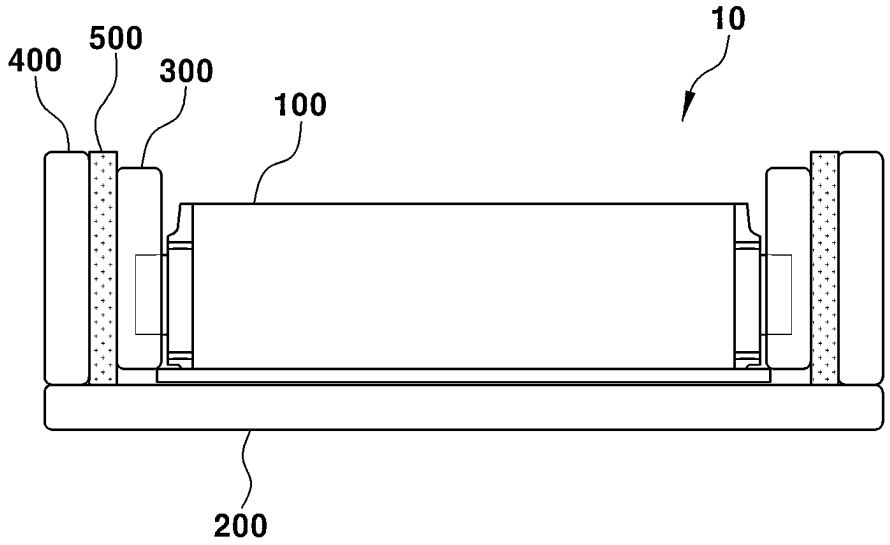



FIG. 2

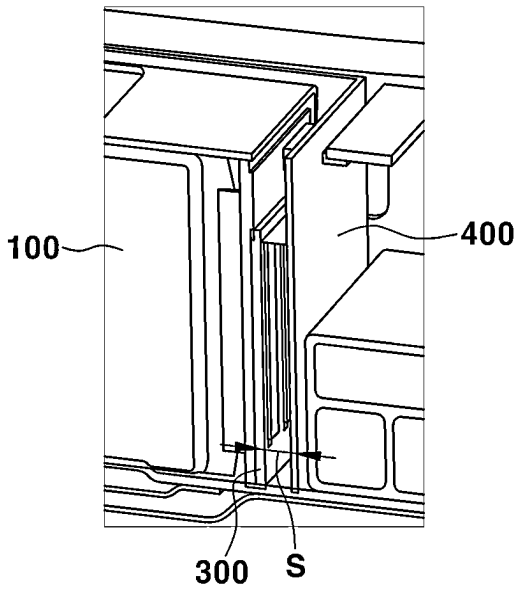


FIG. 3

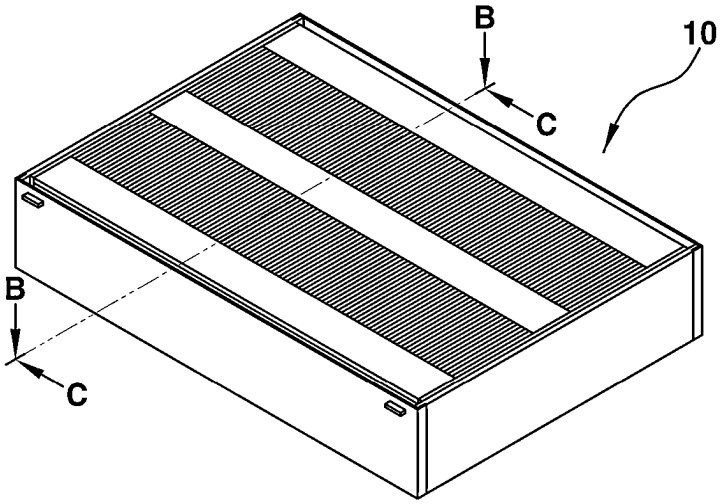



FIG. 4

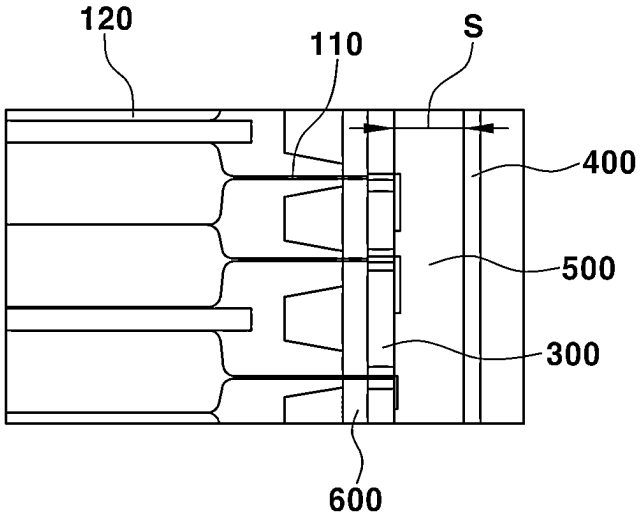


