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BATTERY

Abstract

Conventional batteries have room for improvement in terms of improving structural efficiency. The battery of the present disclosure comprises a power generating portion and a current collecting portion, and the current collecting portion comprises an electrode mixture. In the battery, for example, a layer comprising the electrode mixture in the current collecting portion may be bent together with a current collector.

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Background/Summary

FIELD

[0001] The present application discloses a battery.

BACKGROUND

[0002] PTL 1 discloses a battery, wherein a power generating portion and a terminal portion are electrically connected via a current collecting portion (collector foil portion). PTL 2 discloses an electrode for layered batteries, comprising a layered electrode portion and an electrode terminal portion.

CITATION LIST

Patent Literature

[0003] [PTL 1] Japanese Unexamined Patent Publication No. 2019-160525 [0004] [PTL 2] Japanese Unexamined Patent Publication No. 2019-207746

SUMMARY

Technical Problem

[0005] Conventional batteries have room for improvement in terms of improving structural efficiency (volumetric efficiency).

Solution to Problem

[0006] The present application, as a means for achieving the above object, discloses the following plurality of aspects.

<Aspect 1>

[0007] A battery, comprising a power generating portion and a current collecting portion, wherein [0008] the current collecting portion comprises an electrode mixture.

<Aspect 2>

[0009] The battery according to Aspect 1, wherein a layer comprising the electrode mixture is bent together with a current collector in the current collecting portion.

<Aspect 3>

[0010] The battery according to Aspect 2, wherein the layer that is bent together with the current collector comprises a sagging portion.

<Aspect 4>

[0011] The battery according to Aspect 2 or 3, wherein an end portion of the layer that is bent together with the current collector is protected by a resin.

<Aspect 5>

[0012] The battery according to any of Aspects 1 to 4, wherein the power generating portion comprises a positive electrode active material layer, a solid electrolyte layer, and a negative electrode active material layer.

<Aspect 6>

[0013] The battery according to any of Aspects 1 to 5, wherein the current collecting portion comprises a positive electrode mixture.

Effects of Invention

[0014] The battery of the present disclosure has high structural efficiency.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0015] FIG. 1 schematically shows a cross-sectional configuration of the battery. Features other than the power generating portion and the current collecting portion are omitted.

[0016] FIG. 2 schematically shows a cross-sectional configuration of the electrode body that

constitutes the power generating portion and the current collecting portion.

DESCRIPTION OF EMBODIMENTS

[0017] Hereinafter, one embodiment of the battery of the present disclosure will be described.

However, the battery of the present disclosure is not limited to the following embodiment.

[0018] As shown in FIGS. 1 and 2, a battery **100** according to one embodiment comprises a power generating portion **10** and a current collecting portion **20**. The current collecting portion **20** comprises an electrode mixture.

1. Power Generating Portion

[0019] The power generating portion **10** comprises an electrode body **11** as a power generating element. The power generating portion **10** may be formed by layering a plurality of electrode bodies **11**.

[0020] As shown in FIG. 2, the electrode body **11** may comprise a first electrode current collector **11a**, a first electrode active material layer **11b** comprising a first electrode mixture, an electrolyte layer **11c**, a second electrode active material layer **11d** comprising a second electrode mixture, and a second electrode current collector **11e**. In this case, the first electrode may be a positive electrode, and the second electrode may be a negative electrode. Alternatively, the first electrode may be a negative electrode, and the second electrode may be a positive electrode. One or both of the first electrode current collector **11a** and the second electrode current collector **11e** can protrude from a side face **10z** of the power generating portion **10**. In FIG. 1, an embodiment in which a plurality of first electrode current collector **11a** protrude from a side face **10z** of the power generating portion **10** is exemplified. The current collectors protruding from a side face **10z** of the power generating portion **10** can be bent and bundled to each other to form a current collecting portion **20** described below.

[0021] The number of layers of electrode bodies **11** in the power generating portion **10** is not particularly limited. The power generating portion **10** may have a partially bipolar structure. In the power generating portion **10**, an insulating layer may be provided between one electrode body **11** and another electrode body **11** to insulate the layered surfaces of the electrode bodies **11** from each other. As shown in FIG. 1, the plurality of electrode bodies **11** can be electrically connected to each other through the current collecting portion **20**. For example, the plurality of electrode bodies **11** can be electrically connected to each other in parallel through the current collecting portion **20**.

