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### BATTERY CORE, CASE BODY, BATTERY MODULE AND BATTERY PACK

#### Abstract

The disclosure provides a battery core, a case body, a battery module, and a battery pack. The battery core provided by the disclosure includes the following. A case body is provided, and the case body has side surfaces and a bottom surface connected to each other. A composite layer includes a shear resistant layer and a connection layer. The shear resistant layer is connected to the case body through the connection layer. At least one of the shear resistant layer and the connection layer is an insulation layer, and the composite layer covers at least one of at least part of the side surfaces and at least part of the bottom surface. The battery core provided by the disclosure can ensure the shear strength of the composite layer covering the surface of the battery core, thereby the reliability of the battery core during use is improved.

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## **Background/Summary**

### **CROSS-REFERENCE TO RELATED APPLICATION**

[0001] This application claims the priority benefit of China application serial no. 2024202944401, filed on Feb. 8, 2024. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

### **BACKGROUND**

#### **Technical Field**

[0002] The disclosure relates to the field of battery technology, and particularly relates to a battery core, a case body, a battery module, and a battery pack.

#### **Description of Related Art**

[0003] With the development of new energy vehicles, the demand for power batteries continues to increase. Generally, a power battery pack comprises multiple battery modules, and a battery module comprises multiple battery cores.

[0004] In a method known to persons skilled in the art, the surface of the battery core is covered with an insulation film. When the battery cores are connected to each other, the insulation films keep two adjacent battery cores insulated.

### **SUMMARY**

[0005] The disclosure provides a battery core, a case body, a battery module, and a battery pack that can ensure the shear strength of a composite layer covering the surface of the battery core and improve the reliability of the battery core during use.

[0006] In order to achieve the above purpose, the disclosure provides technical solutions as follows.

[0007] The first aspect of the disclosure provides a battery core, which includes the following.

[0008] A case body is provided. The case body has side surfaces and a bottom surface connected to each other.

[0009] A composite layer is provided. The composite layer includes a shear resistant layer and a connection layer. The shear resistant layer is connected to the case body through the connection layer. At least one of the shear resistant layer and the connection layer is an insulation layer. The composite layer covers at least one of at least part of the side surfaces and at least part of the bottom surface.

[0010] The beneficial effects of the disclosure are as follows. The shear resistant layer is connected to the case body through the connection layer, and the composite layer can protect the surface of the case body. The existence of the shear resistant layer can ensure the shear strength of the composite layer covering the surface of the battery core. Therefore, when the battery core is affected by an external shear force, the composite layer is not likely to rupture, thereby the reliability of the battery core during use is improved.

[0011] In a possible implementation, the shear resistant layer and the connection layer are each provided with one layer.

[0012] Alternatively, both the shear resistant layer and the connection layer are provided with a plurality of layers, and each of the plurality of layers of the shear resistant layer and each of the plurality of layers of the connection layer are alternately stacked and disposed sequentially.

[0013] In this way, when the shear resistant layer and the connection layer are each provided with

one layer, the processing and formation of the composite layer is facilitated; when the shear resistant layer and the connection layer are provided with a plurality of layers, the shear strength of the composite layer can be further ensured.

[0014] In a possible implementation, the shear resistant layer is a PET layer.

[0015] And/or, the connection layer is a photo-cured layer or a temperature-cured layer.

[0016] And/or, when there is one layer of each of the shear resistant layer and the connection layer, the thickness range of both the shear resistant layer and the connection layer is 40-60  $\mu\text{m}$ .

[0017] In this way, the thickness of the shear resistant layer is within this range, which can ensure the shear strength of the shear resistant layer; and the thickness of the connection layer is within this range, which can ensure the connection strength of the connection layer.

[0018] In a possible implementation, the shear strength of the composite layer is not less than 1.4 MPa.

[0019] And/or, the thickness range of the composite layer is 80-120  $\mu\text{m}$ .

[0020] In this way, the shear strength of the composite layer is within this range, which can ensure the ability of the composite layer to resist the external shear force; and the thickness of the composite layer is within this range, which can ensure the shear strength of the composite layer.

[0021] In a possible implementation, the composite layer covers the entire bottom surface; and/or, the composite layer covers part of the side surfaces, and areas on the side surfaces not covered with the composite layer are covered with gel.

[0022] In this way, the gel covering the side surface may play the role of connection, and two adjacent battery cores in the battery module may be connected through the gel.

[0023] In a possible implementation, the composite layer on the side surfaces and the bottom surface are integrally formed.

[0024] In this way, the composite layer are integrally formed, which can improve the overall shear strength and insulation of the composite layer.

[0025] In a possible implementation, the side surfaces include first side surfaces and second side surfaces; and the case body has two first side surfaces opposite to each other, and has two second side surfaces opposite to each other.

[0026] The first side surfaces and the second side surfaces are intersected with each other, and the area of the first side surface is larger than the area of the second side surface; and when the composite layer covers at least part of the side surfaces, both the first side surfaces and the second side surfaces are covered with the composite layer.

[0027] In this way, the first side surface is a large surface of the battery core, and the second side surface is a small surface of the battery core. The composite layer can protect the first side surface and the second side surface.