FIG. 5

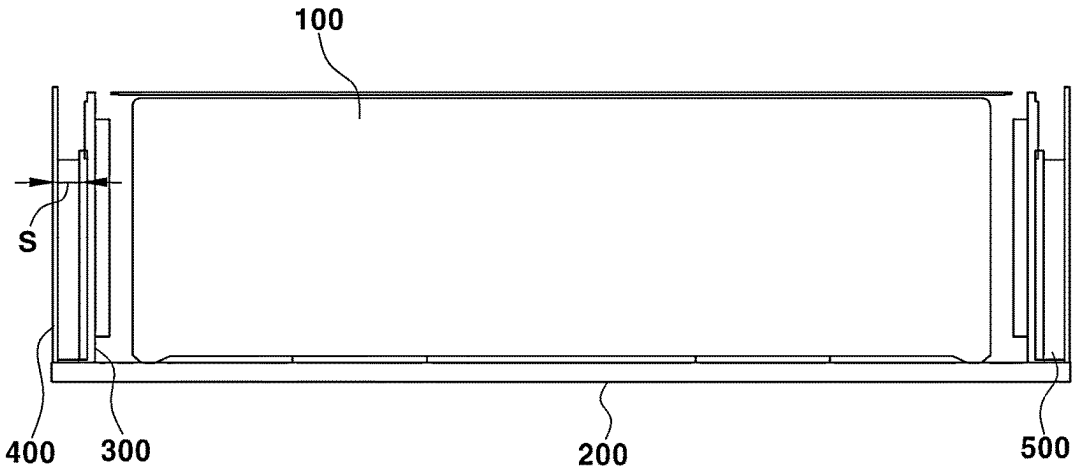


FIG. 6

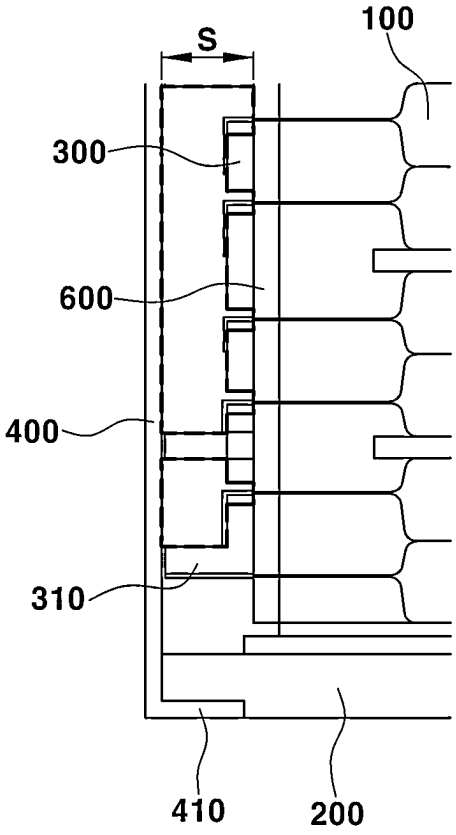


FIG. 7

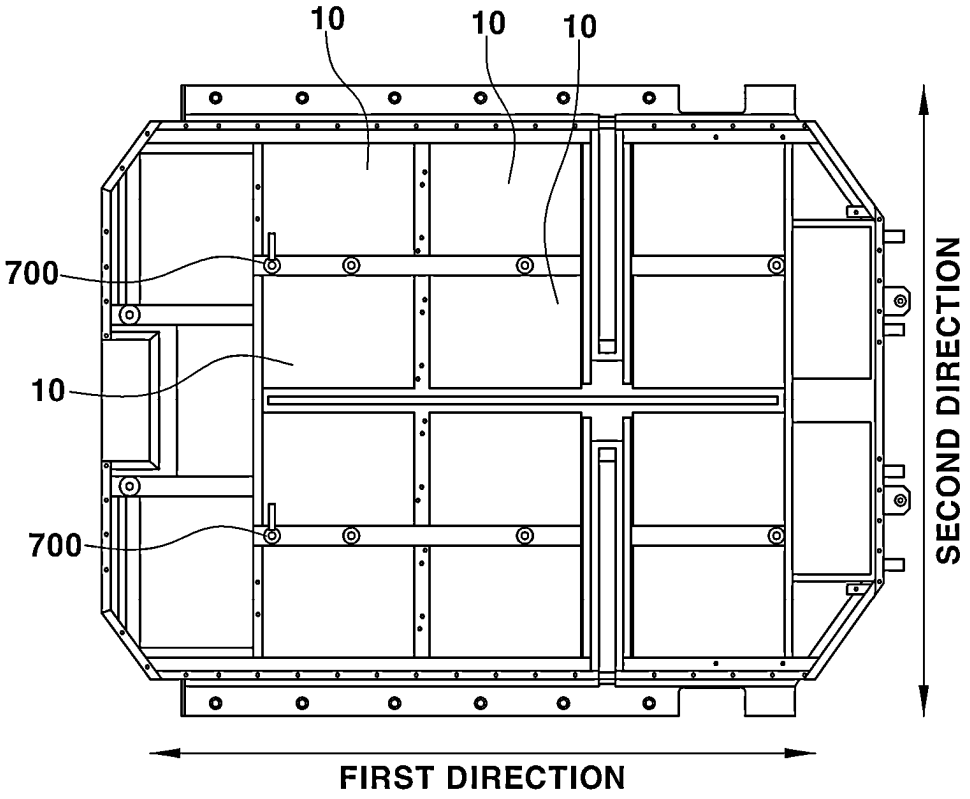
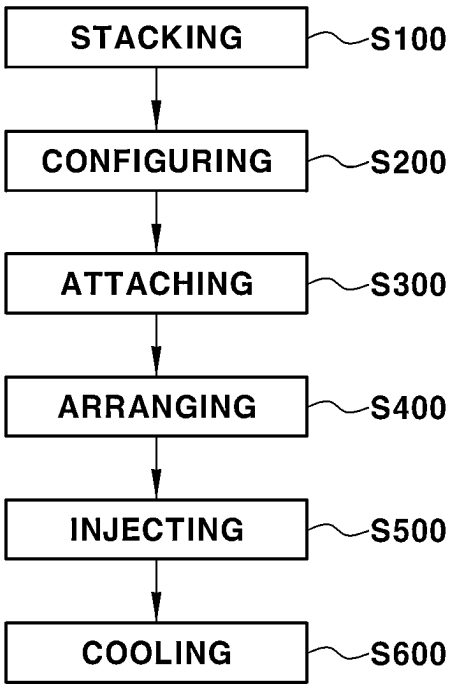


