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(54) **BATTERY MODULE AND BATTERY PACK**

(57) A battery module includes a cell assembly, a collection assembly, a first heat insulating member, and a heat insulation cushion assembly. The cell assembly includes a plurality of cells arranged along a length direction of the battery module. The collection assembly is located on a side of the cell assembly along a height direction of the battery module, and is connected to the cell assembly. The first heat insulating member is located on a side of the collection assembly away from the cell assembly along the height direction of the battery module, and is connected to the collection assembly. The heat insulation cushion assembly is located between two adjacent cells, and includes a second heat insulating member and two cushion members. Each cushion member has one side connected to the second heat insulating member and the other side connected to the corresponding cell.

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BATTERY MODULE AND BATTERY PACK

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of batteries, and in particular, to a battery module and a battery pack.

BACKGROUND

[0002] There is a risk of thermal runaway during operation of a battery module. The thermal runaway may reduce safety of the battery module and affect performance of other aspects of the battery module. Protection measures against the thermal runaway in the existing battery module are insufficient. As a result, heat generated by thermal runaway of a cell spreads inside the battery module, thereby affecting operational performance of other cells and the entire battery module.

SUMMARY

[0003] The present disclosure provides a battery module and a battery pack.

[0004] According to an aspect, a battery module is provided. The battery module includes a cell assembly, a collection assembly, a first heat insulating member, and a heat insulation cushion assembly. The cell assembly includes a plurality of cells arranged along a length direction of the battery module. The collection assembly is located on a side of the cell assembly along a height direction of the battery module, and is connected to the cell assembly. The first heat insulating member is located on a side of the collection assembly away from the cell assembly along the height direction of the battery module, and is connected to the collection assembly. The heat insulation cushion assembly is located between two adjacent cells. The heat insulation cushion assembly includes a second heat insulating member and two cushion members. The two cushion members are located on two sides of the second heat insulating member along the length direction of the battery

module, and each of the cushion members has one side connected to the second heat insulating member and the other side connected to the corresponding cell.

[0005] In some embodiments, each of the two cushion members includes two first body portions extending along the height direction of the battery module and two second body portions extending along a width direction of the battery module, and the two first body portions and the two second body portions are connected to form a frame structure.

[0006] In some embodiments, an end of each of the plurality of cells adjacent to the collection assembly is provided with an explosion-proof port, the collection assembly includes a body portion, the body portion is provided with a plurality of avoidance holes arranged along the length direction of the battery module, the plurality of avoidance holes are in one-to-one correspondence to the explosion-proof ports of the plurality of cells, and each of the avoidance holes is communicated with the explosion-proof port corresponding thereto.

[0007] In some embodiments, the first heat insulating member includes a plurality of grooves arranged along the length direction of the battery module, and the plurality of grooves penetrate along the height direction of the battery module and are in one-to-one correspondence to the plurality of avoidance holes.

[0008] In some embodiments, a dimension D1 of a bottom wall of one of the grooves along the height direction of the battery module satisfies $0.1\ mm \leq D1 \leq 0.2\ mm$.

[0009] In some embodiments, a dimension D2 of the first heat insulating member along the height direction of the battery module satisfies $0.4\ mm \leq D2 \leq 1\ mm$.

[0010] In some embodiments, a dimension D3 of the second heat insulating member along the length direction of the battery module satisfies $0.5\ mm \leq D3 \leq 1\ mm$.

[0011] In some embodiments, a dimension D4 of one of the cushion members along the length direction of the battery module satisfies $0.5\ mm \leq D4 \leq 1\ mm$.

[0012] In some embodiments, the first heat insulating member and/or the second heat insulating member is made of mica.

[0013] In some embodiments, the collection assembly is a Cells Contact System assembly.

[0014] In some embodiments, an end of each of the plurality of cells adjacent to the collection assembly is provided with an explosion-proof port, the collection assembly includes a body portion provided with a plurality of avoidance holes, and the first heat insulating member includes a plurality of grooves penetrating into but not penetrating through the first heat insulating member, wherein the plurality of avoidance holes are in one-to-one correspondence to the explosion-proof ports of the plurality of cells, and in one-to-one correspondence to the plurality of grooves, and wherein each groove is right above the corresponding avoidance hole that is right above and communicated with corresponding explosion-proof port.

[0015] In some embodiments, electrolyte of a thermal-runaway cell of the plurality of cells flows through its explosion-proof port and the corresponding avoidance hole of the collection assembly, and then breaks through a bottom wall of the corresponding groove of the first heat insulating member.

[0016] In some embodiments, the battery module further includes two end plates. The plurality of cells are electrically connected in series, and side surfaces of the plurality of cells are fixed to one or more steel strips. The plurality of cells are arranged between the two end plates, and each of the one or more steel strips includes two ends fixed to the two end plates respectively.

[0017] According to another aspect, a battery pack is provided. The battery pack includes a housing and at least one battery module. An accommodation space is formed in the housing, and the battery module is located in the accommodation space. The battery module includes a cell assembly, a collection assembly, a first heat insulating member, and a heat insulation cushion assembly. The cell assembly includes a plurality of cells arranged along a length direction of the battery module. The collection assembly is located on a side of the cell assembly along a height direction of the battery module, and is connected to the

cell assembly. The first heat insulating member is located on a side of the collection assembly away from the cell assembly along the height direction of the battery module, and is connected to the collection assembly. The heat insulation cushion assembly is located between two adjacent cells. The heat insulation cushion assembly includes a second heat insulating member and two cushion members. The two cushion members are located on two sides of the second heat insulating member along the length direction of the battery module, and each of the cushion members has one side connected to the second heat insulating member and the other side connected to the corresponding cell.

BRIEF DESCRIPTION OF DRAWINGS

[0018] FIG. 1 is a schematic diagram of a battery module according to the present disclosure;

[0019] FIG. 2 is an enlarged view of a region I in FIG. 1; and

[0020] FIG. 3 is an exploded view of a heat insulation cushion assembly of the battery module according to the present disclosure.

[0021] Reference signs:

1: battery module;
11: cell assembly;
111: cell;
111a: explosion-proof port;
112: end plate;
113: steel strip;
12: collection assembly;
121: body portion;
121a: avoidance hole;
122: aluminum bar;
13: first heat insulating member;

131: groove;

14: heat insulation cushion assembly;

141: second heat insulating member;

142: cushion member;

142a: first body portion;

142b: second body portion;

15: fastener.

[0022] The accompanying drawings herein, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the present disclosure and, together with the specification, serve to explain principles of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0023] In order to better understand the technical solutions of the present disclosure, embodiments of the present disclosure will be described in detail below in conjunction with the accompanying drawings.

[0024] It should be clear that the described embodiments are only some rather than all of the embodiments of the present disclosure Based on the embodiments in the present disclosure, all other embodiments obtained by those of ordinary skill in the art without creative efforts fall within the protection scope of the present disclosure.