[0028] In a possible implementation, the composite layer covering the first side surfaces extends to the second side surfaces and covers part of the second side surfaces. Areas on the second side surfaces not covered with the composite layer are window areas, and the window areas are covered with the gel.

[0029] The area of the window areas is 40%-80% of the area of the second side surface; and/or, the spacing between the bottom end of the window areas and the bottom surface is not less than 5 mm.

[0030] In this way, the ratio of the area of the window areas is within this range, which can ensure the bonding area and bonding strength between the gel and the second side surface; and the spacing is within this range, which ensures the protection of the composite layer to the bottom portion of the second side surface.

[0031] In a possible implementation, the composite layer has folding areas on the second side surfaces, and the composite layer is folded in the folding areas.

[0032] In this way, after the composite layer is disposed in the folding areas, the composite layer on the second side surface may be made even, and the shear strength of the composite layer in the folding areas can also be improved.

[0033] In a possible implementation, a maximum quantity of folding layers of the composite layer in the folding areas does not exceed 5 layers.

[0034] In this way, when the maximum quantity of folding layers does not exceed 5 layers, the overall evenness of the composite layer on the second side surface can be ensured.

[0035] The second aspect of the disclosure provides a case body, which has side surfaces and a bottom surface, and at least one of at least part of the side surfaces and at least part of the bottom surface is covered with a composite layer.

[0036] The composite layer includes a shear resistant layer and a connection layer. The shear resistant layer is connected to the case body through the connection layer; and at least one of the shear resistant layer and the connection layer is an insulation layer.

[0037] The third aspect of the disclosure provides a battery module, which includes the battery cores as described in any of the above implementations. The battery cores are disposed in plural, and the plurality of battery cores are connected to form a battery core assembly.

[0038] The fourth aspect of the disclosure provides a battery pack, which includes a battery box and the battery module. The battery box has a containing cavity inside, and the battery module is disposed in the containing cavity.

[0039] Therefore, in the battery core provided by the disclosure, the shear resistant layer is connected to the case body through the connection layer, and the composite layer can protect the surface of the case body; and the existence of the shear resistant layer can ensure the shear strength of the composite layer covering the surface of the battery core. Therefore, when the battery core is affected by the external shear force, the composite layer is not likely to rupture under the action of the external shear force, thereby the reliability of the battery core during use is improved. In addition, the existence of the connection layer can improve the connection strength between the composite layer and the case body.

[0040] The structure of the disclosure, as well as other inventive purposes and beneficial effects according to the disclosure will be more comprehensible by describing the specific embodiments together with the accompanying drawings.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

[0041] In order to clearly illustrate the embodiments of the disclosure or the technical solution in the related art, the drawings to be used in the description of the embodiments or the related art will be briefly introduced below. Certainly, the drawings in the following description are some embodiments of the disclosure. For persons of ordinary skill in the art, other drawings may be obtained based on the drawings without exerting creative efforts.

[0042] FIG. 1 is a three-dimensional view of a battery core provided by an embodiment of the disclosure.

[0043] FIG. 2 is a front view of the battery core provided by an embodiment of the disclosure.

[0044] FIG. 3 is a cross-sectional view of position A to position A in FIG. 2.

[0045] FIG. 4 is an enlarged view of position B in FIG. 3.

[0046] FIG. 5 is another view corresponding to FIG. 4.

[0047] FIG. 6 is a left view of the battery core provided by an embodiment of the disclosure.

[0048] FIG. 7 is a view of FIG. 6 after removing the composite layer.

[0049] FIG. 8 is another view corresponding to FIG. 6.

### DESCRIPTION OF THE EMBODIMENTS

[0050] In a method known to persons skilled in the art, when the battery cores in the battery module are connected to each other, the insulation films covering the surfaces of the battery cores keep two adjacent battery cores insulated. However, the insulation film covering the surface of the

battery core in the related art has the problem of low shear strength. When the battery core is affected by an external shear force, the insulation film is likely to rupture, thus the reliability of the battery core during use is affected.

[0051] Based on the above problems, an embodiment of the disclosure provides a battery core, a case body, a battery module, and a battery pack. The battery module and the battery pack both include the battery core. The battery core includes the case body and a composite layer. The composite layer includes a shear resistant layer and a connection layer. The shear resistant layer is connected to the case body through the connection layer; at least one of the shear resistant layer and the connection layer is an insulation layer; and the composite layer covers at least one of at least part of side surfaces and at least part of a bottom surface on the case body. Therefore, after the shear resistant layer is connected to the surface of the case body through the connection layer, the shear strength of the composite layer covering the surface of the battery core can be ensured, thereby the reliability of the battery core during use is improved.

[0052] In order to make the purpose, technical solutions, and advantages of embodiments of the disclosure clearer, the technical solutions of the embodiments of the disclosure will be clearly and completely described below together with the drawings of the embodiments of the disclosure. Certainly, the embodiments described are part of the embodiments of the disclosure rather than all embodiments. Based on the embodiments in the disclosure, all other embodiments obtained by persons of ordinary skill in the art without creative work fall within the scope of protection of the disclosure.

[0053] The technical solutions of the disclosure and how the technical solutions of the disclosure solve the above technical problems will be described in detail below with specific embodiments. The following specific embodiments may be combined with each other, and the same or similar concepts or processes may not be repeated in some embodiments.