FIG. 8


STACKING
S100
CONFIGURING
S200
ATTACHING
S300
ARRANGING
S400
INJECTING
S500
COOLING
S600

# BATTERY MODULE ASSEMBLY AND A METHOD OF ASSEMBLING SAME

## CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims under 35 U.S.C. § 119(a) the benefit of and priority to Korean Patent Application No. 10-2024-0021649, filed on Feb. 15, 2024, the entire contents of which are incorporated herein by reference.

## BACKGROUND

### (a) Technical Field

**[0002]** The present disclosure relates to a battery module assembly and a method of assembling the battery module assembly.

### (b) Background Art

**[0003]** Electrified vehicles include: electric vehicles (EVs) that drive by powering a drive motor, hybrid electric vehicles (HEVs) that drive using both an engine and a drive motor, and fuel cell electric vehicles (FCEVs) that drive by powering a motor with electricity generated in a fuel battery.

**[0004]** The electric vehicle includes a drive motor for driving the electric vehicle itself and a battery as an electricity storage mean for supplying electricity to the drive motor. Examples of the battery include well-known nickel-hydrogen batteries and lithium polymer-based batteries.

**[0005]** This battery is configured with a battery pack formed by connecting a plurality of battery cells in serial or in parallel. The battery pack is configured to employ a structure of coupling a PCB including battery cells and a protection circuit module (PCM).

**[0006]** Specifically, a battery module assembly is configured using a structure that assembles multiple battery cells. A cell stack-up assembly is configured by stacking the multiple battery cells in one direction. The movement of the cell stack-up assembly resulting from stacking the battery cells in one direction is restricted by a plate surrounding the cell stack-up assembly or by frames, and thus the cell stack-up assembly is bound, and its movement is restricted. The battery module assembly is configured in this manner.

**[0007]** The battery module assembly is formed to employ a structure in which a cell end portion is exposed within the battery pack and in which a module is assembled using the cell end portion. The battery module assembly is configured to employ a structure in which, for cooling, the cooling plate is installed under the battery pack, thereby lowering the temperature of heat occurring in the battery pack.

**[0008]** This battery module assembly does not employ a structure in which a lower end portion of the battery pack and the cooling plate come into direct contact with each other, thereby lowering the temperature of heat. Instead, the temperature of the battery pack is lowered using a heat dissipation layer constituting a cooling flow path. Therefore, a problem arises in that only the temperature of the lower end portion of the battery pack is locally lowered, failing to lower the temperature of the entire battery module assembly.

**[0009]** In addition, the battery module assembly is manufactured by performing a process of stacking the battery cells and assembling a through-bolt in the direction of a cell tab. Heat occurring in the battery module assembly is not effectively lowered due to the through-bolt. A space for installing the cooling flow path positioned in a lower end portion of the battery module assembly cannot be expanded and thus the cooling efficiency of the battery module assembly decreases.

**[0010]** The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

## SUMMARY

**[0011]** One object of the present disclosure, which is contrived to address the above-mentioned object, is to provide a battery module assembly capable of lowering the temperature of an entire battery module assembly in such a manner that prevents any deviation in temperature of heat occurring in the battery module assembly itself.

**[0012]** Another object of the present disclosure is to provide a battery module assembly capable of improving its cooling efficiency and efficiency managing its temperature.

**[0013]** The present disclosure is not limited to the above-mentioned objects. An object not mentioned above could be clearly understandable by embodiments of the present disclosure in the following detailed description. In addition, the objects of the present disclosure can be accomplished by limitations recited in the claims or combination thereof.

**[0014]** The battery module assembly for accomplishing the above-described objects of the present disclosure has the following configurations.

**[0015]** According to one aspect of the present disclosure, a battery module assembly includes: a battery module formed by staking a plurality of battery cells, including electrode tabs, respectively; a cooling plate positioned adjacent to the battery module; at least one bus bar positioned on a lateral surface of the battery module and electrically connecting the plurality of battery cells to each other; and a sensing cover positioned to be spaced a predetermined distance from the at least one bus bar and covering the battery module. In particular, a heat dissipation layer is formed between the at least one bus bar and the sensing cover, and the heat dissipation layer is positioned in contact with the cooling plate and dissipates heat occurring in the battery module and the at least one bus bar.

**[0016]** In the battery module assembly, the cooling plate may be positioned on the bottom surface of the battery module.

