

SPECIFICATION

TITLE OF INVENTION: PIN STRUCTURE, COVER PLATE ASSEMBLY, AND BATTERY

[0001] The present disclosure claims priority to Chinese Patent Application No. 202421409156.0, filed on June 19, 2024, the disclosure of which are incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of batteries, and in particular, to a pin structure, a cover plate assembly, and a battery.

BACKGROUND

[0003] In order to better weld tabs in rechargeable batteries, sub-pins connected with cell package and tabs on the pin are generally bent. The smaller the bending gap of a sub-pin, the better. In the related arts, a notch is generally provided near the bending portion of a pin, and the bending gap of the sub-pin is reduced by the notch. The notch is generally disposed on the sub-pins or on the bending portion connecting the sub-pins.

SUMMARY

[0004] However, when the notch is disposed on a sub-pin, the effective width of welding between the sub-pin and the tab is reduced. When the notch is disposed on the bending portion connecting the sub-pin, two opposing walls of the notch are easy to abut against each other when the sub-pin is bent, so as to interfere with the bending of the sub-pin.

[0005] The present disclosure provides a pin structure, which includes:

[0006] a pole connecting portion configured to be connected with a pole; and

[0007] a tab connecting portion including a connecting plate and a mounting portion, the connecting plate includes a main body portion and a connecting portion, the main body portion extends in a first direction, and one end of the main body portion in the first direction is connected with the pole connecting portion, and the mounting portion is configured to be connected with

the tab;

[0008] wherein the connecting plate includes a first sub-connecting portion and a second sub-connecting portion that are connected with each other, the first sub-connecting portion is disposed in the form of a flat plate and connected with one side of the main body portion in a second direction, the second sub-connecting portion is disposed in the form of an arc shape and connected with the mounting portion, the first direction intersects with the second direction, the connecting portion is provided with a notch extending in the first direction, a part of the notch is disposed on the first sub-connecting portion, another part of the notch is disposed on the second sub-connecting portion, and the second sub-connecting portion is bent relative to the first sub-connecting portion at the notch.

[0009] The present disclosure further provides a cover plate assembly, which includes:

[0010] a top cover on which a pole is disposed; and

[0011] a pin structure as mentioned above, and the pole connecting portion is connected with the pole.

[0012] The present disclosure further provides a battery, which includes:

[0013] a cell package comprising a cell package body and tabs extending from the cell package body; and

[0014] a cover plate assembly as mentioned above;

[0015] wherein the tabs are connected with the mounting portion.

BENEFICIAL EFFECTS

[0016] According to the pin structure provided in the present disclosure, a notch is disposed on the connecting portion. A part of the notch is located on the first sub-connecting portion disposed in the form of a flat plate, and another part of the notch is located on the second sub-connecting portion disposed in the form of an arc shape. That is, the notch is not completely located on the second sub-connecting portion disposed in the form of an arc shape, so that two opposite walls of the notch do not abut against each other when the mounting portion is bent. That is, the arrangement of the notch in the embodiments of the present disclosure can not only reduce the

bending gap of the mounting portion, but also avoid interference with the bending of the mounting portion. In addition, the position of the notch is not located on the mounting portion, therefore, the welding area between the mounting portion and the tabs is not occupied. In this way, more space is provided for the welding of the pins on the mounting portion, and the effective welding area between the tabs and the pin structure is increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a schematic three-dimensional view of a pin structure according to the present disclosure from a perspective view;

[0018] FIG. 2 is a schematic three-dimensional view of a pin structure according to the present disclosure from another perspective view;

[0019] FIG. 3 is a schematic three-dimensional view of the mounting portion in the pin structure after bending according to the present disclosure;

[0020] FIG. 4 is a schematic structural diagram of the mounting portion in the pin structure after bending according to the present disclosure;

[0021] FIG. 5 is a schematic structural diagram of the mounting portion in the pin structure without bending according to the present disclosure;

[0022] FIG. 6 is an enlarged schematic diagram of section A in FIG. 5;

[0023] FIG. 7 an enlarged schematic diagram of section A in FIG. 5;

[0024] FIG. 8 an enlarged schematic diagram of section A in FIG. 5; and

[0025] FIG. 9 is a schematic three-dimensional view of a cover plate assembly according to the present disclosure.