[0022] The power generating portion **10** may have one end face **10x** on one end side in the layering direction of the layers described below, other end face **10y** on other end side in the layering direction, and a side face **10z** linking the one end face **10x** and the other end face **10y**. The side face **10z** can be formed by the outer edges of the layers constituting the power generating portion **10**. In the power generating portion **10**, the side face **10z** may have unevenness or gaps due to the layering area of each layer being different. The side face **10z** may have a surface along the layering direction of the layers in the power generating portion **10**. The current collecting portion **20** described below can be formed by current collectors **11a** protruding from the side face **10z** of the power generating portion **10**. The power generating portion **10** as a whole, for example, may be plate-like or rectangular parallelepiped-like.

[0023] As shown in FIG. 1, the power generating portion **10** may have a thickness **T** in the layering direction of the layers. The thickness **T**, for example, may be 5 mm or more and 300 mm or less, or 10 mm or more and 50 mm or less.

[0024] Hereinafter, the case where the first electrode in the electrode body **11** constituting the power generating portion **10** is a positive electrode and the second electrode is a negative electrode will be exemplified. In one embodiment, the power generating portion **10** may comprise a positive electrode active material layer **11b**, a solid electrolyte layer **11c**, and a negative electrode active material layer **11d**. Alternatively, in one embodiment, the power generating portion **10** may comprise a positive electrode active material layer **11b**, a liquid electrolyte layer **11c**, and a negative electrode active material layer **11d**. Particularly, when the power generating portion **10**

comprises a positive electrode active material layer **11b**, a solid electrolyte layer **11c**, and a negative electrode active material layer **11d**, structural efficiency is likely to be further improved. The shape of the layering surface of each layer constituting the power generating portion **10**, for example, may be rectangular.

1.1 Positive Electrode Active Material Layer

[0025] The positive electrode active material layer **11b** comprises a positive electrode active material, and can further optionally comprise an electrolyte, a conductive aid, and a binder. The content of each of the positive electrode active material, electrolyte, conductive aid, and binder in the positive electrode active material layer **11b** needs only to be appropriately determined according to target battery performance. For example, when the entirety (entire solid content) of the positive electrode active material layer **11b** is 100% by mass, the content of the positive electrode active material may be 40% by mass or greater, 50% by mass or greater, or 60% by mass or greater, and may be 100% by mass or less or 90% by mass or less. The shape of the positive electrode active material layer **11b** is not particularly limited, and for example, may be a sheet-like positive electrode active material layer **11b** having a substantially flat surface. The thickness of the positive electrode active material layer **11b** is not particularly limited, and for example, may be 0.1 μm or more or 1 μm or more, and may be 2 mm or less or 1 mm or less.

[0026] For the positive electrode active material, any publicly known positive electrode active material for batteries can be adopted. When lithium ions are adopted as carrier ions, the positive electrode active material, for example, may be a Li-containing oxide. Specifically, the positive electrode active material may be a Li-containing oxide comprising at least one element M, Li, and O. The element M, for example, may be at least one selected from Mn, Ni, Co, Al, Mg, Ca, Sc, V, Cr, Cu, Zn, Ga, Ge, Y, Zr, Sn, Sb, W, Pb, Bi, Fe, and Ti, or may be at least one selected from the group consisting of Mn, Ni, Co, Al, Fe, and Ti. More specifically, the Li-containing oxide as an additional positive electrode active material may be at least one selected from lithium cobaltate, lithium nickelate, lithium manganate, lithium nickel-cobalt oxide, lithium nickel-manganese oxide, lithium cobalt-manganese oxide, lithium nickel-cobalt-manganese oxide