[0054] The structure of the battery core provided by an embodiment of the disclosure will be described in detail below with reference to FIG. 1 to FIG. 8.

[0055] As shown in FIG. 1 to FIG. 4, the battery core provided by the disclosure includes the following.

[0056] A case body **100** is provided. The case body **100** has side surfaces **110** and a bottom surface **120**. In addition, the case body **100** further has a top surface **130**, and the side surfaces **110** are connected between the bottom surface **120** and the top surface **130**. The case body **100** is disposed with an electrolyte **600** disposed inside.

[0057] A composite layer **200** is provided. The composite layer **200** includes a shear resistant layer **210** and a connection layer **220**. The shear resistant layer **210** is connected to the case body **100** through the connection layer **220**; at least one of the shear resistant layer **210** and the connection layer **220** is an insulation layer; and the composite layer **200** covers at least one of at least part of the side surfaces **110** and at least part of the bottom surface **120**. It should be noted that the side surfaces **110** and the bottom surface **120** of the case body **100** are susceptible to external forces. After the composite layer **200** covers at least part of the side surfaces **110** and at least part of the bottom surface **120**, the composite layer **200** can protect the side surfaces **110** and/or the bottom surface **120**. For example, when the bottom portion of the battery core is connected to the bottom plate of the battery box through gel connection, during the process of removing the battery core from the bottom plate, the bottom surface **120** of the case body **100** is subjected to the shear force. At this time, the composite layer **200** may be used to cover at least part of the bottom surface **120**, thereby the bottom surface **120** is protected. Alternatively, when the side surfaces **110** of two adjacent battery cores are connected through the gel, during the process of disassembling the two adjacent battery cores, the side surfaces **110** of the case body **100** are also subjected to the shear force. At this time, the composite layer **200** may be used to cover at least part of the side surfaces **110**, thereby the side surfaces **110** are protected. Alternatively, when both the side surfaces **110** and the bottom surface **120** of the case body **100** are subjected to the external shear force, the composite

layer **200** may also cover at least part of the side surfaces **110** and at least part of the bottom surface **120** at the same time, thereby the side surfaces **110** and the bottom surface **120** are protected simultaneously.

[0058] Specifically, there may be only one insulation layer of the shear resistant layer **210** and the connection layer **220**, or both the shear resistant layer **210** and the connection layer **220** may be the insulation layer. Therefore, after the composite layer **200** covers the surface of the case body **100**, the insulation between the two adjacent battery cores can be ensured.

[0059] Specifically, when the composite layer **200** covers the side surfaces, the operation may be only part of the side surfaces **110** is covered, or the entire side surfaces are covered; and when the composite layer **200** covers the bottom surface, the operation may be only part of the bottom surface **120** is covered, or the entire bottom surface **120** is covered.

[0060] Therefore, in the battery core provided by the disclosure, the shear resistant layer **210** is connected to the case body **100** through the connection layer **220**, and the composite layer **200** can protect the surface of the case body **100**. The existence of the shear resistant layer **210** can ensure the shear strength of the composite layer **200** covering the surface of the battery core. Therefore, when the battery core is affected by the external shear force, the composite layer **200** is not likely to rupture under the action of the external shear force, thereby the reliability of the battery core during use is improved. In addition, the existence of the connection layer **220** can improve the connection strength between the composite layer **200** and the case body **100**.

[0061] In a specific embodiment, as shown in FIG. 4, the shear resistant layer **210** and the connection layer **220** are each provided with one layer. Therefore, one shear resistant layer **210** is connected to one connection layer **220**, which can simplify the structure of the composite layer **200** and facilitate the processing and formation of the composite layer **200**.

[0062] Specifically, when the shear resistant layer **210** and the connection layer **220** are each provided with one layer, the thickness range of both the shear resistant layer **210** and the connection layer **220** is 40-60  $\mu\text{m}$ . The thickness of the shear resistant layer **210** is within this range, which can reduce the weight and cost of the shear resistant layer **210** while ensuring the shear strength of the shear resistant layer **210**; and the thickness of the connection layer **220** is within this range, which can reduce the weight and cost of the connection layer **220** while ensuring the connection strength of the connection layer **220**.

[0063] In another specific embodiment, as shown in FIG. 5, both the shear resistant layer **210** and the connection layer **220** are provided with multiple layers, and the multiple shear resistant layers **210** and the multiple connection layers **220** are alternately stacked and disposed sequentially. Therefore, the multiple shear resistant layers **210** and the multiple connection layers **220** cooperate with each other to further ensure the shear strength of the composite layer **200** and ensure the reliability of the battery core during use. Specifically, as shown in FIG. 5, the shear resistant layer **210** and the connection layer **220** are each provided with two layers, and the two shear resistant layers **210** and the two connection layers **220** are alternately stacked and disposed sequentially.

[0064] Specifically, the thickness range of the composite layer **200** is 80-120  $\mu\text{m}$ . The thickness of the composite layer **200** is within this range, which can ensure the shear strength of the composite layer **200**. When both the shear resistant layer **210** and the connection layer **220** are provided with multiple layers, the sum of the thicknesses of the multiple shear resistant layers **210** and the multiple connection layers **220** is the thickness of the composite layer **200**.