**[0017]** In the battery module assembly, the sensing cover may come into contact with the heat dissipation layer, and the at least one bus bar may be positioned in contact with the heat dissipation layer.

**[0018]** In the battery module assembly, the sensing cover may be manufactured of one of the following materials with thermal conductivity: aluminum, copper, or silver.

**[0019]** In the battery module assembly, the heat dissipation layer may be formed of a thermal interface material (TIM).

**[0020]** In the battery module assembly, the heat dissipation layer may be formed of a metal material with thermal conductivity.

**[0021]** In the battery module assembly, the cooling plate may absorb heat occurring in the battery module using the sensing cover and the heat dissipation layer that are in contact with the cooling plate.

**[0022]** In the battery module assembly, the battery module and the sensing cover may be arranged to be spaced a predetermined distance apart from each other, a guide hole

may be formed in a space, resulting from the spacing, and the liquid-state heat dissipation layer may be injected in the guide hole.

**[0023]** In the battery module assembly, the sensing cover may include a rib formed in the direction of the cooling plate, wherein the cooling plate may be seated on the rib.

**[0024]** The battery module assembly may further include an injection plate positioned between the battery module and the sensing cover to prevent the liquid-state heat dissipation layer from leaking to the battery cell.

**[0025]** In the battery module assembly, one or more battery module assemblies are arranged in a first direction and a second direction, and a through-bolt may be positioned between the battery module assemblies positioned in the second direction.

**[0026]** In the battery module assembly, the first direction may be a lengthwise direction of the plurality of battery cells, and the second direction may be a direction in which the battery cells are stacked.

**[0027]** In the battery module assembly, the at least one bus bar may include a peripheral bus bar for regulating a position of the heat dissipation layer, and the peripheral bus bar is formed in the shape of the Korean letter "ㄱ" or "ㄴ" in order to prevent flowing of the liquid-state heat dissipation layer.

**[0028]** A method of assembling the battery module assembly for accomplishing the above-described objects of the present disclosure has the following configurations.

**[0029]** According to another aspect of the present disclosure, a method of assembling a battery module assembly includes: stacking a plurality of battery cells having electrode tabs; connecting, the at least one bus bar, the electrode tabs of the plurality of battery cells, thereby configuring a battery module; attaching a cooling plate to the battery module; arranging a sensing cover on front and rear surfaces of the battery module; arranging the battery module and the sensing cover to be spaced a predetermined distance apart from each other; injecting a liquid-state heat dissipation layer into a space formed between the battery module and the sensing cover; and cooling the battery module and the at least one bus bar.

**[0030]** In the method, the cooling plate may be attached to the bottom surface of the battery module.

**[0031]** In the method, an injection plate may be positioned between the battery module and the sensing cover, and, using the injection plate, a position of the liquid-state heat dissipation layer may be regulated in such a manner that the liquid-state heat dissipation layer does not leak.

**[0032]** In the method, the connecting of the plurality of battery cells and the configuring of the battery module may further include: assembling an injection plate to front surfaces and rear surfaces of the plurality of battery cells that are stacked; and pressing against the injection plate to the front surfaces and the rear surfaces of the plurality of battery cells.

**[0033]** In the method, in the arranging of the battery module and the sensing cover and the injecting of the liquid-state heat dissipation layer, the liquid-state heat dissipation layer may be injected using a guide hole.

**[0034]** In the method, the heat dissipation layer may be formed of a thermal interface material (TIM), the cooling plate is formed of a metal material with thermal conductivity, and the sensing cover is manufactured of one of the following materials with thermal conductivity: aluminum, copper, or silver.

**[0035]** According to the present disclosure, the following advantageous effects are obtained through the embodiments described above and through configurations, combinations, and application-based relationships that are described below.

**[0036]** According to the present disclosure, the temperature of the entire battery module assembly can be lowered in such a manner that a deviation in the temperature of heat occurring in the battery module assembly itself.

**[0037]** In addition, according to the present disclosure, the cooling efficiency of the battery module assembly can be improved, and the temperate thereof can be efficiently managed.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0038]** The above and other features of the present disclosure are now described in detail with reference to certain examples thereof illustrated in the accompanying drawings which are given herein below by way of illustration only, and thus are not limitative of the present disclosure, and wherein:

**[0039]** FIG. **1** is a cross-sectional view illustrating a cross section of a battery module assembly according to an embodiment of the present disclosure;

**[0040]** FIG. **2** is a perspective view illustrating one portion of the battery module assembly according to the present disclosure as installed in a vehicle;

**[0041]** FIG. **3** is a perspective view illustrating the battery module assembly according to the present disclosure;

**[0042]** FIG. **4** is a cross-sectional view taken along line B-B on FIG. **3**;

**[0043]** FIG. **5** is a cross-sectional view taken along line C-C on FIG. **3**;

**[0044]** FIG. **6** is a cross-sectional view illustrating a location of a heat dissipation layer in the battery module assembly according to an embodiment of the present disclosure;

**[0045]** FIG. **7** is a view illustrating the battery module assembly according to the present disclosure, as seen from the top; and

**[0046]** FIG. **8** is a block diagram sequentially illustrating steps of a method of assembling the battery module assembly according to an embodiment of the present disclosure.