[0025] Terms used in the embodiments of the present disclosure are only for the purpose of describing specific embodiments, and are not intended to limit the present disclosure. Singular forms of "a/an", "the", and "said" used in the embodiments of the present disclosure and the appended claims are intended to include plural forms, unless otherwise clearly specified in the context.

[0026] It should be understood that the term "and/or" used herein describes an association relationship between associated objects and represents that three relationships may exist. For example, A and/or B may represent the following three cases: only A exists,

both A and B exist, and only B exists. In addition, the character "/" herein generally indicates an "or" relationship between the associated objects.

[0027] It is to be noted that orientation terms such as "up", "down", "left", and "right" described in the embodiments of the present disclosure are described from the perspective shown in the accompanying drawings, and should not be construed as limiting the embodiments of the present disclosure. Besides, in this context, it is to be further understood that one element described as being connected "on" or "under" another element not only means that the element may be directly connected "on" or "under" the another element, but also means that the element may be indirectly connected "on" or "under" the another element through an intermediate element.

[0028] As shown in FIG. 1 to FIG. 3, embodiments of the present disclosure provide a battery module 1, including a cell assembly 11, a collection assembly 12, a first heat insulating member 13, and a heat insulation cushion assembly 14. The cell assembly 11 includes a plurality of cells 111 arranged along a first direction X of the battery module 1. The first direction X is the length direction X of the battery module 1. The collection assembly 12 is located on a side of the cell assembly 11 along a second direction Z of the battery module 1, and is connected to the cell assembly 11. The second direction Z is the height direction Z of the battery module 1. The first heat insulating member 13 is located on a side of the collection assembly 12 away from the cell assembly 11 along the height direction Z of the battery module 1, and is connected to the collection assembly 12. The heat insulation cushion assembly 14 is located between two adjacent cells 111. The battery module 1 may include a plurality of heat insulation cushion assemblies 14, and every two adjacent cells 111 are separated by one heat insulation cushion assembly 14. The heat insulation cushion assembly 14 includes a second heat insulating member 141 and two cushion members 142. The two cushion members 142 are located on two sides of the second heat insulating member 141 along the length direction X of the battery module 1, and each of the cushion members 142 has a first side connected to the second heat insulating member 141 and a

second side connected to the corresponding cell 111.

[0029] In the cell assembly 11, the plurality of cells 111 are connected in series and fixed by end plates 112 and steel strips 113. The collection assembly 12 is a Cells Contact System (CCS) assembly. The collection assembly 12 is configured to collect data such as temperatures and voltages of the cells 111, so as to monitor states of the cells 111. The collection assembly 12 includes aluminum bars 122. The aluminum bar 122 may be connecting to a pole of the cell 111 for example by welding to the pole of the cell 1, thereby realizing a fixed connection between the collection assembly 12 and the cell assembly 11. The first heat insulating member 13 is fixedly connected to the collection assembly 12 through a plurality of fasteners 15. The first heat insulating member 13 has functions of heat insulation and isolation, so as to reduce a possibility of heat exchange between the cell assembly 11 and the outside. When thermal runaway occurs in a single cell 111, a high-temperature electrolyte inside the cell 111 may be released through the explosion-proof port 111a, and the released electrolyte may break through the first heat insulating member 13 and reach a surface of the first heat insulating member 13 away from the cell assembly 11. In this case, the first heat insulating member 13 plays a role of isolation between the cell assembly 11 and the electrolyte, thereby reducing a possibility that the high-temperature electrolyte moves to other cells 111 causes thermal runaway of the other cells 111. The heat insulation cushion assembly 14 is arranged between two adjacent cells 111. The cushion members 142 on two sides of the second heat insulating member 141 may be bonded with the second heat insulating member 141 by gel such as glue or a double-sided tape. In some embodiments, the cushion members 142 may be bonded with the corresponding cells 111 by gel. The second heat insulating member 141 plays a role of heat insulation between two cells 111, reducing heat exchange between the two cells 111. The cushion member 142 may absorb deformation of the expanded cell 111, thereby reducing a possibility of large stress between the cells 111.

[0030] The conventional battery module has insufficient protection measures against

the thermal runaway of the cell. Firstly, there is no heat insulation measures between adjacent cells, resulting in poor heat insulation between the cells, and heat is easy to spread between the cells. Secondly, there is no heat insulation and isolation measures on the top of the cell assembly. Therefore, in the conventional battery module, if thermal runaway occurs in a single cell, heat of the cell may spread rapidly, leading to a rapid rise in temperature of surrounding cells, and a high-temperature electrolyte leakage from the cell is easy to move to other cells, leading to a further rise in temperatures of other cells, so that thermal runaway also occurs in other cells. That is, heat generated by the cell in which thermal runaway occurs spreads inside the battery module, thereby triggering a chain reaction of thermal runaway, which may affect the service life and operational performance of the battery module.

[0031] Compared with the conventional battery module, in the battery module 1 provided in embodiments of the present disclosure, the heat insulation cushion assembly 14 is arranged between adjacent cells 111. The cushion member 142 may absorb deformation of the expanded cell 111, reducing a possibility of damages to the cells 111 caused by mutual extrusion between the cells 111 after the cells 111 expand, and improving operational reliability and stability of the cell 111. The second heat insulating member 141 may play an effective heat insulation role between the adjacent cells 111, which improves heat insulation performance between the cells 111, thereby reducing heat transfer between the cells 111. At the same time, the first heat insulating member 13 is arranged on the top of the cell assembly 11. The first heat insulating member 13 may isolate and protect the cell assembly 11, preventing the electrolyte from the cell 111 where thermal runaway occurs from affecting other cells 111, thereby reducing the influence of the cell 111 where thermal runaway occurs on other cells 111. At the same time, the first heat insulating member 13 provides heat insulation for the cell assembly 11, reducing a possibility of diffusion of heat of the high-temperature electrolyte to the cells 111. To sum up, in some embodiments of the present disclosure, thermal runaway protection measures are taken between adjacent cells

111 and on the top of the cell assembly 11, which reduces a spread possibility of heat generated by the thermal-runaway cell 111inside the battery module 1, thereby reducing a possibility of a chain reaction of thermal runaway among the plurality of cells 111 and further improving the operational performance and prolong the service life of the battery module 1.

[0032] As shown in FIG. 3, in some embodiments, the cushion member 142 includes two first body portions 142a extending along the height direction Z of the battery module 1 and two second body portions 142b extending along a width direction Y of the battery module 1, and the two first body portions 142a and the two second body portions 142b are connected to form a frame structure.

[0033] For example, the cushion member 142 may be made of foam or other materials with a cushioning and shock-absorbing effect. The first body portion 142a and the second body portion 142b may be strip-shaped, and the two first body portions 142a and the two second body portions 142b are connected to define a hollowed rectangle structure, for example, a rectangular ring structure. As shown in FIG. 3, the two first body portions 142a and the two second body portions 142b define a □ shape. The two first body portions 142a are parallel to each other, and the two second body portions 142b are parallel to each other.