[0065] For example, the shear resistant layer **210** may be a PET layer. PET has a good shear resistance, wear and friction resistance, dimensional stability, and electrical insulation, thereby the performance of the composite layer **200** is improved.

[0066] For example, the connection layer **220** is a photo-cured layer or a temperature-cured layer. Specifically, the connection layer **220** is photo-cured glue or temperature-cured glue. When the connection layer **220** is the photo-cured glue, the connection layer **220** may use epoxy system cationic glue. Therefore, the connection layer **220** may be quickly cured under ultraviolet light

irradiation, and the cured connection layer **220** has a good chemical corrosion resistance, wear resistance, and heat resistance. When the connection layer **220** is the temperature-cured glue, the connection layer **220** may use epoxy resin. The connection layer **220** may form a dense structure and a fixed shape after heat curing under a specific temperature. In addition, after being cured, the connection layer **220** can also withstand a certain shear force, thereby the shear strength of the composite layer **200** is improved.

[0067] In an embodiment of the disclosure, the shear strength of the composite layer **200** is not less than 1.4 MPa. Specifically, the shear strength of the composite layer **200** may be in a range of 1.4-5.5 MPa. The shear strength of the composite layer **200** is within this range, which can ensure the ability of the composite layer **200** to resist the external shear force and reduce the cost of the composite layer **200**.

[0068] In an embodiment of the disclosure, the composite layer **200** may be covered on the surface of the case body **100** first. After the covering using the composite layer **200** is completed, a case cover **300** may be welded on the top portion of the case body **100**. Alternatively, the case cover **300** may be welded on the top portion of the case body **100** first, and then the composite layer **200** is covered on the surface of the case body **100**.

[0069] In an embodiment of the disclosure, as shown in FIG. 6 and FIG. 7, the composite layer **200** covers the entire bottom surface **120**. Since the bottom surface **120** of the case body **100** is subjected to a large shear force, after the composite layer **200** covers the entire bottom surface **120**, the composite layer **200** can protect the entire bottom surface **120**. In addition, the composite layer **200** covers part of the side surfaces **110**, and areas on the side surfaces **110** not covered with the composite layer **200** are covered with gel. The gel covering the side surfaces **110** may play the role of connection, two adjacent battery cores in the battery module may be connected through the gel, or the battery core and the side plate of the battery module may be connected through the gel.

[0070] It should be noted that the bonding force between the gel and the composite layer **200** is weak; in comparison, the bonding force between the gel and the side surface **110** of the case body **100** is strong, which can improve the reliability of the connection between two adjacent battery cores.

[0071] In an embodiment of the disclosure, the composite layer **200** on the side surfaces **110** and the bottom surface **120** is integrally formed. For example, the composite layer **200** is one film layer, and the film layer covers the side surfaces **110** and the bottom surface **120** simultaneously. After the composite layer **200** is integrally formed, the overall shear strength and insulation of the composite layer **200** can be improved.

[0072] In an embodiment of the disclosure, as shown in FIG. 1 to FIG. 3, the side surfaces **110** include first side surfaces **111** and second side surfaces **112**. The case body **100** has two first side surfaces **111** opposite to each other, and two second side surfaces **112** opposite to each other. The first side surfaces **111** and the second side surfaces **112** are intersected with each other, and the area of the first side surface **111** is larger than the area of the second side surface **112**. When the composite layer **200** covers at least part of the side surfaces **110**, both the first side surfaces **111** and the second side surfaces **112** are covered with the composite layer **200**. The first side surface **111** is a large surface of the battery core, and the second side surface **112** is a small surface of the battery core. The composite layer **200** can protect the first side surfaces **111** and the second side surfaces **112**. Specifically, the first side surface **111** and the second side surface **112** are disposed perpendicularly to each other, and at this time, the battery core is formed in a square shape. In addition, the battery core may also be formed in a column shape, and the side surfaces **110** of the battery core are columnar surfaces.

[0073] Specifically, as shown in FIG. 1 and FIG. 6, the composite layer **200** covering the first side surfaces **111** extends to the second side surfaces **112**, and covers part of the second side surfaces **112**. Areas on the second side surfaces **112** not covered with the composite layer **200** are window areas **400**, and the window areas **400** are covered with gel. The gel covering the second side

surfaces **112** may play the role of connection. When two adjacent battery cores in the battery module are connected, the window areas **400** of the two battery cores are opposite to each other and disposed closely to be tiled, so that the two adjacent battery cores are connected through the gel, which improves the reliability of the connection between the two adjacent battery cores.

[0074] For example, the area of the window areas **400** is 40%-80% of the area of the second side surface **112**. The ratio of the area of the window areas **400** is within this range, which can ensure the bonding area and bonding strength between the gel and the second side surface **112**, which improves the reliability of the connection between two adjacent battery cores, thereby the safety and the stability of the battery module and the battery pack are improved. Further, the ratio of the area of the window areas **400** is in a range of 50% to 70%. Within this range, the bonding area and bonding strength between the gel and the second side surface **112** can be ensured. At the same time, the coverage area of the composite layer **200** on the second side surface **112** can also be ensured.

