

**TITLE OF INVENTION: METHOD FOR MANUFACTURING BATTERY MODULE AND
BATTERY MODULE**

TECHNICAL FIELD

[0001] The present disclosure relates to a method for manufacturing a battery module, and a battery module.

BACKGROUND

[0002] A battery module includes a battery assembly, in which batteries are stacked, and various components, such as end plates and voltage sensing assemblies. Accordingly, to manufacture the battery module, a process of assembling the battery assembly and the other components is necessary.

[0003] However, according to the conventional technology, relative locations between the battery assembly and the other components are misaligned in the process of assembling the components including the battery assembly to manufacture the battery module whereby defects of the battery module occur frequently. In particular, because no part that directly fixes the components including the battery assembly is present before the components are jointed in a welding process, the locations of the components in the battery module are frequently misaligned before the welding process. This degrades a quality of the battery module.

[0004] For example, in the battery module provided with the

pouch type batteries, a sealing area that is formed when partial areas of the pouches are jointed may interfere with other configurations of the battery module.

SUMMARY

[0005] The present disclosure has been made to solve the above-mentioned problems occurring in the prior art while advantages achieved by the prior art are maintained intact.

[0006] An aspect of the present disclosure is to, when there is a high possibility of a battery module and other components in a battery module interfering with each other in a process of manufacturing the battery module, detect it in advance to solve a problem of relative locations of the battery assembly and the other components in the battery module being misaligned.

[0007] The technical problems to be solved by the present disclosure are not limited to the aforementioned problems, and any other technical problems not mentioned herein will be clearly understood from the following description by those skilled in the art to which the present disclosure pertains.

[0008] According to an aspect of the present disclosure, a method for manufacturing a battery module includes an assembly manufacturing operation of manufacturing the battery assembly having a structure, in which a plurality of batteries are stacked in a leftward/rightward direction "W", a component disposing operation of disposing components of the battery module, except

for the battery assembly, on one side of the battery assembly, and a location measuring operation of measuring relative locations between the battery assembly and the components.

[0009] The component disposing operation may include disposing voltage sensing assemblies on a front surface and a rear surface of the battery assembly, respectively, and the location measuring operation may include measuring relative locations between the battery assembly and the voltage sensing assemblies.

[0010] The location measuring operation may include measuring relative locations between electrode leads protruding outwards from the battery assembly and the voltage sensing assemblies.

[0011] The location measuring operation may include measuring distances between lowermost end parts of the electrode leads protruding outwards from the battery assembly and the voltage sensing assemblies.

[0012] The location measuring operation may include measuring distances between lowermost end parts of the electrode leads protruding outwards from the battery assembly and lower extending areas of the voltage sensing assemblies, which are provided on lower sides of the electrode leads and extending in the leftward/rightward direction "W".

[0013] The component disposing operation may include disposing a front electrode lead protruding forwards from the battery assembly such that the front electrode lead protrudes forwards while passing through a front voltage sensing assembly disposed

on a front surface of the battery assembly and disposing a rear electrode lead protruding rearwards from the battery assembly such that the rear electrode lead protrudes rearwards while passing through a rear voltage sensing assembly disposed on a rear surface of the battery assembly.

[0014] The method may further include a lead bending operation of bending a front end part of the front electrode lead such that the front end part of the front electrode lead faces the front voltage sensing assembly in a forward/rearward direction "F", and bending a rear end part of the rear electrode lead such that the rear end part of the rear electrode lead faces the rear voltage sensing assembly in the forward/rearward direction "F".

[0015] The lead bending operation may be performed before the location measuring operation.

[0016] The lead bending operation may be performed after the location measuring operation.

[0017] The method may further include an assembling performance determining operation of determining whether the battery module is assembled with a defect, the assembling performance determining operation being performed after the location measuring operation, and a correction operation of correcting locations between the battery assembly and the components of the battery module, except for the battery module, when it is determined in the assembling performance determining operation that the battery module is assembled with a defect.

[0018] The assembling performance determining operation may include determining that the battery module is assembled with a defect when distances between portions of lowermost end parts of the plurality of electrode leads protruding outwards from the battery assembly and lower extending areas of the voltage sensing assembly, which are provided on a lower side of the electrode leads and extends in the leftward/rightward direction are within a specific distance.

[0019] The component disposing operation may further include disposing end plates on opposite side surfaces of the battery assembly in the leftward/rightward direction "W", and disposing an upper cover on an upper surface of the battery assembly.