[0034] In this way, the cushion member 142 can absorb deformation generated around the cell 111, thereby improving a cushioning effect of the cushion member 142, reducing a possibility of mutual extrusion between adjacent cells 111, further prolonging the service life of the cells 111, and improving operational reliability and stability of the cells 111.

[0035] As shown in FIG. 2, in some embodiments, an end of each cell 111 close to the collection assembly 12 is provided with an explosion-proof port 111a, the collection assembly 12 includes a body portion 121, the body portion 121 is provided with a plurality of avoidance holes 121a arranged along the length direction X of the battery module 1, the plurality of avoidance holes 121a are in one-to-one correspondence to the explosion-proof ports 111a of the plurality of cells 111, and each of the avoidance holes 121a is communicated with the explosion-proof port 111a corresponding thereto.

[0036] The body portion 121 may be a wire harness separator of the collection assembly 12. The first heat insulating member may be fixed to the wire harness separator through a fastener 15. The avoidance holes 121a are provided along the height direction Z of the battery module 1, and each of the avoidance holes 121a corresponds to the explosion-proof port 111a of one cell 111. After thermal runaway occurs in a cell 111, pressure and the electrolyte inside the cell 111 are released through the explosion-proof port 111a. The electrolyte may be sprayed onto the first heat insulating member 13 through the avoidance hole 121a. The electrolyte may break through the first heat insulating member 13, and may move on the surface on the side of the first heat insulating member 13 away from the cell assembly 11.

[0037] The thermal-runaway cell 111 can release the internal pressure and the electrolyte through the arrangement of the avoidance holes 121a in the body portion 121, which reduces a possibility that the collection assembly 12 hinders the electrolyte released by the cell 111, and at the same time, reduces a possibility that the electrolyte may impact the collection assembly 12. At the same time, this design allows the electrolyte to smoothly break through the first heat insulating member 13 and fall on the surface of the first heat insulating member 13, thereby reducing a possibility that the electrolyte falls on other cells 111 and causes thermal runaway of the other cells 111.

[0038] As shown in FIG. 2, in some embodiments, the first heat insulating member 13 is provided with a plurality of grooves 131 arranged along the length direction X of the battery module 1, and the plurality of grooves 131 penetrate along the height direction Z of the battery module 1 and are in one-to-one correspondence to the plurality of avoidance holes 121a.

[0039] The first heat insulating member 13 is thinned at the grooves 131, and each groove 131 is arranged at a position corresponding to a position of one avoidance hole 121a. That is, each groove 131 corresponds to the explosion-proof port 111a of one cell 111. The electrolyte released by the thermal-runaway cell 111 can be collected in the

corresponding groove 131 through the corresponding avoidance hole 121a. Since a thickness of a bottom wall of the groove 131 is small, the electrolyte can break through the bottom wall of the groove 131 and fall on the surface of the first heat insulating member 13.

[0040] The groove 131 is provided in the first heat insulating member 13 to realize the thinning design of the first heat insulating member 13 at the position corresponding to the explosion-proof port 111a of the cell 111, so that the electrolyte released by the cell 111 can break through the first heat insulating member 13, which realizes an isolation and protection effect of the first heat insulating member 13 on the cell 111 and reduces a possibility of an influence of the electrolyte on other cells 111.

[0041] In some embodiments, a dimension D1 of the bottom wall of the groove 131 along the height direction Z of the battery module 1 satisfies 0.1 mm≤D1≤0.2 mm.

[0042] A thickness of the thinned part of the first heat insulating member 13 may be 0.1 mm, 0.15 mm, 0.18 mm, or 0.2 mm, or other values within the above range, which is not limited in this embodiment.

[0043] The thickness of the bottom wall of the groove 131 is less than or equal to 0.2 mm. If the bottom wall of the groove 131 has an excessive thickness, the electrolyte cannot break through the first heat insulating member 13 and the electrolyte may spray onto other cells 111 due to an excessive thickness of the bottom wall of the groove 131, causing thermal runaway of other cells 111.

[0044] In some embodiments, a dimension D2 of the first heat insulating member 13 along the height direction Z of the battery module 1 satisfies 0.4 mm≤D2≤1 mm.

[0045] A thickness of the first heat insulating member 13 may be 0.4 mm, 0.5 mm, 0.6 mm, or 1 mm, or other values within the above range, which is not limited in this embodiment.

[0046] The thickness of the first heat insulating member 13 is configured within the above range, so that the first heat insulating member 13 can provide effective heat insulation and isolation protection, thereby reducing the risk that the thermal runaway of a single cell 111 cause the thermal runaway of the whole battery module. In addition, an excessive

thickness of the first heat insulating member 13 is prevented, avoiding an excessively large volume of the entire battery module 1.

[0047] In some embodiments, a dimension D3 of the second heat insulating member 141 along the length direction X of the battery module 1 satisfies 0.5 mm≤D3≤1 mm.

[0048] The thickness of the second heat insulating member 141 may be designed within a range from 0.1 mm to 1.5 mm. Furthermore, in this embodiment, the thickness of the second heat insulating member 141 may be designed within a range from 0.5 mm to 1 mm, and the thickness of the second heat insulating member 141 may be 0.5 mm, 0.65 mm, 0.7 mm, 0.85 mm, or 1 mm.

[0049] The thickness of the second heat insulating member 141 is configured within the above range, which improves a heat insulation effect of the second heat insulating member 141 between adjacent cells 111 and reduces heat transfer between adjacent cells 111. In addition, a miniaturization design of the battery module 1 is realized, and an excessively large volume of the battery module 1 caused by an excessive thickness of the second heat insulating member 141 is avoided.

[0050] In some embodiments, a dimension D4 of the cushion member 142 along the length direction X of the battery module 1 satisfies 0.5 mm≤D4≤1 mm.

[0051] The thickness of the cushion member 142 may be designed within a range from 0.1 mm to 2 mm. Furthermore, in this embodiment, the thickness of the cushion member 142 may be designed within a range from 0.5 mm to 1 mm, and the thickness of the cushion member 142 may be 0.5 mm, 0.6 mm, 0.75 mm, 0.9 mm, or 1 mm.

[0052] The thickness of the cushion member 142 is configured within the above range, which improves a shock-absorbing and cushioning effect of the cushion member 142 on the cell 111, so that the cushion member 142 can effectively absorb strain generated by expansion of the cell 111, thereby improving operational reliability and stability of the cell 111, further realizing a miniaturization design of the battery module 1, and reducing a possibility of an excessively large volume of the battery module 1 caused by an excessive

thickness of the cushion member 142.

[0053] In some embodiments, at least one of the first heat insulating member 13 and the second heat insulating member 141 is made of mica.

[0054] The first heat insulating member 13 and/or the second heat insulating member 141 may be formed by laminating mica sheets. Conventionally, aerogel may be used in the battery module for heat insulation. Compared with the aerogel, the mica has a lower use cost and is easier to be assembled with other components such as the cell 111.

[0055] The mica is used as a heat insulating material, which improves heat insulation performance of the entire battery module 1 and also reduces a manufacturing cost of the battery module 1.