[0075] For example, the spacing between the bottom end of the window areas **400** and the bottom surface **120** is not less than 5 mm. As shown in FIG. 6, the second side surface **112** located between the window areas **400** and the bottom surface **120** is covered with the composite layer **200**. The spacing between the bottom end of the window areas **400** and the bottom surface **120** is the height of the portion of the composite layer **200**. The spacing is within this range, which ensures the protection of the composite layer **200** to the bottom portion of the second side surface **112**.

[0076] Further, as shown in FIG. 6 and FIG. 8, the composite layer **200** has folding areas **500** on the second side surfaces **112**, and the composite layer **200** is folded in the folding areas **500**. It should be noted that when the composite layer **200** is a film layer, during the process of wrapping the surface of the case body **100**, the film layer forms excess film material in the corner area of the film layer. At this time, the excess film material may be folded. Through this disposition, the composite layer **200** is folded in the folding areas **500**, which can make the composite layer **200** on the second side surface **112** evenly disposed, and the shear strength of the composite layer **200** can also be improved.

[0077] Specifically, a maximum quantity of folding layers of the composite layer **200** in the folding areas **500** does not exceed 5 layers. The maximum quantity of folding layers does not exceed 5 layers, which can ensure the overall evenness of the composite layer **200** on the second side surface **112**.

[0078] As shown in FIG. 6, the composite layer **200** has two folding areas **500** on each second side surface **112**, and the two folding areas **500** do not overlap. At this time, the two folding areas **500** are maximum folding layer quantity areas **510**, and the maximum quantity of folding layers of the composite layer **200** in the maximum folding layer quantity area **510** is 3 layers. At this time, there is the window areas **400** on the second side surface **112**, and the film-wrapping structure on the battery core is a half-wrapped structure.

[0079] As shown in FIG. 8, the composite layer **200** has two folding areas **500** on each second side surface **112**, and the two folding areas **500** overlap. At this time, the overlapping area of the two folding areas **500** is the maximum folding layer quantity area **510**, and the maximum quantity of folding layers of the composite layer **200** in the maximum folding layer quantity area **510** is 5 layers. At this time, there is no window areas **400** on the second side surface **112**, and the film-wrapping structure on the battery core is an all-wrapped structure.

[0080] An embodiment of the disclosure further provides the case body **100**, as shown in FIG. 1 to FIG. 4. The case body **100** has the side surfaces **110** and the bottom surface **120**. In addition, the case body **100** further has the top surface **130**, and the side surfaces **110** are connected between the bottom surface **120** and the top surface **130**. The case body **100** is disposed with the electrolyte **600** disposed inside to form the main body of the battery core.

[0081] Further, at least one of at least part of the side surfaces **110** and at least part of the bottom surface **120** is covered with the composite layer **200**. The side surfaces **110** and the bottom surface **120** of the case body **100** are susceptible to external forces. After the composite layer **200** covers at



least part of the side surfaces **110** and at least part of the bottom surface **120**, the composite layer **200** can protect the side surfaces **110** and/or the bottom surface **120**. For example, when the bottom portion of the case body **100** is connected to the bottom plate of the battery box through gel connection, during the process of removing the case body **100** from the bottom plate, the bottom surface **120** of the case body **100** is subjected to the shear force. At this time, the composite layer **200** may be used to cover at least part of the bottom surface **120**, thereby the bottom surface **120** is protected. Alternatively, when the side surfaces **110** of two adjacent case bodies **100** are connected through the gel, during the process of disassembling the two adjacent case bodies **100**, the side surfaces **110** of the case body **100** are also subjected to the shear force. At this time, the composite layer **200** may be used to cover at least part of the side surfaces **110**, thereby the side surfaces **110** are protected. Alternatively, when both the side surfaces **110** and the bottom surface **120** of the case body **100** are subjected to the external shear force, the composite layer **200** may also cover at least part of the side surfaces **110** and at least part of the bottom surface **120** at the same time, thereby the side surfaces **110** and the bottom surface **120** are protected simultaneously.

[0082] In addition, when the composite layer **200** covers the side surfaces **110**, the operation may be only part of the side surfaces **110** is covered, or the entire side surfaces are covered; and when the composite layer **200** covers the bottom surface **120**, the operation may be only part of the bottom surface **120** is covered, or the entire bottom surface **120** is covered.

[0083] Specifically, the composite layer **200** includes the shear resistant layer **210** and the connection layer **220**. The shear resistant layer **210** is connected to the case body **100** through the connection layer **220**; at least one of the shear resistant layer **210** and the connection layer **220** is an insulation layer. For example, only one of the shear resistant layer **210** and the connection layer **220** may be an insulation layer, or both the shear resistant layer **210** and the connection layer **220** may be insulation layers. Therefore, after the composite layer **200** covers the surface of the case body **100**, the insulation between two adjacent case bodies **100** can be ensured.

[0084] Accordingly, the existence of the shear resistant layer **210** can ensure the shear strength of the composite layer **200** covering the surface of the case body **100**. Therefore, when being subjected to the external shear force, the composite layer **200** is not likely to rupture under the action of the external shear force, thereby the reliability of the case body **100** during use is improved.