[0020] The component disposing operation may include disposing a lower clamp surrounding a lower surface of the battery assembly and the end plates.

[0021] The component disposing operation may further include disposing a front cover on a front side of the front voltage sensing assembly and disposing a rear cover on a rear side of the rear voltage sensing assembly.

[0022] The method may further include a joining operation of joining configurations in the battery module, the joining operation being performed after the correction operation.

[0023] According to another aspect of the present disclosure, in a battery module manufactured through the method of claim 1 for manufacturing the battery module, the battery module includes

an electrode assembly, in which electrodes and separators are alternately disposed, electrode leads jointed to the electrode assembly and protruding outwards in a forward/rearward direction "F", and a pouch type case accommodating the electrode assembly, the case includes an accommodation area having a space, in which the electrode assembly is accommodated, and a sealing area provided at a circumference of the accommodation area, to which the case is joined, and from which the electrode leads protrude outwards, and the sealing area extends along an upward/downward direction "H".

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The above and other objects, features and advantages of the present disclosure will be more apparent from the following detailed description taken in conjunction with the accompanying drawings:

[0025] FIG. 1 is an exploded perspective view illustrating a structure of a battery module according to the present disclosure;

[0026] FIG. 2 is a perspective view illustrating a state, in which a battery assembly is assembled, according to the present disclosure;

[0027] FIG. 3 is a perspective view illustrating a state, in which voltage sensing assemblies are disposed on a front surface and a rear surface of a battery assembly;

[0028] FIG. 4 is a perspective view illustrating a state, in

which end plates are disposed on opposite side surfaces of a battery assembly in a leftward/rightward direction according to the present disclosure;

[0029] FIG. 5 is a perspective view illustrating a state, in which a front electrode lead is bent, according to the present disclosure;

[0030] FIG. 6 is a perspective view illustrating a state, in which a rear electrode lead is bent, according to the present disclosure;

[0031] FIG. 7 is a perspective view illustrating a state, in which an upper cover and a lower clamp are disposed on an upper surface and a lower surface of a battery assembly, according to the present disclosure;

[0032] FIG. 8 is a perspective view illustrating a state, in which a front cover and a rear cover are disposed on a front surface and a rear surface of a battery assembly, according to the present disclosure; and

[0033] FIG. 9 is a view illustrating an area, in which relative locations between a battery assembly and voltage sensing assemblies are measured, in a location measuring operation of a method for manufacturing a battery module.

DETAILED DESCRIPTION

[0034] Hereinafter, a method for manufacturing a battery module and a battery module according to the present disclosure will be

described with reference to the drawings.

[0035] Method for Manufacturing Battery Module

[0036] FIG. 1 is an exploded perspective view illustrating a structure of a battery module according to the present disclosure, and FIG. 2 is a perspective view illustrating a state, in which the battery assembly is assembled, according to the present disclosure. FIG. 3 is a perspective view illustrating a state, in which voltage sensing assemblies are disposed on a front surface and a rear surface of the battery assembly, and FIG. 4 is a perspective view illustrating a state, in which end plates are disposed on opposite side surfaces of the battery assembly in a leftward/rightward direction according to the present disclosure. FIG. 5 is a perspective view illustrating a state, in which a front electrode lead is bent, according to the present disclosure, and FIG. 6 is a perspective view illustrating a state, in which a rear electrode lead is bent, according to the present disclosure. FIG. 7 is a perspective view illustrating a state, in which an upper cover and a lower clamp are disposed on an upper surface and a lower surface of the battery assembly, according to the present disclosure, and FIG. 8 is a perspective view illustrating a state, in which a front cover and a rear cover are disposed on a front surface and a rear surface of the battery assembly, according to the present disclosure. Furthermore, FIG. 9 is a view illustrating an area, in which relative locations between the battery assembly and the voltage sensing assemblies

are measured, in a location measuring operation of a method for manufacturing a battery module.

[0037] Referring to the drawings, the method for manufacturing a battery module according to the present disclosure may include an assembly manufacturing operation of manufacturing a battery module 100 having a structure, in which a plurality of batteries 100 are stacked in a leftward/rightward direction "W".