[0026] List of reference signs:

[0027] 1. pole connecting portion; 2. pole; 3. tab connecting portion; 31. connecting plate; 311. main body portion; 312, connecting portion; 32. mounting portion; 3121. first sub-connecting portion; 3122, second sub-connecting portion; 4. notch; 5. first surface; 51. first sub-surface; 6. second surface; 7. fuse groove; 8. pole fixing hole; 9. top cover.

DETAILED DESCRIPTION

[0028] In description of the present disclosure, the terms "connection", "linking" and "fixing" should be broadly understood, for example, it may be a fixed connection, a detachable connection, or an integral connection, unless otherwise clearly specified and defined. It may be a mechanical connection or an electrical connection. It may be a direct connection or an indirect connection via an intermediate medium, may be an internal communication within two elements or an interaction between two elements. The specific meaning of the above terms in the present disclosure may be understood by a person skilled in the art according to specific situations.

[0029] In the present disclosure, unless clearly specified and limited otherwise, a first feature "above" or "below" a second feature may include direct contact of the first feature and the second feature, and it may also be included that the first feature and the second feature are not in direct contact but are contacted by additional features between them. Moreover, the first feature "on", "above" and "upper" the second feature includes the first feature directly above and obliquely upward the second feature, or merely indicates that a level of the first feature is higher than a level of the second feature. The first feature "lower", "below" and "under" the second feature includes the first feature directly below and obliquely downward the second feature, or merely indicates that a level of the first feature is less than a level of the second feature.

[0030] In the description of the present disclosure, terms such as "above", "below", "left", "right", "front", "back" refer to the orientation or positional relationship shown in the appended drawings, and are only for the purpose of facilitating the description and simplifying of operation, rather than indicating or implying that the apparatus or component referred to must have a particular orientation or must be configured or operated in a particular orientation, therefore should not be construed as a limitation towards the present disclosure. In addition, terms such as "first", "second" are merely for the purpose of description and should not be construed as an indication or implication of relative importance thereof.

[0031] The present disclosure proposes a pin structure. FIGs. 1 to 9 are some embodiments of the present disclosure.

[0032] Referring to FIGs. 1 to 2, in some embodiments of the present disclosure, the pin structure includes a pole connecting portion 1 extending in a third direction X, and the pole connection portion 1 is configured to be connected with the pole 2.

[0033] In some embodiments of the present disclosure, the pin structure further includes a tab connecting portion 3. The tab connecting portion 3 includes a connecting plate 31 and a mounting portion 32. The connecting plate 31 includes a main body portion 311 and a connecting portion 312. The main body portion 311 extends in a first direction Z. One end of the main body portion 311 in the first direction is connected with the pole connecting portion 1. The connecting portion 312 includes a first sub-connecting portion 3121 and a second sub-connecting portion 3122 that are connected with each other. The first sub-connecting portion 3121 is disposed in the form of a flat plate and connected with one side of the main body portion 311 in a second direction Y. The second sub-connecting portion 3122 is disposed in the form of an arc shape and connected with the mounting portion 32. The mounting portion 32 configured to be connected with the tab. The mounting portion 32 can be bent toward one side of the main body portion 311 away from the pole connecting portion 1 in the third direction X through the connecting portion 312. One side of the mounting portion 32 away from the main body portion 311 in the second direction Y is used for fixing and mounting the tab.

[0034] The connecting portion 312 is provided with a notch 4 extending in the first direction Z. A part of the notch 4 is disposed on the first sub-connecting portion 3121, another part of the notch 4 is disposed on the second sub-connecting portion 3122. The second sub-connecting portion 3122 is bent relative to the first sub-connecting portion 3121 at the notch 4. That is, the arrangement of the notch 4 can facilitate the relative bending of the first sub-connecting portion 3121 and the second sub-connecting portion 3122. Since the second sub-connecting portion 3122 is connected with the mounting portion 32, and the first sub-connecting portion 3121 is connected with the main body portion 311, the mounting portion 32 can be bent to a state as shown in FIGs. 3 and 4. In this embodiment, the notch 4 is disposed at the connection position of the first sub-connecting portion 3121 and the second sub-connecting portion 3122, two opposite walls of the notch 4 do not abut against each other when the mounting portion 32 is bent, so as to avoid interference with the mounting portion 32. The surfaces of the bent mounting portion 32 and the main body portion 311 that are close to each other are parallel to each other.