[0085] A detailed description of the specific structure of the case body **100** according to an embodiment provided in the disclosure is as follows.

[0086] In a specific embodiment, as shown in FIG. 4, the shear resistant layer **210** and the connection layer **220** are each provided with one layer. Therefore, one shear resistant layer **210** is connected to one connection layer **220**, which can simplify the structure of the composite layer **200** and facilitate the processing and formation of the composite layer **200**.

[0087] Specifically, when the shear resistant layer **210** and the connection layer **220** are each provided with one layer, the thickness range of both the shear resistant layer **210** and the connection layer **220** is 40-60  $\mu\text{m}$ . The thickness of the shear resistant layer **210** is within this range, which can reduce the weight and cost of the shear resistant layer **210** while ensuring the shear strength of the shear resistant layer **210**; and the thickness of the connection layer **220** is within this range, which can reduce the weight and cost of the connection layer **220** while ensuring the connection strength of the connection layer **220**.

[0088] In another specific embodiment, as shown in FIG. 5, both the shear resistant layer **210** and the connection layer **220** are provided with multiple layers, and the multiple shear resistant layers **210** and the multiple connection layers **220** are alternately stacked and disposed sequentially. Therefore, the multiple shear resistant layers **210** and the multiple connection layers **220** cooperate with each other to further ensure the shear strength of the composite layer **200** and ensure the reliability of the case body **100** during use. Specifically, as shown in FIG. 5, the shear resistant layers **210** and the connection layers **220** are each provided with two layers, and the two shear

resistant layers **210** and the two connection layers **220** are alternately stacked and disposed sequentially.

[0089] Specifically, the thickness range of the composite layer **200** is 80 to 120  $\mu\text{m}$ . The thickness of the composite layer **200** is within this range, which can ensure the shear strength of the composite layer **200**. When both the shear resistant layers **210** and the connection layer **220** are provided with multiple layers, the sum of the thicknesses of the multiple shear resistant layers **210** and the multiple connection layers **220** is the thickness of the composite layer **200**.

[0090] For example, the shear resistant layer **210** may be a PET layer. PET has a good shear resistance, wear and friction resistance, dimensional stability, and electrical insulation, thereby the performance of the composite layer **200** is improved.

[0091] For example, the connection layer **220** is a photo-cured layer or a temperature-cured layer. Specifically, the connection layer **220** is photo-cured glue or temperature-cured glue. When the connection layer **220** is the photo-cured glue, the connection layer **220** may use epoxy system cationic glue. Therefore, the connection layer **220** may be quickly cured under ultraviolet light irradiation, and the cured connection layer **220** has a good chemical corrosion resistance, wear resistance, and heat resistance. When the connection layer **220** is the temperature-cured glue, the connection layer **220** may use epoxy resin. The connection layer **220** can form a dense structure and a fixed shape after heat curing under a specific temperature. In addition, after being cured, the connection layer **220** can also withstand a certain shear force, thereby the shear strength of the composite layer **200** is improved.

[0092] In an embodiment of the disclosure, the shear strength of the composite layer **200** is not less than 1.4 MPa. Specifically, the shear strength of the composite layer **200** may be in a range of 1.4-5.5 MPa. The shear strength of the composite layer **200** is within this range, which can ensure the ability of the composite layer **200** to resist the external shear force and reduce the cost of the composite layer **200**.

[0093] In an embodiment of the disclosure, the composite layer **200** may be covered on the surface of the case body **100** first. After the covering using the composite layer **200** is completed, the case cover **300** may be welded on the top portion of the case body **100**. Alternatively, the case cover **300** may be welded on the top portion of the case body **100** first, and then the composite layer **200** is covered on the surface of the case body **100**.

[0094] In an embodiment of the disclosure, as shown in FIG. 6 and FIG. 7, the composite layer **200** covers the entire bottom surface **120**. Since the bottom surface **120** of the case body **100** is subjected to a large shear force, after the composite layer **200** covers the entire bottom surface **120**, the composite layer **200** can protect the entire bottom surface **120**. In addition, the composite layer **200** covers part of the side surfaces **110**, and the areas on the side surfaces **110** not covered with the composite layer **200** are covered with gel. The gel covering the side surfaces **110** may play the role of connection, two adjacent case bodies **100** in the battery module may be connected through the gel, or the case body **100** and the side plate of the battery module may be connected through the gel.

[0095] It should be noted that the binding force between the gel and composite layer **200** is weak; in comparison, the binding force between the gel and the side surface **110** of the case body **100** is strong, which can improve the reliability of the connection between two adjacent case bodies **100**.

[0096] In the embodiment of the disclosure, the composite layer **200** on the side surface **110** and the bottom surface **120** is integrally disposed; for example, the composite layer **200** is a whole film layer that covers the side surface **110** and the bottom surface **120** at the same time. After the composite layer **200** is integrated and disposed, the overall shear strength and insulation of the composite layer **200** can be improved.

[0097] In an embodiment of the disclosure, as shown in FIG. 1 to FIG. 3, the side surfaces **110** include the first side surfaces **111** and the second side surfaces **112**. The case body **100** has two first side surfaces **111** opposite to each other, and two second side surfaces **112** opposite to each other.