[0056] Embodiments of the present disclosure further provide a battery pack, including: a housing (not shown in the figure) and at least one battery module 1. An accommodation space is formed in the housing, and the battery module 1 is located in the accommodation space. The battery module 1 is the battery module 1 described in any one of the above embodiments.

[0057] The battery module 1 is accommodated in the housing. The number of the battery module in in the battery pack may be one or more. By use of the above battery module 1, heat insulation performance of the battery pack is improved, and the operational reliability and stability of the battery pack are also improved.

[0058] Embodiments of the present disclosure provide a battery module 1 and a battery pack. The battery module 1 includes a cell assembly 11, a collection assembly 12, a first heat insulating member 13, and a heat insulation cushion assembly 14. The cell assembly 11 includes a plurality of cells 111 arranged along a length direction X of the battery module 1. The collection assembly 12 is located on a side of the cell assembly 11 along a height direction Z of the battery module 1, and is connected to the cell assembly 11. The first heat insulating member 13 is located on a side of the collection assembly 12 away from the cell assembly 11 along the height direction Z of the battery module 1, and is connected to the

collection assembly 12. The heat insulation cushion assembly 14 is located between two adjacent cells 111. The heat insulation cushion assembly 14 includes a second heat insulating member 141 and two cushion members 142. The two cushion members 142 are located on two sides of the second heat insulating member 141 along the length direction X of the battery module 1, and each of the cushion members 142 has one side connected to the second heat insulating member 141 and the other side connected to the corresponding cell 111. With the above design, deformation of the expanded cells 111 is absorbed, damages to the cells 111 due to mutual extrusion between the cells 111 are reduced, heat insulation performance between the cells 111 is improved, and the heat transfer between the cells 111 is reduced. In addition, the electrolyte released by one thermal-runaway cell 111 is prevented from moving to other cells 111, thereby avoiding thermal runaway of the whole battery module due to thermal runaway of a single cell 111.

[0059] The above descriptions are only preferred embodiments of the present disclosure, and are not intended to limit the present disclosure. For those skilled in the art, various modifications and changes may be made to the present disclosure. Any modifications, equivalent replacements, improvements, and the like made within the principle of the present disclosure shall fall within the protection scope of the present disclosure.

CONCLUSIES

1. Een batterij module (1), bestaande uit:

een cel samenstel (11) omvattende een groot aantal cellen (111) die gerangschikt zijn langs een lengterichting van de batterij module (1);

een verzamel samenstel (12), waarbij het verzamel samenstel (12) zich bevindt aan een zijde van het cel samenstel (11) en in een hoogterichting van de batterij module (1), en verbonden is met het cel samenstel (11);

een eerste warmte-isolerend onderdeel (13), waarbij het eerste warmte-isolerend onderdeel (13) zich bevindt aan een zijde van het verzamel samenstel (12) die van het cel samenstel (11) is af gericht en in de hoogterichting van de batterij module (1), en verbonden is met het verzamel samenstel (12); en

een warmte-isolerend kussen samenstel (14) dat zich bevindt tussen twee aangrenzende cellen van het grote aantal cellen (111),

waarbij het warmte-isolerende kussen samenstel (14) een tweede warmte-isolerend onderdeel (141) en twee kussenonderdelen (142) omvat, waarbij de twee kussenonderdelen (142) in de lengterichting van de batterij module (1) aan twee zijden van het tweede warmte-isolerend onderdeel (141) zijn geplaatst, en waarbij elk van de twee kussenonderdelen (142) een eerste zijde bezit dat is verbonden met het tweede warmte-isolerend onderdeel (141) en een tweede zijde bezit dat is verbonden met één van de twee aangrenzende cellen (111).

2. De batterij module volgens conclusie 1, waarbij elk van de twee kussenonderdelen (142) twee eerste lichaamsdelen (142a) omvat die zich uitstrekken langs de hoogterichting van de batterij module en twee tweede lichaamsdelen (142b) omvat die zich uitstrekken langs een breedterichting. van de batterij module, en waarbij de twee eerste lichaamsdelen (142a) en de twee tweede lichaamsdelen (142b) met elkaar zijn verbonden teneinde een frame constructie te vormen.

3. De batterij module volgens conclusie 2, waarbij een uiteinde van elk van het grote aantal cellen (111) grenzend aan het verzamel samenstel (12) is voorzien van een explosieveilige aansluiting (111a), waarbij het verzamel samenstel (12) is voorzien van een lichaamsdeel (121), waarbij het lichaamsdeel (121) is voorzien van een groot aantal ontwijkingsopeningen (121a) die zijn aangebracht in de lengterichting van de batterij module (1), waarbij het grote aantal ontwijkingsopeningen (121a) in een één-op-één

samenhang zijn met de explosieveilige aansluitingen (111a) van het grote aantal cellen (111), en waarbij elk van de ontwijkingsopeningen (121a) samenwerkt met de ermee samenhangende explosieveilige aansluiting (111a).

4. De batterij module volgens conclusie 3, waarbij het eerste warmte-isolerende onderdeel (13) een groot aantal groeven (131) omvat, die gerangschikt zijn in de lengterichting van de batterij module, en waarbij het grote aantal groeven (131) uitstrekken in de hoogterichting. van de batterij module en één-op-één overeen met het grote aantal ontwijkingsopeningen (121a).

5. De batterij module volgens conclusie 4, waarbij een afmeting D1 van een bodemwand van één van de groeven (131) in de hoogterichting van de batterij module voldoet aan $0,1 \text{ mm} \leq D1 \leq 0,2 \text{ mm}$.

6. De batterij module volgens één van de conclusies 1 tot 5, waarbij een afmeting D2 van het eerste warmte-isolerend onderdeel (13) in de hoogterichting van de batterij module voldoet aan $0,4 \text{ mm} \leq D2 \leq 1 \text{ mm}$.

7. De batterij module volgens één van de conclusies 1 tot 5, waarbij een afmeting D3 van het tweede warmte-isolerend onderdeel (141) in de lengterichting van de batterij module voldoet aan $0,5 \text{ mm} \leq D3 \leq 1 \text{ mm}$.

8. De batterij module volgens één van de conclusies 1 tot 5, waarbij een afmeting D4 van één van de kussenonderdelen (142) in de lengterichting van de batterij module voldoet aan $0,5 \text{ mm} \leq D4 \leq 1 \text{ mm}$.

9. De batterij module volgens één van de conclusies 1 tot en met 5, waarbij het eerste warmte-isolerend onderdeel (13) en/of het tweede warmte-isolerend onderdeel (141) is vervaardigd van mica.