[0038] Various kinds of batteries 100 may be mounted on the battery module 10 according to the present disclosure. As an example, according to the present disclosure, the battery 110 may be a pouch type battery. However, unlike this, the battery 110 may be an angular battery or a cylindrical battery. Hereinafter, a description will be made with a premise that the battery 110 is a pouch type battery. Meanwhile, although not explicitly illustrated in the drawings, the battery assembly 100 may further include an impact absorbing pad member provided between two adjacent batteries 110, in addition to the batteries 110. The impact absorbing pad member may be a configuration for absorbing an increased pressure in the battery assembly 100 when the batteries 110 are swollen. As an example, the impact absorbing pad member may include polyurethane. However, a material of the impact absorbing pad member is not limited to polyurethane.

[0039] Furthermore, the method for manufacturing a battery module may further include a component disposing operation of disposing components of the battery module 10, except for the

battery assembly 100, on one side of the battery assembly 100. In the specification, the components are defined as terms that mean configurations of the battery module 10, except for the battery assembly 100. That is, according to the present disclosure, the battery module 10 may include the battery assembly 100 and the components.

[0040] Referring to the drawings again, the method for manufacturing a battery module may further include a location measuring operation of measuring relative locations between the battery assembly 100 and the components. As will be described later, according to the present disclosure, in the location measuring operation, it may be determined whether the battery module 10 is assembled with a defect by measuring relative locations between the battery assembly 100 and the components.

[0041] Meanwhile, the battery module 10 may further include the voltage sensing assemblies 200 disposed on a front surface and a rear surface of the battery assemblies 100. Referring to the above-described contents, the method for manufacturing a battery module may include disposing the voltage sensing assemblies 200 on a front surface and a rear surface of the battery assembly 100. Then, in the above-described location measuring operation, the relative locations between the battery assembly 100 and the voltage sensing assemblies 200 may be measured.

[0042] Referring to FIGS. 1 and 2, the battery 110 provided in the battery assembly 100 may include the electrode assembly (not

illustrated), in which electrodes and separators are alternately disposed, electrode leads 112 that are joined to the electrode assembly and protrude outwards in a forward/rearward direction "F", and a pouch type case 114 that accommodates the electrode assembly.

[0043] Then, according to the present disclosure, in the above-described location measuring operation, the relative locations between the electrode leads 112 that protrude outwards from the battery assembly 100 and the voltage sensing assemblies 200 may be measured.

[0044] Preferably, in the location measuring operation, distances between lowermost end parts of the electrode leads 112 that protrude outwards from the battery assembly 100 and the voltage sensing assemblies 200 may be measured. More preferably, in the location measuring operation, distances between the lowermost end parts of the electrode leads 112 that protrude outwards from the battery assembly 100, and lowermost extending areas 200a of the voltage sensing assembly 200, which are provided on lower sides of the electrode leads 112 and extend in a leftward/rightward direction "W".

[0045] Several conditions have to agree with each other to secure an assembling quality of the battery module, and one of the conditions is that there should be no interference between the batteries provided in the battery assembly and the other components. However, when interferences occur between the

batteries and the other components in a process of assembling the battery module, the quality of the battery module may be badly influenced.

[0046] For example, when the battery provided in the battery assembly is a pouch type battery, it may have a substantially rectangular circumferential shape, but a section, in which a portion of the sealing area protrudes while deviating from the above-described rectangular shape, may be formed in a process of joining the case to form the sealing area. Because the protruding section is relatively small as described above, it is difficult to detect whether there is an interference with the other component, whereas the durability thereof is vulnerable whereby an electrolyte in the battery may be leaked when the protruding section is damaged due to the interference with the components.

[0047] The present disclosure may be one for solving the above-described problem. That is, according to the present disclosure, in the location measuring operation, in the location measuring operation, it may be indirectly detected whether there is an interference between the above-described protruding section and the other components by measuring the distances between the lowermost end parts of the electrode leads 112 and the lower extending areas 200a of the voltage sensing assemblies 200. In particular, when the sealing area extending in the upward/downward direction in the pouch type case, the protruding sections are formed at an upper end and a lower end of the sealing

area, respectively, and according to the present disclosure, it may be determined whether there is an interference between the protruding section formed at the lower end of the sealing area and the other components disposed in the lower area of the battery module.

[0048] Referring now to the drawings, each of the electrode leads 112 may include a front electrode lead 112a that protrudes to a front side and a rear electrode lead 112b, and the voltage sensing assembly 200 may include a front voltage sensing assembly 210, through which the front electrode lead 112a passes, and a rear voltage sensing assembly 220, through which the rear electrode lead 112b passes.