## DETAILED DESCRIPTION

**[0047]** Embodiments of the present disclosure are described in more detail below with reference to the accompanying drawings. The embodiments of the present disclosure may be modified in various forms, and the scope of the present disclosure should not be interpreted as being limited to the embodiments described below. The embodiments are described in sufficient detail to enable a person of ordinary skill in the art to make and use the present disclosure without undue experimentation.

**[0048]** The term "unit," "module," or the like, which is used throughout the specification, means an individual component that performs at least one function or operation and may be realized in hardware, software, or a combination of both.

**[0049]** The terms used in the present specification are only for describing a specific embodiment and are not intended to impose any limitation on the specific embodiment. A noun

in singular form has the same meaning as when used in its plural form, unless it has a different meaning in context.

**[0050]** When a component, device, element, or the like of the present disclosure is described as having a purpose or performing an operation, function, or the like, the component, device, or element should be considered herein as being "configured to" meet that purpose or to perform that operation or function.

**[0051]** In addition, in order to distinguish among constituent elements that have the same name, the terms first, second, and so on are used throughout the present specification. In the following description, no limitation is necessarily imposed to the order of the terms.

**[0052]** The embodiments are described in detail below with reference to the accompanying drawings. The same reference numbers are assigned to the same constituent elements or to constituent elements that correspond to each other. The same description thereof is not repeated.

**[0053]** FIG. **1** is a cross-sectional view illustrating a cross section of a battery module assembly according to an embodiment of the present disclosure. FIG. **2** is a perspective view illustrating one portion of the battery module assembly according to the present disclosure as installed in a vehicle. FIG. **3** is a perspective view illustrating the battery module assembly according to the present disclosure. FIG. **4** is a cross-sectional view taken along line B-B on FIG. **3**. FIG. **5** is a cross-sectional view taken along line C-C on FIG. **3**. FIG. **6** is a cross-sectional view specifically illustrating a position of a heat dissipation layer in the battery module assembly according to an embodiment of the present disclosure. FIG. **7** is a view illustrating the battery module assembly, according to the present disclosure, as seen from the top. FIG. **8** is a block diagram sequentially illustrating steps of a method of assembling the battery module assembly according to an embodiment of the present disclosure.

**[0054]** With reference to FIGS. **1** to **6**, a battery module assembly **10** according to a first embodiment of the present disclosure includes: a battery module **100** formed by staking a plurality of battery cells **120** each including an electrode tab **110**; a cooling plate **200** positioned on a bottom surface of the battery module **100**; and a bus bar **300** positioned on a lateral surface of the battery module **100** and electrically connecting the plurality of battery cells **120** to each other. The battery module **100** further includes a sensing cover **400** positioned to be spaced a predetermined distance from the bus bar **300** and covering the battery module **100**. The battery module assembly **10** employs a structure in which a heat dissipation layer **500** is formed into a space "S", resulting from the spacing, between the bus bar **300** and the sensing cover **400**.

**[0055]** The battery module **100** of the battery module assembly **10** according to the first embodiment of the present disclosure is configured as a stack-up assembly formed by stacking the plurality of battery cells **120** in one direction. The battery cell **120** may have the shape of a cylinder, pouch, square, or the like. The number of the battery cells **120** that constitute one cell stack-up assembly may fall within a range suitably selected by a person of ordinary skill in the art. In addition, a cell stack-up assembly may be formed as a group resulting from stacking the plurality of battery cells **120** according to the present disclosure in a single row. In addition, the plurality of battery cells **120** according to the present disclosure are connected to the electrode tabs **110**, respectively. Thus, the plurality of battery cells **120** are configured to have an electrical coupling structure. In addition, the battery cell **120** is charged with electric power supplied from the outside and is discharged by supplying the stored electric power to the outside.

**[0056]** According to the present disclosure, the battery module **100** is described as being formed by the configuration of the battery cells **120** and the electrode tabs **110**. However, a secondary cell may be configured with various structures of the battery module **100** that is manufactured by a person of ordinary skill in the art to which the present disclosure pertains. A secondary battery that undergoes repeated charging or discharging through electrochemical reactions is employed as the battery module **100** according to the present disclosure. Furthermore, a high-capacity secondary battery may be employed suitably for use in driving a vehicle.

**[0057]** The cooling plate **200** of the battery module assembly **10** according to the first embodiment of the present disclosure is positioned on the bottom surface of the battery module **100**, comes into contact with the sensing cover **400** and the heat dissipation layer **500**, which are described below, and serves to absorb and dissipate heat that occurs in the battery module **100**. Specifically, the cooling plate **200** of the battery module assembly **10** may be made of a metal material with high thermal conductivity to efficiently dissipate heat that occurs in the battery module **100**. For example, the cooling plate **200** may be formed of a metal material with high thermal conductivity, such as aluminum or copper, and may employ various shapes, such as a cooling fin and a cooling plate. For example, the cooling plate **200** may employ any shape or material, as long as it can effectively maximize transfer of heat that occurs in the battery module **100**.

**[0058]** In addition, the cooling plate **200** according to the present disclosure can be manufactured in the shape of a plate with an area that is expanded to come into contact with the sensing cover **400** and the heat dissipation layer **500**, thereby increasing cooling efficiency. The cooling plate **200** according to the present disclosure is described as employing the shape of a plate, but it is also possible that the cooling plate **200** has a cooling flow path. Furthermore, it is also possible that the cooling plate **200** employs a structure in which a cooling line through which a coolant flows is provided inside the cooling plate **200** and in which the coolant is used as a refrigerant.