The first side surfaces **111** and the second side surfaces **112** are intersected with each other, and the area of the first side surface **111** is larger than the area of the second side surface **112**. When the composite layer **200** covers at least part of the side surfaces **110**, both the first side surfaces **111** and the second side surfaces **112** are covered with the composite layer **200**. The first side surface **111** is a large surface of the case body **100**, and the second side surface **112** is a small surface of the case body **100**. The composite layer **200** can protect the first side surfaces **111** and the second side surfaces **112**. Specifically, the first side surface **111** and the second side surface **112** are disposed perpendicularly to each other, and at this time, the case body **100** is formed in a square shape. In addition, the case body **100** may also be formed in a column shape, and the side surfaces **110** of the case body **100** are columnar surfaces.

[0098] Specifically, as shown in FIG. 1 and FIG. 6, the composite layer **200** covering the first side surfaces **111** extends to the second side surfaces **112**, and covers part of the second side surfaces **112**. Areas on the second side surfaces **112** not covered with the composite layer **200** are the window areas **400**, and the window areas **400** are covered with gel. The gel covering the second side surfaces **112** may play the role of connection. When two adjacent case bodies **100** in the battery module are connected, the window areas **400** of the two case bodies **100** are opposite to each other and disposed closely to be tiled, so that the two adjacent case bodies **100** are connected through the gel, which improves the reliability of the connection between the two adjacent case bodies **100**.

[0099] For example, the area of the window areas **400** is 40%-80% of the area of the second side surface **112**. The ratio of the area of the window areas **400** is within this range, which can ensure the bonding area and bonding strength between the gel and the second side surface **112**, which improves the reliability of the connection between two adjacent case bodies **100**, thereby the safety and the stability of the battery module and the battery pack are improved. Further, the ratio of the area of the window areas **400** is in a range of 50% to 70%. Within this range, the bonding area and bonding strength between the gel and the second side surface **112** can be ensured. At the same time, the coverage area of the composite layer **200** on the second side surface **112** can also be ensured.

[0100] For example, the spacing between the bottom end of the window areas **400** and the bottom surface **120** is not less than 5 mm. As shown in FIG. 6, the second side surface **112** located between the window areas **400** and the bottom surface **120** is covered with a portion of the composite layer **200**. The spacing between the bottom end of the window areas **400** and the bottom surface **120** is the height of the portion of the composite layer **200**. The spacing is within this range, which ensures the protection of the composite layer **200** to the bottom portion of the second side surface **112**.

[0101] Further, as shown in FIG. 6 and FIG. 8, the composite layer **200** has the folding areas **500** on the second side surfaces **112**, and the composite layer **200** is folded in the folding areas **500**. It should be noted that when the composite layer **200** is a film layer, during the process of wrapping the surface of the case body **100**, the film layer forms excess film material in the corner area of the film layer. At this time, the excess film material may be folded. Through this disposition, the composite layer **200** is folded in the folding areas **500**, which can make the composite layer **200** on the second side surface **112** evenly disposed, and the shear strength of the composite layer **200** can also be improved.

[0102] Specifically, a maximum quantity of folding layers of the composite layer **200** in the folding areas **500** does not exceed 5 layers. The maximum quantity of folding layers does not exceed 5 layers, which can ensure the overall evenness of the composite layer **200** on the second side surface **112**.

[0103] As shown in FIG. 6, the composite layer **200** has two folding areas **500** on each second side surface **112**, and the two folding areas **500** do not overlap. At this time, the two folding areas **500** are maximum folding layer quantity areas **510**, and the maximum quantity of folding layers of the composite layer **200** in the maximum folding layer quantity area **510** is 3 layers. At this time, there

is the window areas **400** on the second side surface **112**, and the film-wrapping structure on the battery core is a half-wrapped structure.

[0104] As shown in FIG. **8**, the composite layer **200** has two folding areas **500** on each second side surface **112**, and the two folding areas **500** overlap. At this time, the overlapping area of the two folding areas **500** is the maximum folding layer quantity area **510**, and the maximum quantity of folding layers of the composite layer **200** in the maximum folding layer quantity area **510** is 5 layers. At this time, there is no window areas **400** on the second side surface **112**, and the film-wrapping structure on the battery core is an all-wrapped structure.

[0105] Based on the embodiments, the disclosure further provides a battery module, which includes a battery core in any of the embodiments. The battery cores are disposed in plural, and the plurality of battery cores are connected to form a battery core assembly. Specifically, the window areas **400** on the second side surface **112** is covered with gel. When two adjacent battery cores in the battery module are connected, the window areas **400** of the two battery cores are opposite to each other and disposed closely to be tiled, so that the two adjacent battery cores are connected through the gel, which improves the reliability of the connection between the two adjacent battery cores.

[0106] In addition, the disclosure further provides a battery pack, which includes a battery box and the battery module in the embodiments. The battery box has a containing cavity inside, and the battery module is disposed in the containing cavity. Since the composite layer **200** on the battery core can improve the ability of the battery core to resist the shear force, the working reliability of the battery core, the battery module, and the battery pack all can be improved.