10. De batterij module volgens conclusie 1, waarbij het verzamel samenstel (12) een Cells Contact System samenstel is.

11. De batterij module volgens conclusie 1, waarbij een uiteinde van elk van het grote aantal cellen (111) grenzend aan het verzamel samenstel (12) is voorzien van een explosieveilige aansluiting (111a), waarbij het verzamel samenstel (12) een lichaamsdeel (121) omvat dat is voorzien van meerdere ontwijkingsopeningen (121a), en waarbij het eerste warmte-isolerend onderdeel (13) een groot aantal groeven (131) omvat, die reiken in maar niet doordringen in het eerste warmte-isolerend onderdeel (13), waarbij het aantal ontwijkingsopeningen (121a) in een één-op-één samenhang zijn met de explosieveilige aansluitingen (111a) van het grote aantal cellen (111), en in een één-op-één samenhang

zijn met het grote aantal groeven (131), en waarbij elke groef (131) zich precies boven de overeenkomende ontwijkingsopening (121a) bevindt, dat precies boven en samenwerkt met de overeenkomende explosieveilige aansluiting (111a).

12. De batterij module volgens conclusie 11, waarbij een elektrolyt van een thermisch op hol geslagen cel (111) van het grote aantal cellen door zijn explosieveilige aansluiting (111a) en de overeenkomende ontwijkingsopening (121a) van het verzamel samenstel (12) stroomt, en vervolgens door een bodemwand van de corresponderende groef (131) van het eerste warmte-isolerend onderdeel (13) breekt.

13. De batterij module volgens conclusie 1, verder omvattende twee eindplaten (112), waarbij het grote aantal cellen (111) elektrisch in serie zijn verbonden, en waarbij zijoppervlakken van het grote aantal cellen (111) aan een of meer stalen strips (113) zijn bevestigd, en waarbij het grote aantal cellen (111) tussen de twee eindplaten (112) zijn gerangschikt, en elk van de een of meer stalen strips (113) twee uiteinden omvat, die aan de twee respectievelijke eindplaten zijn bevestigd.

14. Een batterij pakket, bestaande uit:

een behuizing, waarbij in de behuizing een opneemruimte is gevormd; en

ten minste één batterij module volgens een van de conclusies 1 tot en met 13, waarbij de ten minste ene batterij module zich in de opneemruimte bevindt.