($\text{Li}_{1-x}\text{Ni}_x\text{Co}_y\text{Mn}_z\text{O}_{2+\delta}$ (for example, $0 < x < 1$, $0 < y < 1$, $0 < z < 1$, and $x + y + z = 1$)), spinel-based lithium compounds (such as heteroelement-substituted Li—Mn spinels having a composition represented by $\text{Li}_{1-x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$ (where M is one or more selected from Al, Mg, Co, Fe, Ni, and Zn)), lithium nickel-cobalt-aluminum oxide (for example, $\text{Li}_{1-x}\text{Ni}_p\text{Co}_q\text{Al}_r\text{O}_{2+\delta}$ (for example, $p + q + r = 1$)), lithium titanate, and lithium metal phosphates (such as LiMPO_4 , where M is one or more selected from Fe, Mn, Co, and Ni). The positive electrode active material may be of one type used alone, or may be of two or more types used in combination. The shape of the positive electrode active material needs only to be any general shape of positive electrode active materials for batteries. The positive electrode active material, for example, may be particulate. The positive electrode active material may be primary particles, or may be secondary particles of a plurality of agglomerated primary particles. The average particle size D50 of the positive electrode active material, for example, may be 1 nm or more, 5 nm or more, or 10 nm or more, and may be 500 μm or less, 100 μm or less, 50 μm or less, or 30 μm or less. Note that the average particle size D50 referred to in the present application is the 50% cumulative particle size (median diameter) in a volume-based particle size distribution determined by a laser diffraction/scattering method. On the surface of the positive electrode active material, a protective layer having ion-conducting properties may be formed. The protective layer having ion-conducting properties can comprise various ion-conducting compounds. The ion-conducting compound, for example, is at least one selected from ion-conducting oxides and ion-conducting halides.

[0027] The electrolyte that can be contained in the positive electrode active material layer **11b** may be a solid electrolyte, may be a liquid electrolyte, or may be a combination thereof. Particularly, when the positive electrode active material layer **11b** comprises a solid electrolyte, structural

efficiency is likely to be improved.

[0028] For the solid electrolyte that can be contained in the positive electrode active material layer **11b**, any publicly known solid electrolyte having carrier ion-conducting properties can be adopted. The solid electrolyte may be an inorganic solid electrolyte or a polymer electrolyte. Particularly, an inorganic solid electrolyte has excellent ion-conducting properties and thermal resistance. Examples of the inorganic solid electrolyte include oxide solid electrolytes, sulfide solid electrolytes, and inorganic solid electrolytes having ion-binding properties. Among inorganic solid electrolytes, sulfide solid electrolytes, and further thereamong, sulfide solid electrolytes comprising at least Li, S, and P as constituent elements have high performance. Alternatively, among inorganic solid electrolytes, solid electrolytes having ion-binding properties, and further thereamong, solid electrolytes comprising at least Li, Y, and a halogen (at least one of Cl, Br, I, and F) as constituent elements have high performance. The solid electrolyte may be amorphous, or may be crystalline. The solid electrolyte may be particulate. The average particle size D50 of the solid electrolyte, for example, may be 10 nm or more and 10 μ m or less.

[0029] The liquid electrolyte (electrolyte solution) that can be contained in the positive electrode active material layer **11b** is a liquid comprising carrier ions. The carrier ions, for example, may be lithium ions. The electrolyte solution may be a water-based electrolyte solution or a non-water-based electrolyte solution. The composition of the electrolyte solution is publicly known. The electrolyte solution may be a lithium salt dissolved in water or a non-water-based solvent. Examples of the non-water-based solvent include various carbonate-based solvents. Examples of the lithium salt include lithium amide and LiPF₆.

[0030] Examples of the conductive aid that can be contained in the positive electrode active material layer **11b** include carbon materials such as vapor-grown carbon fiber (VGCF), acetylene black (AB), ketjen black (KB), carbon nanotube (CNT), and carbon nanofiber (CNF); and metal materials such as nickel, titanium, aluminum and stainless steel. The conductive aid, for example, may be particulate or fibrous, and the size thereof is not particularly limited. The conductive aid may be of one type used alone, or may be of two or more types used in combination.

[0031] Examples of the binder that can be contained in the positive electrode active material layer **11b** include butadiene rubber (BR)-based binders, butylene rubber (IIR)-based binders, acrylate-butadiene rubber (ABR)-based binders, styrene-butadiene rubber (SBR)-based binders, polyvinylidene fluoride (PVdF)-based binders, polytetrafluoroethylene (PTFE)-based binders, and polyimide (PI)-based binders. The binder may be of one type used alone, or may be of two or more types used in combination.

1.2 Electrolyte Layer

[0032] The electrolyte layer **11c** is arranged between the positive electrode active material layer **11b** and the negative electrode active material layer **11d**. The electrolyte layer **11c** comprises at least an electrolyte, and may further optionally comprise a binder. The contents of the electrolyte and the binder in the electrolyte layer **11c** are not particularly limited. Alternatively, the electrolyte layer **11c** may comprise a separator for retaining an electrolyte solution and preventing contact between the positive electrode active material layer **11b** and the negative electrode active material layer **11d**. The thickness of the electrolyte layer **11c** is not particularly limited, and for example, may be 0.1 μ m or more or 1 μ m or more, and may be 2 mm or less or 1 mm or less.