**[0059]** In another embodiment, the bus bar **300** of the battery module assembly **10** is connected to each of the electrode tabs **110** and electrically connects the plurality of battery cells **120** and a substrate (not illustrated) to each other. In addition, the bus bar **300** according to the present disclosure, shaped to be coupled to each of the positive and negative electrodes of the battery module **100** at both lateral sides of the battery cell **120** is provided. The bottom surface of the bus bar **300** may be arranged to be positioned adjacent to the cooling plate **200**, but not in contact therewith. In addition, one or more bus bar **300** are arranged. Furthermore, the bus bar **300** adjacent to the heat dissipation layer **500** is a peripheral bus bar **310** formed in the shape of the Korean letter "ㄱ" or "ㄴ" in order to prevent the flow of the liquid-state heat dissipation layer **500** and regulate a position of the heat dissipation layer **500**. Specifically, the peripheral bus bar **310** is positioned adjacent to the heat dissipation layer **500** among one or more bus bars **300**. The peripheral bus bar **310** is formed in such a manner as to have a greater

area than the other bus bars **300**. The peripheral bus bar **310** may be formed in the shape of the Korean letter "ㄱ" or "ㄴ" in order to prevent the flow of the liquid-state heat dissipation layer **500**.

**[0060]** The sensing cover **400** of the battery module assembly **10** according to the first embodiment of the present disclosure is positioned in such a manner that the bottom surface thereof is in contact with the cooling plate **200**. Furthermore, the sensing cover **400** is configured in such a manner that a lateral surface thereof is spaced a predetermined distance apart from the bus bar **300** and is in contact with the heat dissipation layer **500**. Specifically, the sensing cover **400** may be mad of a material with thermal conductivity in order to effectively dissipate heat occurring in the battery module **100** and to significantly lower the temperature of the battery module **100**. Examples of the material include aluminum, copper, and silver.

**[0061]** In addition, the sensing cover **400** according to the present disclosure may also be used to protect the battery module **100**. Accordingly, the sensing cover **400** may be manufactured in the shape that is appropriately designed by a person of ordinary skill in the art according to the suitable shape and size of the battery module **100**.

**[0062]** In addition, a rib **410** may be formed in the direction of the cooling plate **200** on the sensing cover **400** according to the present disclosure. The sensing cover **400** may be configured to employ a structure in which the cooling plate **200** is seated on the rib **410**.

**[0063]** With reference to FIG. **6**, the cooling plate **200** may be arranged to come into contact with the rib **410** on the sensing cover **400**. The reason for forming the rib **410** on the sensing cover **400** is to stably bring the cooling plate **200** into contact with the sensing cover **400** and to expand an area of the cooling plate **200** that comes into contact with the cooling plate **200**. In addition, the rib **410** on the sensing cover **400** increases the area, in contact with the cooling plate **200**, of the sensing cover **400**, thereby effectively lowering heat that occurs in the battery module **100**.

**[0064]** The sensing cover **400** according to the present disclosure is made of a material with thermal conductivity, the bottom surface thereof comes into contact with the cooling plate **200**, and the lateral surface thereof comes into contact with the heat dissipation layer **500**. Accordingly, heat that occurs in the battery module **100** can be effectively dissipated.

**[0065]** The heat dissipation layer **500** of the battery module assembly **10** according to the first embodiment of the present disclosure is positioned in the space "S" between the bus bar **300** and the sensing cover **400**. The heat dissipation layer **500** is in contact with the cooling plate **200** so that the heat dissipation layer **500** serves to dissipate heat occurring in the battery module **100** and the bus bar **300**.

**[0066]** Specifically, the heat dissipation layer **500** of the battery module assembly **10** according to the present disclosure is formed of a thermal interface material (TIM). The heat dissipation layer **500** is arranged in such a manner that one surface thereof can be attached to the sensing cover **400** and that a different surface opposite to the one surface can come into contact with the bus bar **300**.

**[0067]** FIG. **7** is a view illustrating the battery module assembly according to the present disclosure, when viewed from the top. With reference to FIG. **7**, one or more battery module assemblies **10** according to the present disclosure may be configured and may be arranged in a first direction and a second direction.

**[0068]** At this point, the first direction is the lengthwise direction of a battery cell, and the second direction is a direction in which the battery cells are stacked. In the related art, a through-bolt **700** is assembled in the direction of the bus bar **300** of the battery module assembly **10** or in the direction of the electrode tabs **110**. However, in one embodiment of the present disclosure, the through-bolt **700** is assembled between the battery module assemblies **10**. In the related art, the position of the through-bolt **700** does not effectively reduce heat that occurs in the bus bar **300** or the electrode tabs **110**. However, the assembling of the through-bolt **700** between the battery module assemblies **10** according to the present disclosure can effectively reduce heat that occurs in the battery module assembly **10**. In addition, according to the present disclosure, the through-bolt **700** is used to establish connection to the battery module assembly **10**. Accordingly, the position of the through-bolt **700** can expand a space for installing the cooling plate **200** positioned below the battery module assembly **10** or for installing the cooling flow path. With this simple structure that changes the position of the through-bolt **700**, heat management for the battery module assembly **10** capable of lowering heat occurring in the battery module assembly **10** can be realized.