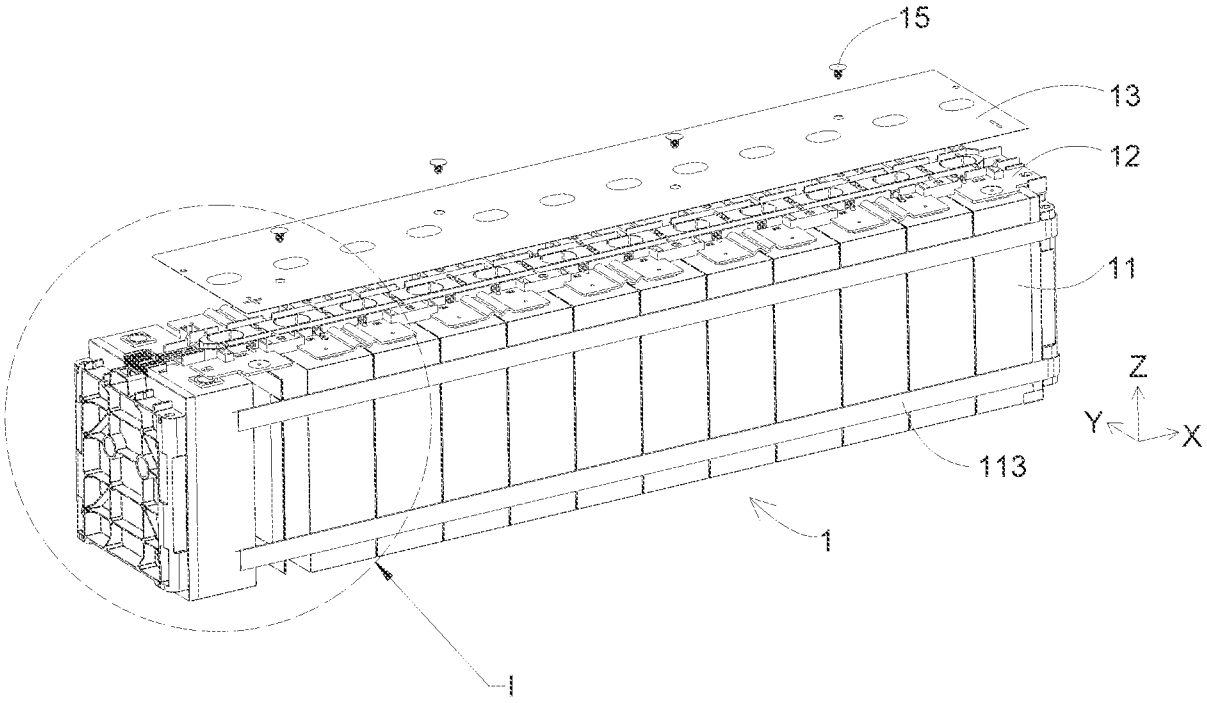

FIG. 1

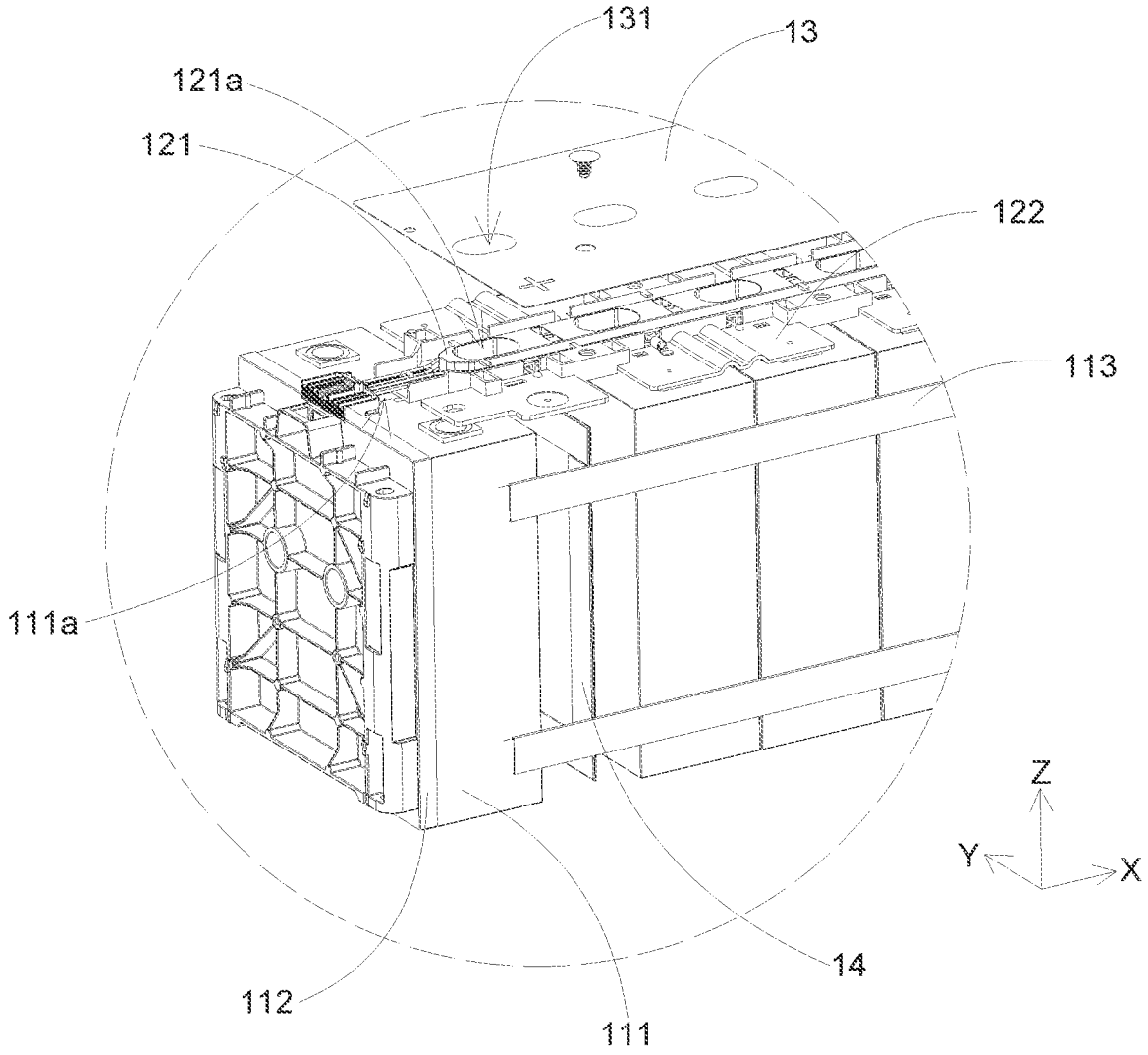

FIG. 2

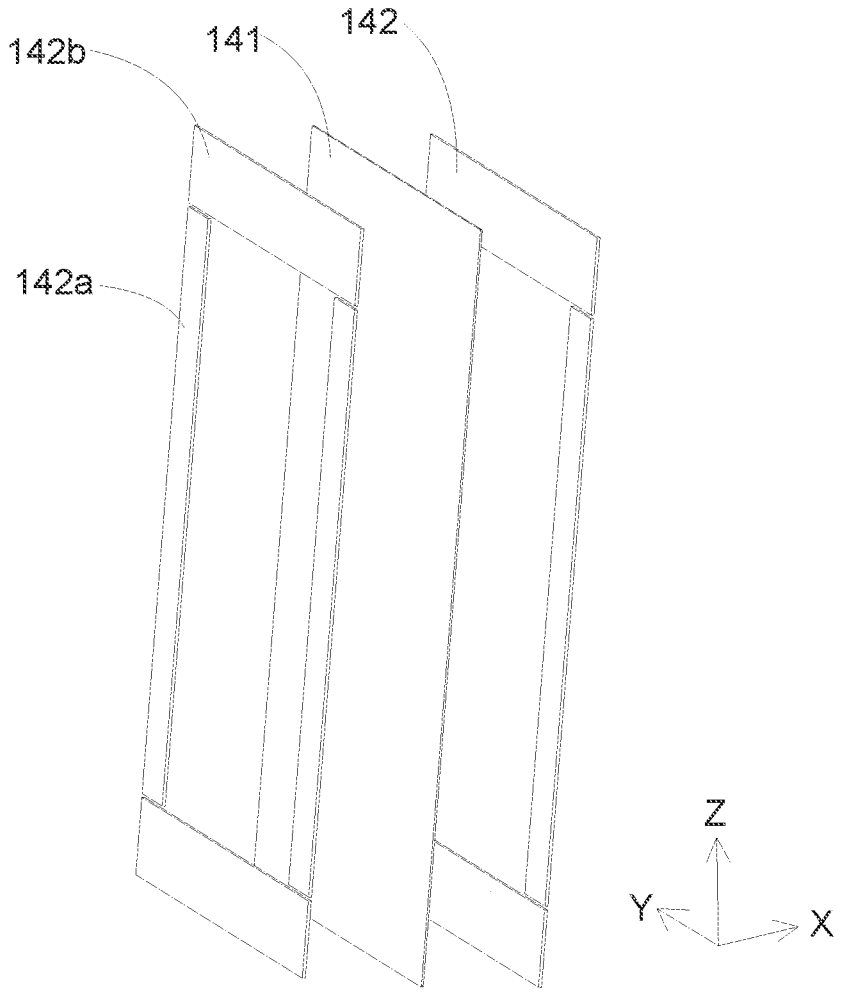

FIG. 3

Rijksdienst voor Ondernemend Nederland

OCTROOIAANVRAAG NR.:
NO 143421
NL 2036282

ONDERZOEKSRAPPORT

BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

RELEVANTE LITERATUUR

Categorie[1]	Literatuur met, voor zover nodig, aanduiding van speciaal van belang zijnde tekstgedeelten of figuren.	Van belang voor conclusie(s) nr:	Classificatie(IPC)
Y	CN 216 698 613 U (SUZHOU ATES NEW ENERGY DEV CO LTD ET AL.) 7 juni 2022 (2022-06-07) * figuren 1-6 * -----	1-14	INV. H01M10/658 H01M50/204 H01M50/209 H01M50/24
Y	CN 217 086 790 U (SHANGHAI RUIPU QINGCHUANG NEW ENERGY CO LTD) 29 juli 2022 (2022-07-29) * figuren 1-7 * -----	1-3,6-8, 10,13	H01M50/291
Y	US 2022/247050 A1 (XU WENCAI [CN] ET AL) 4 augustus 2022 (2022-08-04) * figuren 1-21 * * alinea [0005] - alinea [0153] * -----	1,2,6-8, 13,14	
Y	US 2022/166086 A1 (KOGAMI NAO [JP] ET AL) 26 mei 2022 (2022-05-26) * figuren 1-8 * * alinea [0006] - alinea [0058] * -----	1-14	
A	US 5 663 008 A (SHIMAKAWA SHINICHI [JP] ET AL) 2 september 1997 (1997-09-02) * figuur 1 * * kolom 4, regel 54 - regel 61 * -----	13	Onderzochte gebieden van de techniek H01M

Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op:

Plaats van onderzoek:	Datum waarop het onderzoek werd voltooid:	Bevoegd ambtenaar:
München	1 augustus 2024	Kuhn, Tanja

[1] NDERLINCATEGORIE VAN DE VERMELDE LITERATUUR

X: de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur
Y: de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht
A: niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft
O: niet-schriftelijke stand van de techniek
P: tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur
T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding
E: eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven
D: in de octrooiaanvrage vermeld
L: om andere redenen vermelde literatuur
&: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

EOB FORM 02.83 (P0414B)

AANHANGSEL BEHORENDE BIJ HET RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK, UITGEVOERD IN DE OCTROOIAANVRAGE NR.