[0035] In the technical solutions of the present disclosure, the connecting portion 312 is provided with a notch 4. A part of the notch 4 is disposed on the first sub-connecting portion 3121

in the form of a flat plate, and another part of the notch 4 is disposed on the second sub-connecting portion 3122 in the form of an arc shape. That is, the notch 4 is not completely located on the second sub-connecting portion 3122 disposed in the form of an arc shape, so that two opposite walls of the notch 4 do not abut against each other when the mounting portion 32 is bent. That is, the arrangement of the notch 4 in the embodiments of the present disclosure can not only reduce the bending gap of the mounting portion 32, but also avoid interference with the bending of the mounting portion 32. In addition, the position of the notch 4 is not located on the mounting portion 32, therefore, the welding area between the mounting portion 32 and the tabs is not occupied. In this way, more space is provided for the welding of the pins on the mounting portion 32, and the effective welding area between the tabs and the pin structure is increased.

[0036] Referring to FIG. 5 to FIG. 6, in some embodiments of the present disclosure, a width of a part of the notch 4 on the first sub-connection part 3121 in the second direction Y is D1. A thickness of the main body portion 311 in a third direction X is H1. A ratio of D1 and H1 satisfies: $0.5 H1 \leq D1 \leq 1.5 H1$. In this embodiment, the D1 value and the H1 value are designed to meet the range of $0.5 H1 \leq D1 \leq 1.5 H1$, which can improve the bending effect of the mounting portion 32, so that the fitting effect of the mounting portion 32 to the main body portion 311 after bending is better. If the value of D1 is less than $0.5 H1$, the space of the notch 4 in the second direction Y is insufficient, which will easily interfere with the bending of the mounting portion 32 and affect the bending effect of the mounting portion 32. If the value of D1 is greater than $1.5 H1$, the vertical distance from the second sub-connecting portion 3122 to the main body portion 311 in the second direction Y is too large, thereby increasing the material cost of and weight of the pin structure.

[0037] In some embodiments of the present disclosure, since at least a part of the notch 4 is located on the first sub-connecting portion 3121, the vertical distance L from the connection of the first sub-connecting portion 3121 and the second sub-connecting portion 3122 in the second direction Y to the main body portion 311 is L. A ratio of L and D1 satisfies: $D1 \leq L$. This arrangement ensures that the notch 4 is located on the first sub-connecting portion 3121 and does not extend to the main body portion 311 in the second direction Y.

[0038] In some embodiments of the present disclosure, the thickness of the pin structure is

uniform in the portions where the notch 4 is not provided. That is, the thickness of the pin structure is H1.

[0039] Referring to FIG. 7, in some embodiments of the present disclosure, the connecting portion 312 includes a first surface 5 and a second surface 6 that are disposed opposite to each other. The notch 4 is recessed from the first surface 5 to the second surface 6.

[0040] A vertical distance from a lowest point of the notch 4 to the second surface 6 is H2. A ratio of the H2 and the H1 satisfies: $\frac{7}{20} H1 \leq H2 \leq \frac{3}{5} H1$. In this embodiment, H1 and H2 are designed to satisfy $\frac{7}{20} H1 \leq H2 \leq \frac{3}{5} H1$, which can improve the bending effect of the mounting portion 32, so that the fitting effect of the mounting portion 32 to the main body portion 311 after bending is better. If H2 is less than $\frac{7}{20} H1$, the thickness of the connecting portion 312 at the position where the notch 4 is provided is too small, and therefore the connecting portion 312 has a small over-current capability at the position where the notch 4 is disposed. If H2 is greater than $\frac{3}{5} H1$, the thickness of the connecting portion 312 at the position where the notch 4 is provided is too large, that is, the depth of the notch 4 is too small, thereby affecting the bending of the mounting portion 32.

[0041] In an embodiment, the lowest point of the notch 4 may be located on the first sub-connection portion 3121. In another embodiment, the lowest point of the notch 4 may also be located on the second sub-connecting portion 3122.

[0042] Referring to FIGs. 7 and 8, in some embodiments of the present disclosure, the first surface 5 includes a first sub-surface 51 disposed in the form of an arc shape, and the first sub-surface 51 is disposed on the second sub-connecting portion 3122. That is, the first sub-surface 51 is a curved portion of the second sub-connecting portion 3122.