[0107] In the description of the disclosure, it should be noted that the orientation descriptions such as “top portion” and “bottom portion” are relative to the structural diagrams of the battery cores in FIG. **2** and FIG. **3**, and should not be understood as limitations of the disclosure.

[0108] In the description of the disclosure, it should be noted that, unless otherwise expressly specified and limited, terms “installation”, “interconnection”, and “connection” should be understood in a broad sense. For example, the connection may be a fixed connection, or may be an indirect connection through an intermediary, or may be an internal connection between two elements or an interaction between two elements. For persons of ordinary skill in the art, the specific meanings of the terms in the disclosure may be understood according to specific circumstances.

[0109] Devices or elements mentioned in the disclosure or implicitly has to have a specific orientation, be constructed and operated in a specific orientation, and therefore are not to be construed as limitations of the disclosure. In the description of the disclosure, “plurality” means two or more, unless otherwise precisely and specifically stated.

[0110] The terms such as “first”, “second”, “third”, and “fourth” in the description and claims of the disclosure and the drawings are used to distinguish similar objects and are not necessarily used to describe a specific order or sequence. It is to be understood that the data so used are interchangeable under appropriate circumstances so that embodiments of the disclosure described herein, for example, may be practiced in sequences other than the sequences illustrated or described herein. Furthermore, the terms “include” and “have” and any variations thereof are intended to cover non-exclusive inclusion, for example, a process, method, system, product, or apparatus that includes a series of steps or units need not be limited to the steps or units that are expressly listed, but may include other steps or units inherent to the equipment that are not expressly listed or that are not specific to the process, method, product, or device.

[0111] Finally, it should be noted that: the above embodiments are only used to illustrate the technical solution of the disclosure, but not to limit the disclosure. Although the disclosure has been described in detail with reference to each of the embodiments, persons of ordinary skill in the art should understand that the persons may still modify the technical solutions recorded in each of the embodiments, or make equivalent substitutions for some or all of the technical features. However,

the modifications or substitutions do not make the essence of the corresponding technical solution deviate from the scope of the technical solution in embodiments of the disclosure.

## Claims

1. A battery core, comprising: a case body, wherein the case body has side surfaces and a bottom surface; a composite layer, wherein the composite layer comprises a shear resistant layer and a connection layer, the shear resistant layer is connected to the case body through the connection layer; at least one of the shear resistant layer and the connection layer is an insulation layer; and the composite layer covers at least one of at least part of the side surfaces and at least part of the bottom surface.
2. The battery core according to claim 1, wherein the shear resistant layer and the connection layer are each provided with one layer; or both the shear resistant layer and the connection layer are provided with a plurality of layers, and each of the plurality of layers of the shear resistant layer and each of the plurality of layers of the connection layer are alternately stacked and disposed sequentially.
3. The battery core according to claim 2, wherein the shear resistant layer is a PET layer; and/or, the connection layer is a photo-cured layer or a temperature-cured layer; and/or, when the shear resistant layer and the connection layer are each provided with one layer, a thickness range of the shear resistant layer and a thickness range of the connection layer are both 40-60  $\mu\text{m}$ .
4. The battery core according to claim 1, wherein a shear strength of the composite layer is not less than 1.4 MPa; and/or, a thickness range of the composite layer is 80-120  $\mu\text{m}$ .
5. The battery core according to claim 1, wherein the composite layer covers the bottom surface entirely; and/or, the composite layer covers part of the side surfaces, and areas on the side surfaces not covered with the composite layer are covered with gel.
6. The battery core according to claim 1, wherein the composite layer on the side surfaces and the bottom surface are integrally formed.
7. The battery core according to claim 1, wherein the side surfaces comprise first side surfaces and second side surfaces; and the case body has two first side surfaces opposite to each other, and has two second side surfaces opposite to each other; and the first side surfaces and the second side surfaces are intersected with each other, and an area of the first side surface is larger than an area of the second side surface; and when the composite layer covers at least part of the side surfaces, both the first side surfaces and the second side surfaces are covered with the composite layer.
8. The battery core according to claim 7, wherein the composite layer covering the first side surfaces extends to the second side surfaces, and covers part of the second side surfaces; and areas on the second side surfaces not covered with the composite layer are window areas, and the window areas are covered with gel; an area of the window areas is 40%-80% of the area of the second side surface; and/or, a spacing between a bottom end of the window areas and the bottom surface is not less than 5 mm.
9. The battery core according to claim 7, wherein the composite layer has folding areas on the second side surfaces, and the composite layer is folded in the folding areas.
10. The battery core according to claim 9, wherein a maximum quantity of folding layers of the composite layer in the folding areas is 5 or less than 5.
11. A case body, comprising side surfaces and a bottom surface, wherein at least one of at least part of the side surfaces and at least part of the bottom surface is covered with a composite layer; and the composite layer comprises a shear resistant layer and a connection layer, and the shear resistant layer is connected to the case body through the connection layer; and at least one of the shear resistant layer and the connection layer is an insulation layer.
12. A battery module, comprising battery cores according to claim 1, wherein the battery cores are disposed in plural, and the battery cores are connected to form a battery core assembly.

**13.** A battery pack, comprising a battery box and the battery module according to claim 12, wherein the battery box has a containing cavity inside, and the battery module is disposed in the containing cavity.

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