NO 143421
NL 2036282

Het aanhangsel bevat een opgave van elders gepubliceerde octrooiaanvragen of octrooien (zogenaamde leden van dezelfde octrooifamilie), die overeenkomen met octrooischriften genoemd in het rapport.
De opgave is samengesteld aan de hand van gegevens uit het computerbestand van het Europees Octrooibureau per
De juistheid en volledigheid van deze opgave wordt noch door het Europees Octrooibureau, noch door het Bureau voor de Industriële eigendom gegarandeerd;; de gegevens worden verstrekt voor informatiedoeleinden.

01-08-2024

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
CN 216698613 U	07-06-2022	GEEN	
CN 217086790 U	29-07-2022	GEEN	
US 2022247050 A1	04-08-2022	EP 3944408 A1	26-01-2022
		HU E061015 T2	28-05-2023
		JP 7386986 B2	27-11-2023
		JP 2022552726 A	19-12-2022
		KR 20220066132 A	23-05-2022
		PL 3944408 T3	20-03-2023
		US 2022247050 A1	04-08-2022
		WO 2021078079 A1	29-04-2021
US 2022166086 A1	26-05-2022	CN 113614983 A	05-11-2021
		EP 3952009 A1	09-02-2022
		JP 7491903 B2	28-05-2024
		JP WO2020194938 A1	01-10-2020
		US 2022166086 A1	26-05-2022
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US 5663008 A	02-09-1997	CN 1134041 A	23-10-1996
		DE 69608725 T2	26-10-2000
		EP 0732759 A1	18-09-1996
		JP H08250151 A	27-09-1996
		KR 960036188 A	28-10-1996
		US 5663008 A	02-09-1997

Algemene informatie over dit aanhangsel is gepubliceerd in de 'Official Journal' van het Europees Octrooibureau nr 12/82 blz 448 ev

SCHRIFTELIJKE OPINIE

DOSSIER NUMMER	INDIENINGSDATUM	VOORRANGSDATUM	AANVRAAGNUMMER
NO143421	16.11.2023	18.05.2023	NL2036282

CLASSIFICATIE
INV. H01M10/658 H01M50/204 H01M50/209 H01M50/24 H01M50/291

AANVRAGER
Jinko Energy Storage Technology Co., Ltd.

Deze schriftelijke opinie bevat een toelichting op de volgende onderdelen:

- ☒ Onderdeel I Basis van de schriftelijke opinie
- ☐ Onderdeel II Voorrang
- ☐ Onderdeel III Vaststelling nieuwheid, inventiviteit en industriële toepasbaarheid niet mogelijk
- ☐ Onderdeel IV De aanvraag heeft betrekking op meer dan één uitvinding
- ☒ Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid
- ☐ Onderdeel VI Andere geciteerde documenten
- ☒ Onderdeel VII Overige gebreken
- ☒ Onderdeel VIII Overige opmerkingen

DE BEVOEGDE AMBTENAAR
Kuhn, Tanja

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2036282

Onderdeel I Basis van de Schriftelijke Opinie

1. Deze schriftelijke opinie is opgesteld op basis van de meest recente conclusies ingediend voor aanvang van het onderzoek.

2. Deze motivering is opgesteld, met betrekking tot **nucleotide- en/of aminozuursequenties** die genoemd worden in de aanvraag, op basis van een sequentielijst die:

   a. ☐ is opgenomen in de aanvraag zoals deze oorspronkelijk is ingediend

   b. ☐ aangeleverd is na de indieningsdatum ten behoeve van het onderzoek

      ☐ en vergezeld ging van een verklaring dat de sequentielijst niet meer informatie bevat dan de aanvraag zoals deze oorspronkelijk is ingediend.

3. ☐ Deze motivering is opgesteld, met betrekking tot nucleotide- en/of aminozuursequenties die genoemd worden in de aanvraag, voor zover een zinvolle motivering gevormd kon worden zonder een sequentielijst die voldeed aan WIPO standaard ST.26.

4. Overige opmerkingen:

Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid

1. Verklaring

Nieuwheid	Ja:	Conclusies 1-14
	Nee:	Conclusies
Inventiviteit	Ja:	Conclusies
	Nee:	Conclusies 1-14
Industriële toepasbaarheid	Ja:	Conclusies 1-14
	Nee:	Conclusies

2. Citaties en toelichting:

Zie aparte bladzijde

Onderdeel VII Overige gebreken

De volgende gebreken in de vorm of inhoud van de aanvraag zijn opgemerkt:

Zie aparte bladzijde

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2036282

Onderdeel VIII Overige opmerkingen

De volgende opmerkingen met betrekking tot de duidelijkheid van de conclusies, beschrijving, en figuren, of met betrekking tot de vraag of de conclusies nawerkbaar zijn, worden gemaakt:

Zie aparte bladzijde

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. **Prior art**

1.1. Reference is made to the following documents; the numbering will be adhered to in the rest of the procedure.

D1 CN 216 698 613 U (SUZHOU ATES NEW ENERGY DEV CO LTD ET AL.) 7 June 2022 (2022-06-07)

D1a computer-generated English translation of CN 216 698 613 U

D2 CN 217 086 790 U (SHANGHAI RUIPU QINGCHUANG NEW ENERGY CO LTD) 29 July 2022 (2022-07-29)

D2a computer-generated English translation of CN 217 086 790 U

D3 US 2022/247050 A1 (XU WENCAI [CN] ET AL) 4 August 2022 (2022-08-04)

D4 US 2022/166086 A1 (KOGAMI NAO [JP] ET AL) 26 May 2022 (2022-05-26)

2. **Novelty and inventive step**

2.1.

None of the established prior art documents discloses a battery module with all technical features of claim 1. Hence, the subject-matter of claims 1-14 is considered to be novel.

2.2.

D1 and its computer-generated English translation D1a (figures 1-6 / [[0001]-[0045]) are considered to represent the closest prior art and disclose a battery module and an energy storage module with the battery module.

The battery module thereby firstly comprises a battery cell stack, see cells 1 stacked one next to another in figure 2. The battery cells all comprise an explosion-proof valve11. A collection assembly in the form of a CCS-component 5 (see also figures 2, 3 and 5) is further provided at the top of the battery cells and is connected to the cell assembly, e.g. via conductive sheets 52 and connecting line 53. A heat insulating member/ plate 4 is further provided on the CCS-component 5 at a location away from the battery cells, see also figures 2 to 4. The CCS-component 5 comprises elliptical

openings extending in the longitudinal direction of the CCS component 5 and located at a centre line of the CCS-component 5, see figure 3. From the number of these openings, their location on the CCS-component 5, the number of battery cells 1 and the location of the explosion proof valves 11 in figures 2 and 3 it can clearly be taken that these openings of the CCS-component 5 are aligned with the explosion-proof valves 11 of the battery cells. The heat insulation plate 4 further comprises pressure relief grooves 41 which are not thicker then 0.2 mm (see [0030] of D1a). The plate 4 is made of mica ([0029] of D1a). Even though D1/D1a does not disclose a thickness of the plate 4 it discloses a thickness of a heat insulating side plate 3 to be 0.8mm and it is therefore considered that the overall thickness of the heat insulating plate 4 is in the same range as that of heat insulating side plates 3. As is further disclosed in [0028] of D1a the pressure relief grooves 41 are opposite to the pressure relief valves 11 of the battery cells 1 and the grooves 41 are broken in case energy is released from the battery cells through the explosion-proof valves 11. The battery module of D1/D1a further also comprises strips 6, which hold the battery stack between end plates 7.