**[0069]** The heat dissipation layer **500** is positioned in the space S, resulting from the spacing, between the bus bar **300** and the sensing cover **400**. A guide hole (not illustrated) is formed in the space S created by the spacing. The liquid-state heat dissipation layer **500** is injected into the guide hole. In addition, the cooling plate **200** is arranged on the bottom surface of the space S, resulting from the spacing, in such a manner that the liquid-state heat dissipation layer **500** does not flow.

**[0070]** A method of assembling the battery module assembly **10** by injecting the liquid-state heat dissipation layer **500** through the guide hole when assembling the battery cell **120** of the stacking-resulting battery module **100** and the sensing cover **400** is described in detail below.

**[0071]** FIG. **8** is a block diagram illustrating a method of manufacturing the battery module assembly according to an embodiment of the present disclosure.

**[0072]** With reference to FIG. **8**, steps of the method of manufacturing the battery module assembly **10** are sequentially described.

**[0073]** For the battery module assembly **10**, the plurality of battery cells **120** are stacked in one direction (a step S**100**).

**[0074]** In a step S**200**, the electrode tabs are connected to the plurality of battery cells **120**, respectively. The bus bars **300** that electrically connects the battery cells **120** to each other in a direction in which each of the electrode tabs **110** protrudes is assembled. The bus bars **300** may be coupled to both lateral surfaces, respectively, of the plurality of battery cells **120**. The battery module **100** may be formed by electrically connecting the electrode tabs **110** and the bus bar **300** to the battery cell **120**.

**[0075]** In a step S**300**, the cooling plate **200** is attached to the bottom surface of the battery module **100**. The cooling plate **200** is attached to the battery module **100** in a manner that comes into close contact therewith, in order to cool the battery module **100** or lower the temperature thereof. In

addition, the expansion of the area of the cooling plate **200**, which is in contact with the battery module **100**, increases the area of the cooling plate **200**, to which the battery module **100** transfers heat. In other words, by expanding the contact area with the battery module (**100**), the heat transfer area to the battery module (**100**) increases. Therefore, the battery module **100** can be quickly cooled, or the temperature thereof can be effectively lowered.

**[0076]** Subsequently, in a step S**400**, the sensing cover **400** is positioned on the front and rear surfaces of the battery module **100** and is arranged to be a predetermined distance apart from the battery module **100**. In addition, the cooling plate **200** is attached on the bottom surface of the sensing cover **400**. When the area of the sensing cover **400**, which comes into contact with the cooling plate **200**, is expanded and is brought into close contact with the cooling plate **200**, the area of the sensing cover **400**, to which heat is transferred, is also increased, thereby facilitating quick cooling of the battery module **100** and lowering of the temperature thereof. Therefore, it is desired to form the close contact between the sensing cover **400** and the cooling plate **200** and to expand the close contact area.

**[0077]** Subsequently, in a step S**500**, the liquid-state heat dissipation layer **500** is injected into the space S, resulting from the spacing, between the battery module **100** and the sensing cover **400**. In the space "S" positioned between the battery module **100** and the sensing cover **400**, the liquid-state heat dissipation layer **500** is injected through the guide hole in such a manner that the liquid-state heat dissipation layer **500** does not flow to another module. The cooling plate **200** is positioned on the bottom surface of the heat dissipation layer **500**, and the positions of the sensing cover **400** and the battery module **100** are regulated in such a manner that the liquid-state heat dissipation layer **500** does not leak. Thus, the heat dissipation layer **500** may be stably positioned in the space S.

**[0078]** In another embodiment, the battery module assembly **10** may further include an injection plate **600** positioned in the space S, which is positioned between the sensing cover **400** and the battery module **100**, in such a manner that the liquid-state heat dissipation layer **500** is stably injected. The injection plate **600** is positioned adjacent to the battery cell **120** of the battery module **100** and serves to regulate the flow of the liquid-state heat dissipation layer **500** in such a manner that it is not injected into the battery module **100**.

**[0079]** In a step S**600**, a step of cooling the battery module **100** and the bus bar **300** is performed. Specifically, the liquid-state heat dissipation layer **500** is injected, and the cooling plate **200** is driven in order to cool the heat dissipation layer **500** or lower the temperature thereof. The cooling plate **200** may employ the shape of a plate or a flow path, thereby fully cooling the battery module **100** and the bottom of the bus bar **300**.

**[0080]** By cooling the cooling plate **200**, low temperature is transferred to sensing cover **400** and the heat dissipation layer **500** that are in contact with the cooling plate **200**. The material properties of the sensing cover **400** and the heat dissipation layer **500** can significantly facilitate quick temperature transfer to the bus bar **300**. The cooling plate **200** in contact with the battery module **100** can also quickly lower the temperature of the battery module **100**.

**[0081]** This coupling relationship in the battery module assembly **10** according to the present disclosure can significantly lower the temperature of the battery module **100**. In addition, the battery module **100** is positioned in such a manner that the bottom surface thereof is in contact with the cooling plate **200**. The sensing cover **400** and the heat dissipation layer **500** are positioned in such a manner that the bottom surfaces thereof are in contact with the cooling plate **200**. Thus, a deviation in temperature that occurs within the battery module **100** can be effectively reduced. Consequently, the battery module assembly **10** capable of effectively controlling heat generation in the battery module **100** can be realized. In addition, the positioning of the heat dissipation layer **500** between the sensing cover **400** and the bus bar **300** can change the position of the through-bolt **700** assembled in the direction of a cell tab, thereby improving the cooling efficiency of the battery module assembly **10**.