[0049] Then, according to the method for manufacturing a battery module according to the present disclosure, in the component disposing operation, the front electrode lead 112a disposed on a front side in the battery assembly 100 may be disposed to protrude forwards while passing through the front voltage sensing assembly 210 disposed on the front surface of the battery assembly 100, and the rear electrode lead 112b that protrudes on a rear side in the battery assembly 100 may be disposed to protrude rearwards while passing through the rear voltage sensing assembly 220 disposed on the rear surface of the battery assembly 100.

[0050] Meanwhile, referring to FIGS. 5 and 6, the method for manufacturing a battery module may further include a lead bending operation of bending the front end part of the front electrode

lead 112a such that the front end part of the front electrode lead 112a faces the front voltage sensing assembly 210 in the forward/rearward direction "F", and bending the rear end part of the rear electrode lead 112b such that the rear end part of the rear electrode lead 112b faces the rear voltage sensing assembly 220 in the forward/rearward direction "F".

[0051] Then, according to the present disclosure, the above-described lead bending operation may be performed before the above-described location measuring operation. That is, according to the present disclosure, the location measuring operation may be performed after the lead bending operation. In this case, because the distances between the electrode leads 112 and the voltage sensing assemblies 200 may be measured after the electrode leads 112 to be measured are adhered to the voltage sensing assemblies 200, the distance between the two objects, which is to be measured is reduced whereby the costs for the inspection device may be reduced. However, unlike the above description, according to the present disclosure, the lead bending operation may be performed after the location measuring operation.

[0052] Referring to the drawings again, the method for manufacturing a battery module according to the present disclosure may further include an assembling performance determining operation of determining whether the battery module 10 is assembled with a defect, the assembling performance determining operation being performed after the location

measuring operation, and a correction operation of correcting locations between the battery assembly 100 and the components of the battery module 10, except for the battery module, when it is determined in the assembling performance determining operation that the battery module 10 is assembled with a defect.

[0053] In more detail, in the above-described assembling performance determining operation, when distances between some of the lowermost ends of the plurality of electrode leads 112 that protrude outwards from the battery assembly 100, and the lower extending areas 20a of the voltage sensing assemblies 200, which are provided on lower sides of the electrode leads 112 and extend in the leftward/rightward direction "W" are within a specific distance, it may be determined that the battery 10 is assembled with a defect.

[0054] Hereinafter, the above-described component disposing operation will be described.

[0055] The component disposing operation may further include an operation of disposing the end plates 300 on opposite side surfaces of the battery assembly 100 in the leftward/rightward direction "W", an operation of disposing the upper cover 400 on the upper surface of the battery assembly 100, an operation of disposing the lower clamp that surrounds the lower surface of the battery assembly 100 and the end plates 300, and an operation of disposing the front cover 610 on a front side of the front voltage sensing assembly 210 and disposing the rear cover 620 on a rear

side of the rear voltage sensing assemblies 220.

[0056] Furthermore, the method for manufacturing a battery module according to the present disclosure may further include a joining operation of joining configurations in the battery module 10, the joining operation being performed after the correction operation. The above-described joining operation, for example, may be performed through welding.

[0057] Battery Module

[0058] The battery 10 according to the present disclosure may be the battery module 10 manufactured through the above-described method for manufacturing a battery module.

[0059] In more detail, the battery 110 provided in the battery assembly 100 of the battery module 10 may include the electrode assembly, in which the electrodes and the separators are alternately disposed, the electrode leads 112 that are jointed to the electrode assembly and protrude outwards in the forward/rearward direction "F", and the pouch type case 114 that accommodates the electrode assembly.

[0060] The case 114 may include the accommodation area 114a having a space, in which the electrode assembly is accommodated, and the sealing area 114b that is provided at a circumference of the accommodation area 114a, to which the case 114 is joined, and from which the electrode leads 112 protrude outwards. Then, according to the present disclosure, the sealing area 114b may extend along the upward/downward direction "H" as illustrated in

the drawings.

[0061] Meanwhile, the above-described contents of the method for manufacturing a battery module according to the present disclosure may be applied to the battery module according to the present disclosure in the same way, and an opposite case may be possible.

[0062] According to the present disclosure, when there is a high possibility of a battery module and other components in a battery module interfering with each other in a process of manufacturing the battery module, it may be detected in advance whereby a problem of relative locations of the battery assembly and the other components in the battery module being misaligned may be solved.

[0063] Although the present disclosure has been described above with reference to the limited embodiments and drawings, the present disclosure is not limited thereto, and it is apparent that various embodiments may be made within the technical spirits of the present disclosure and an equivalent range of the claims, which will be described below.