D1/D1a does not disclose any material of these strips and it is therefore considered that the reader of D1/D1a understands these strips to be made of a material that is commonly used therefore, one of which is steel, see also D5 (figure 1; column 4, line 54 - line 61). Moreover, the battery module of D1/D1a comprises heat insulation plates 2 provided between adjacent battery cells, see also figure 2 and the battery module of D1/D1a is, finally, arranged in an energy storage device (figure 6) which comprises a storage box and, thus, a housing and the battery module.

The subject-matter of claim 1 therewith differs from D1/D1a by the additional technical feature of the heat insulation cushion assembly provided between adjacent battery cells and comprising a heat insulation member and two cushion members provided at both sides of the heat insulation plate as defined in claim 1.

The technical effect of this difference is an improved protection of the battery module in the situation of a thermal runaway because the cushion members absorb deformation during the expansion of the cells in such an event and thereby reduce the possibility of damages of the cells (description, para [0031]).

The present application thus solves the technical problem of how to further improve the protection of the battery module and its cells of D1 / D1a in case of a thermal runaway.

D4 (figures 1-8; paragraph [0006] - paragraph [0058]) discloses a battery module of the type of D1/D1a whereby separators 2 are provided between adjacent battery cells and whereby the separators 2 comprise a heat insulation sheet 5 (similar to plate 2 in the battery module of D1/D1a) and which additionally comprises rubber-like elastic sheets 6 on either one or both sides of the heat insulation plate 5 (see e.g. figure 5 of D4 for an

arrangement where rubber-like sheets 6 are provided on both sides of the heat insulation sheet 5). As is also disclosed in figures 4 and 5 the rubber-like sheets are provided on the sheet 5 in the form of a frame whereby portions 2A extend both in the height direction and the width direction of sheet 5. Portions 2B are so-called "non-stacked" portions (see [0048] of D4) and thus are portions where the separator 2 only comprises the heat insulation sheet 5. The thickness of the rubber-like portions 6 is preferably 0.3 to 1 mm ([0046] of D4). The rubber-like sheets 5 provide the beneficial effect of compensating/absorbing pressure caused by the expansion of the battery cells as the pressure is mitigated to the area 2B of the separator where no such rubber-like sheets but only a heat insulation sheet 5 is present. This reduces the risk of damage of the battery cells, suppresses deterioration of the heat insulating properties of the separator 2 and improves the safety of the battery module (see e.g. [0006] and [0048] of D4).

Given, that the separator 2 of D4 with its rubber-like sheets for absorbing the expansion of the battery cells obtains the above-described beneficial effects the reader of D4 will realise that this separator represents a potential solution to the problem posed and he will, therefore, at least by way of trail either fully (heat insulation sheet 5 with rubber-like elastic sheets 6) or only partly (rubber-like elastic sheets 6) apply the separator 2 of D4t to the battery module of D1/D1a to solve the problem posed . In both ways he would thereby, however, firstly arrive at the subject-matter of claim 1. Given, that the additional technical features of claims 2-14 are also either explicitly or implicitly known from D1 / D1a or D4 - see the discussion of their disclosures above - he would, at the same timealso arrive at the subject-matter of claims 2-14 without any inventive skill.

Hence, the subject-matter of present claims 1-14 is not inventive over D1/D1a in combination with D4.

2.3.

The subject-matter of claims 1-3, 6-8,10 and 13 is, furthermore, not inventive over D2/ D2a (figures 1 -7 / [0008]-[0049]) in combination with D4.

D2/D2a also disclose a battery module with a cell stack whereby the battery cells of the stack all comprise pressure relief valves 21 and whereby a CCS assembly 1 (collection assembly in the sense of claim 1) is provided on top of the battery cells and whereby furthermore a heat insulation film 13 made of PET is provided on the CCS assembly, see also figures of D2. The CCS assembly and the PET heat insulation film 13 comprises openings 12 that are aligned with the pressure relief valves 21 and in case of

a thermal runaway the pressure can be vented through these openings. Given, that heat insulation film 13 is a film its thickness is considered to be inherently comprised in the range of present claim 6. Moreover, the battery module of D2/D2a also comprises strips which are attached to end plates and which hold the battery cells of the module at their places (see figure 5). D2/D2a is also silent about any material of these strips and therefore the same argumentation as above in view of D1/D1a applies for the steel material of these strips claimed in claim 13.

The subject-matter of claim 1 therewith differs from D2/D2a by the additional technical feature of the heat insulation cushion assembly with a heat insulation member and cushion members as defined in claim 1.

The technical effect of this difference is the same as that already stated above in view of D1/D1a. Hence the same argumentation as given under item 2.1. above also applies for the problem to be solved, the disclosure of D4 and the obviousness of combining the separator 2 of D4 to the battery module of D2/D2a.

Hence, the subject-matter of claims 1-3, 6-8, 10 and 13 is also not inventive over D2/ D2a in combination with D4.

2.4.

The subject-matter of claims 1,2, 6-8, 13 and 14 is, finally, not inventive over D3 (figures 1-21; paragraph [0005] - paragraph [0153]) in combination with D4.

Also D3 discloses a battery module comprising a stack of battery cells 2,1 connection assembly 1 that also collects informations about the battery cells ([0103]) and which is, thus also a collection assembly in the sense of claim 1 that is placed on top of the battery cells, see figures 1, 2. A first heat insulation film 111 is further placed on top of the connection/collection assembly 1, see e.g. figure 3. As film 111 is again a film its thickness is again considered to be inherently comprised in the range of claim 6. Finally, the battery module of D3 is placed in a box B with housing parts B1 and B2 (see also figure 21).

The subject-matter of claim 1 therewith again differs from D3 by the additional technicalfeature of the heat insulation cushion assembly as further defined in claim 1.

Therewith the same argumentation in view of the technical effect, the problem to be solved, the disclosure of D4 and the obviousness to consider its teaching to solve the problem posed as already presented above under items 2.1. and 2.2. applies also in view of D3.

Hence, the subject-matter of claims 1, 2, 6-8, 13 and 14 is also not inventive over D3 in combination with D4.

The present set of claims is not allowable. It is not at present apparent which part of the application could serve as a basis for a new, allowable claim.

Re Item VII

Certain defects in the application

The relevant background art disclosed in documents D1 to D4 is not mentioned in the description, nor is this document identified therein.

Re Item VIII

Certain observations on the application - Lack of clarity

The last sentence in para [0059] of the description according to which also "equivalent replacements, improvements and the like made within the principle of the present disclosure" shall fall under the protection scope of the disclosure of the application leads to a doubtful extension of the disclosure and a lack of clarity of claims in view of the description.