**[0082]** The present disclosure is described in detail above in an exemplary manner. In addition, the embodiments of the present disclosure are described in sufficient detail to enable a person of ordinary skill in the art to practice the present disclosure. Various modifications to, and combinations of, the embodiment of the present disclosure may be made under various conditions. Modifications or alterations would be made to the embodiments, as disclosed in the present disclosure, within the scope of the concept of the present disclosure, the scope of equivalents of the disclosed contents, and/or the scope of the technology or knowledge in the art. It is also possible that various modifications, which may be required in the field in which the present disclosure finds application, are made to the embodiments. Therefore, the embodiments, as disclosed in detail above, of the present disclosure are not intended to impose any limitation on the present disclosure. In addition, the following claims should be construed as covering other embodiments of the present disclosure as well.

What is claimed is:

**1**. A battery module assembly comprises:

a battery module formed by staking a plurality of battery cells, including electrode tabs, respectively;

a cooling plate positioned adjacent to the battery module;

at least one bus bar positioned on a lateral surface of the battery module and electrically connecting the plurality of battery cells to each other; and

a sensing cover positioned to be spaced a predetermined distance from the at least one bus bar and covering the battery module,

wherein a heat dissipation layer is formed between the at least one bus bar and the sensing cover, and

wherein the heat dissipation layer is positioned in contact with the cooling plate and configured to dissipate heat occurring in the battery module and the at least one bus bar.

**2**. The battery module assembly of claim **1**, wherein the cooling plate is positioned on a bottom surface of the battery module.

**3**. The battery module assembly of claim **1**, wherein the sensing cover comes into contact with the heat dissipation layer, and the at least one bus bar is positioned in contact with the heat dissipation layer.

**4**. The battery module assembly of claim **1**, wherein the sensing cover is manufactured of one of the following materials with thermal conductivity: aluminum, copper, or silver.

**5**. The battery module assembly of claim **1**, wherein the heat dissipation layer is formed of a thermal interface material (TIM).

6. The battery module assembly of claim 1, wherein the heat dissipation layer is formed of a metal material with thermal conductivity.

7. The battery module assembly of claim 1, wherein the cooling plate is configured to absorb heat occurring in the battery module using the sensing cover and the heat dissipation layer that are in contact with the cooling plate.

8. The battery module assembly of claim 1, wherein the battery module and the sensing cover are arranged to be spaced a predetermined distance apart from each other, a guide hole is formed in a space, resulting from the spacing, and the heat dissipation layer in a liquid state is injected into the guide hole.

9. The battery module assembly of claim 1, wherein the sensing cover comprises:

a rib formed in a direction of the cooling plate,

wherein the cooling plate is seated on the rib.

10. The battery module assembly of claim 1, further comprising:

an injection plate positioned between the battery module and the sensing cover to prevent the heat dissipation layer in a liquid state from leaking to the plurality of battery cells.

11. The battery module assembly of claim 1, wherein one or more battery module assemblies are arranged in a first direction and a second direction, and a through-bolt is positioned between the battery module assemblies positioned in the second direction.

12. The battery module assembly of claim 11, wherein the first direction is a lengthwise direction of the plurality of battery cells, and the second direction is a direction in which the plurality of battery cells are stacked.

13. The battery module assembly of claim 1, wherein the at least one bus bar includes a peripheral bus bar for regulating a position of the heat dissipation layer, and the peripheral bus bar is formed in a shape of a Korean letter "ㄱ" or "ㄴ" in order to prevent flowing of the heat dissipation layer in a liquid state.

14. A method of assembling a battery module assembly, the method comprising:

stacking a plurality of battery cells having electrode tabs;

connecting, by at least one bus bar, the electrode tabs of the plurality of battery cells, thereby configuring a battery module;

attaching a cooling plate to the battery module;

arranging a sensing cover on front and rear surfaces of the battery module;

arranging the battery module and the sensing cover to be spaced a predetermined distance apart from each other;

injecting a liquid-state heat dissipation layer into a space formed between the battery module and the sensing cover; and

cooling the battery module and the at least one bus bar.

15. The method of claim 14, wherein the cooling plate is attached to a bottom surface of the battery module.

16. The method of claim 14, wherein an injection plate is positioned between the battery module and the sensing cover, and, using the injection plate, a position of the liquid-state heat dissipation layer is regulated in such a manner that the liquid-state heat dissipation layer does not leak.

17. The method of claim 14, wherein the connecting of the plurality of battery cells and the configuring of the battery module further comprises:

assembling an injection plate to front surfaces and rear surfaces of the plurality of battery cells that are stacked; and

pressing against the injection plate to the front surfaces and the rear surfaces of the plurality of battery cells.

18. The method of claim 14, wherein, in the arranging of the battery module and the sensing cover and the injecting of the liquid-state heat dissipation layer, the liquid-state heat dissipation layer is injected using a guide hole.

19. The method of claim 14, wherein, the liquid-state heat dissipation layer is formed of a thermal interface material (TIM), the cooling plate is formed of a metal material with thermal conductivity, and the sensing cover is manufactured of one of the following materials with thermal conductivity: aluminum, copper, or silver.

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