[0043] A width of a part of the notch 4 on the second sub-connecting portion 3122 in the second direction is D2. A radius of a circle where the first sub-surface 51 is located is R. A ratio of D2 and R satisfies: $\frac{1}{2} R \leq D2 \leq \frac{\sqrt{3}}{2} R$. In this embodiment, R and D2 are designed to be within the range of $R \leq D2 \leq R$, which can improve the bending effect of the mounting portion 32 and make the mounting portion 32 have a better fitting effect with the main body portion 311 after bending. If D2 is less than R, the space of the notch 4 in the second direction Y is insufficient, which will

easily interfere with the bending of the mounting portion 32 and affect the bending effect of the mounting portion 32. If $D2$ is greater than R , the portion in which the notch 4 is provided in the second sub-connection portion 3122 is excessive, resulting in an increase in the thinning area on the second sub-connecting portion 3122, and an increase in the temperature when over-current is accrued on the second sub-connecting portion 3122.

[0044] In some embodiments of the present disclosure, a ratio of R and $H1$ further satisfies: $1/2 H1 \leq R \leq H1$. In this embodiment, R and $H1$ are designed to satisfy $1/2 H1 \leq R \leq H1$, which can improve the bending effect of the mounting portion 32 and make the mounting portion 32 have a better fitting effect with the main body portion 311 after bending. If R is greater than $H1$, the material cost of the second sub-connecting portion 3122 will increase. If R is less than $1/2 H1$, bending of the mounting portion 32 is unfavorable.

[0045] In some embodiments of the present disclosure, at least a part of the walls of the notch 4 is curved, so as to avoid the formation of a relatively sharp portion on the notch 4, and to avoid the stress concentration of the connecting portion 312 at the notch 4 when the pin structure is bent. Meanwhile, if there are sharp portions at the notch 4, it is easy to interfere with the bending of the mounting portion 32. In an embodiment of the present disclosure, the cross-section of the notch 4 has a trapezoidal-like design. Furthermore, each wall of the notch 4 is disposed in a manner of smooth transition.

[0046] In some embodiments of the present disclosure, the pole connecting portion 1 is provided with a fuse groove 7. The fuse groove 7 extends through the pole connecting portion 1 in the first direction Z . Here, the fuse groove 7 is designed so that, in the second direction Y , the cross-sectional area of a part of the pole connecting portion 1 located on both sides of the fuse groove 7 decreases. In this way, when the current increases sharply, the temperature of the part of the pole connecting portion 1 located on both sides of the fuse groove 7 rises instantaneously, thereby causing metal to be fused, thereby playing a role of safety protection.

[0047] In some embodiments of the present disclosure, the pole connecting portion 1 is provided with a pole fixing hole 8. The pole fixing hole 8 extends through the pole connecting portion 1 in the first direction Z , and the pole 2 located on the top cover 9 is welded and fixed in the pole fixing hole 8.

[0048] Referring to FIG. 9, the present disclosure further provides a cover plate assembly. The cover plate assembly includes a top cover 9 and a pin structure, wherein a pole 2 is disposed on the top cover 9. The pin structure is as described above. The pole connecting portion 1 in the pin structure is connected with the pole 2. Since the cover plate assembly adopts all the technical solutions of all the above-mentioned embodiments, it has at least the beneficial effects brought by the technical solutions of the above-mentioned embodiments, which will not be described again here.

[0049] Since the cover plate assembly is provided with two poles 2, which are positive pole and negative pole respectively, the number of pin structures is two as well, one of which is connected with the positive pole and the other is connected with the negative pole.

[0050] In some embodiments of the present disclosure, the pin structure in the cover plate assembly is provided with a notch 4 on the connecting portion 312. A part of the notch 4 is located on the first sub-connecting portion 3121 disposed in the form of a flat plate, and another part of the notch 4 is located on the second sub-connecting portion 3122 disposed in the form of an arc shape. That is, the notch 4 is not completely located on the second sub-connecting portion 3122 disposed in the form of an arc shape, so interference with the bending of the mounting portion 32 can be avoided when the mounting portion 32 is bent. In addition, the notch 4 is not located on the mounting portion 32, so it does not occupy the welding area between the mounting portion 32 and the tabs, which provides more space for the welding of the pins on the mounting portion 32, and increases the effective welding area between the tabs and the pin structure.