WHAT IS CLAIMED IS:

[Claim 1] A method for manufacturing a battery module, the method comprising:

an assembly manufacturing operation of manufacturing the battery assembly having a structure, in which a plurality of batteries are stacked in a leftward/rightward direction (W);

a component disposing operation of disposing components of the battery module, except for the battery assembly, on one side of the battery assembly; and

a location measuring operation of measuring relative locations between the battery assembly and the components.

[Claim 2] The method of claim 1, wherein the component disposing operation includes:

disposing voltage sensing assemblies on a front surface and a rear surface of the battery assembly, respectively, and

wherein the location measuring operation includes:

measuring relative locations between the battery assembly and the voltage sensing assemblies.

[Claim 3] The method of claim 2, wherein the location measuring operation includes:

measuring relative locations between electrode leads protruding outwards from the battery assembly and the voltage sensing assemblies.

[Claim 4] The method of claim 2, wherein the location measuring operation includes:

measuring distances between lowermost end parts of the electrode leads protruding outwards from the battery assembly and the voltage sensing assemblies.

[Claim 5] The method of claim 2, wherein the location measuring operation includes:

measuring distances between lowermost end parts of the electrode leads protruding outwards from the battery assembly and lower extending areas of the voltage sensing assemblies, which are provided on lower sides of the electrode leads and extending in the leftward/rightward direction (W).

[Claim 6] The method of claim 4, wherein the component disposing operation includes:

disposing a front electrode lead protruding forwards from the battery assembly such that the front electrode lead protrudes forwards while passing through a front voltage sensing assembly disposed on a front surface of the battery assembly and disposing a rear electrode lead protruding rearwards from the battery

assembly such that the rear electrode lead protrudes rearwards while passing through a rear voltage sensing assembly disposed on a rear surface of the battery assembly.

[Claim 7] The method of claim 6, further comprising:

a lead bending operation of bending a front end part of the front electrode lead such that the front end part of the front electrode lead faces the front voltage sensing assembly in a forward/rearward direction (F), and bending a rear end part of the rear electrode lead such that the rear end part of the rear electrode lead faces the rear voltage sensing assembly in the forward/rearward direction (F).

[Claim 8] The method of claim 7, wherein the lead bending operation is performed before the location measuring operation.

[Claim 9] The method of claim 7, wherein the lead bending operation is performed after the location measuring operation.

[Claim 10] The method of claim 6, further comprising:

an assembling performance determining operation of determining whether the battery module is assembled with a defect, the assembling performance determining operation being performed after the location measuring operation; and

a correction operation of correcting locations between the battery assembly and the components of the battery module, except for the battery module, when it is determined in the assembling performance determining operation that the battery module is assembled with a defect.

[Claim 11] The method of claim 10, wherein the assembling performance determining operation includes:

determining that the battery module is assembled with a defect when distances between portions of lowermost end parts of the plurality of electrode leads protruding outwards from the battery assembly and lower extending areas of the voltage sensing assembly, which are provided on a lower side of the electrode leads and extends in the leftward/rightward direction are within a specific distance.

[Claim 12] The method of claim 10, wherein the component disposing operation further includes:

disposing end plates on opposite side surfaces of the battery assembly in the leftward/rightward direction (W); and
disposing an upper cover on an upper surface of the battery assembly.

[Claim 13] The method of claim 12, wherein the component disposing operation includes:

disposing a lower clamp surrounding a lower surface of the battery assembly and the end plates.

[Claim 14] The method of claim 13, wherein the component disposing operation further includes:

disposing a front cover on a front side of the front voltage sensing assembly and disposing a rear cover on a rear side of the rear voltage sensing assembly.

[Claim 15] The method of claim 14, further comprising:
a joining operation of joining configurations in the battery module, the joining operation being performed after the correction operation.

[Claim 16] A battery module manufactured through the method of claim 1 for manufacturing the battery module, wherein each of the batteries includes:

an electrode assembly, in which electrodes and separators are alternately disposed;

electrode leads jointed to the electrode assembly and protruding outwards in a forward/rearward direction (F); and

a pouch type case accommodating the electrode assembly,
wherein the case includes:

an accommodation area having a space, in which the electrode assembly is accommodated; and

a sealing area provided at a circumference of the accommodation area, to which the case is joined, and from which the electrode leads protrude outwards, and

wherein the sealing area extends along an upward/downward direction (H).