[0051] The present disclosure also provides a battery. The battery includes a cell package and a cover plate body. The cell package includes a cell package body and tabs extending from the cell package body. The cover assembly is as described above. The mounting portion 32 in the cover plate assembly is connected with the tabs. Since the cover assembly adopts all the technical solutions of all the above-mentioned embodiments, the cover assembly has at least the beneficial effects brought by the technical solutions of the above-mentioned embodiments, which will not be described again here.

What claimed is:

[Claim 1] A pin structure comprising:

a pole connecting portion (1) configured to be connected with a pole (2); and

a tab connecting portion (3) comprising a connecting plate (31) and a mounting portion (32), the connecting plate (31) comprising a main body portion (311) and a connecting portion (312), the main body portion (311) extending in a first direction, and one end of the main body portion (311) in the first direction being connected with the pole connecting portion (1), and the mounting portion (32) being configured to be connected with a tab;

wherein the connecting plate (31) comprises a first sub-connecting portion (3121) and a second sub-connecting portion (3122) that are connected with each other, the first sub-connecting portion (3121) is disposed in the form of a flat plate and connected with one side of the main body portion (311) in a second direction, the second sub-connecting portion (3122) is disposed in the form of an arc shape and connected with the mounting portion (32), the first direction intersects with the second direction, the connecting portion (312) is provided with a notch (4) extending in the first direction, a part of the notch (4) is disposed on the first sub-connecting portion (3121), another part of the notch (4) is disposed on the second sub-connecting portion (3122), and the second sub-connecting portion (3122) is bent relative to the first sub-connecting portion (3121) at the notch (4).

[Claim 2] The pin structure according to claim 1, wherein a width of a part of the notch (4) on the first sub-connection part (3121) in the second direction is D1, a thickness of the main body portion (311) in a third direction is H1, and the first direction and the second direction are perpendicular to the third direction, respectively; and

wherein a ratio of D1 and H1 satisfies: $0.5 H1 \leq D1 \leq 1.5 H1$.

[Claim 3] The pin structure according to claim 2, wherein a vertical distance from a connection

of the first sub-connecting portion (3121) and the second sub-connecting portion (3122) to the main body portion (311) in the second direction is L; and

wherein a ratio of L and D1 satisfies: $D1 \leq L$.

[Claim 4] The pin structure according to claim 2, wherein the connecting portion (312) comprises a first surface (5) and a second surface (6) disposed opposite to each other, the notch (4) is recessed from the first surface (5) to the second surface (6); and

a vertical distance from a lowest point of the notch (4) to the second surface (6) is H2; and wherein a ratio of the H2 and the H1 satisfies: $\frac{7}{20} H1 \leq H2 \leq \frac{3}{5} H1$.

[Claim 5] The pin structure according to claim 4, wherein the first surface (5) comprises a first sub-surface (51) disposed in the form of an arc shape, and the first sub-surface (51) is disposed on the second sub-connecting portion (3122);

a width of a part of the notch (4) on the second sub-connecting portion (3122) in the second direction is D2, and a radius of a circle where the first sub-surface (51) is located is R; and

wherein a ratio of D2 and R satisfies: $\frac{1}{2} R \leq D2 \leq \frac{\sqrt{3}}{2} R$.

[Claim 6] The pin structure of claim 5, wherein a ratio of R and H1 further satisfies: $\frac{1}{2} H1 \leq R \leq H1$.

[Claim 7] The pin structure according to any one of claims 1 to 6, wherein at least a part of walls of the notch (4) is curved.

[Claim 8] The pin structure according to any one of claims 1 to 6, wherein the pole connecting portion (1) is provided with a fuse groove (7), and the fuse groove (7) penetrates through the pole connecting portion (1) and extends in the first direction; and/or,

the pole connecting portion (1) is provided with a pole fixing hole (8), and the pole fixing hole (8) penetrates through the pole connecting portion (1) and extends in the first direction.

[Claim 9] A cover plate assembly comprising:

a top cover (9) on which the pole (2) is disposed; and

the pin structure according to any one of claims 1 to 8, and the pole connecting portion (1) being connected with the pole (2).

[Claim 10] A battery comprising:

a cell package comprising a cell package body and tabs extending from the cell package body;
and

the cover plate assembly according to claim 9;

wherein the tabs are connected with the mounting portion (32).