[0033] The electrolyte contained in the electrolyte layer **11c** needs only to be appropriately selected from among those (solid electrolytes and/or liquid electrolytes) exemplified as an electrolyte that can be contained in the positive electrode active material layer **11b** described above. In addition, the binder that can be contained in the electrolyte layer **11c** needs only to be appropriately selected from among those exemplified as a binder that can be contained in the positive electrode active material layer described above. The electrolyte and the binder may each be of one type used alone, or may be of two or more types used in combination. The separator needs only to be a commonly used separator in batteries, and examples include those made of resins such as polyethylene (PE),

polypropylene (PP), polyester, and polyamide. The separator may be of a single-layer structure, or may be of a multilayer structure. Examples of separators having a multilayer structure can include separators of a PE/PP two-layer structure and separators of a PP/PE/PP or PE/PP/PE three-layer structure. The separator may consist of a nonwoven fabric such as cellulose fabric, resin nonwoven fabric, or glass-fiber nonwoven fabric.

1.3 Negative Electrode Active Material Layer

[0034] The negative electrode active material layer **11d** comprises a negative electrode active material, and can further optionally comprise an electrolyte, a conductive aid, and a binder. The content of each of the negative electrode active material, electrolyte, conductive aid, and binder in the negative electrode active material layer **11d** needs only to be appropriately determined according to target battery performance. For example, when the entirety (entire solid content) of the negative electrode active material layer **11d** is 100% by mass, the content of the negative electrode active material may be 40% by mass or greater, 50% by mass or greater, or 60% by mass or greater, and may be 100% by mass or less or 90% by mass or less. The shape of the negative electrode active material layer **11d** is not particularly limited, and for example, may be a sheet-like negative electrode active material layer **11d** having a substantially flat surface. The thickness of the negative electrode active material layer **11d** is not particularly limited, and for example, may be 0.1 μm or more or 1 μm or more, and may be 2 mm or less or 1 mm or less.

[0035] For the negative electrode active material, any publicly known negative electrode active material for batteries can be adopted. Of publicly known active materials, various materials having a low electric potential (charge and discharge potential) for storing and releasing carrier ions compared to the above positive electrode active material can be adopted. When lithium ions are adopted as carrier ions, as the negative electrode active material, for example, silicon-based active materials such as Si, Si alloys, and silicon oxides; carbon-based active materials such as graphite and hard carbon; various oxide-based active materials such as lithium titanate; and metallic lithium and lithium alloys can be adopted. The negative electrode active material may be of one type used alone, or may be of two or more types used in combination. The shape of the negative electrode active material needs only to be any general shape of negative electrode active materials for batteries. For example, the negative electrode active material may be particulate. The negative electrode active material particles may be primary particles, or may be secondary particles of a plurality of agglomerated primary particles. The average particle size D50 of the negative electrode active material particles, for example, may be 1 nm or more, 5 nm or more, or 10 nm or more, and may be 500 μm or less, 100 μm or less, 50 μm or less, or 30 μm or less. Alternatively, the negative electrode active material may be sheet-like (foil-like or membranous), such as a lithium foil. Specifically, the negative electrode active material layer **11d** may consist of a sheet of negative electrode active material.

[0036] Examples of the electrolyte that can be contained in the negative electrode active material layer **11d** include the solid electrolytes and electrolyte solutions described above and combinations thereof. The conductive aid that can be contained in the negative electrode active material layer **11d**, for example, needs only to be appropriately selected from among those exemplified as a conductive aid that can be contained in the positive electrode active material layer described above. The binder that can be contained in the negative electrode active material layer **11d**, for example, needs only to be appropriately selected from among those exemplified as a binder that can be contained in the positive electrode active material layer described above. The electrolyte, conductive aid, and binder may each be of one type used alone, or may be of two or more types used in combination.

1.4 Positive Electrode Current Collector

[0037] As shown in FIGS. **1** and **2**, the battery **100** can comprise a positive electrode current collector **11a** in contact with the positive electrode active material layer **11b**. A portion of the positive electrode current collector **11a** can protrude from the power generating portion **10** to form

a current collecting portion **20**. For the positive electrode current collector **11a**, any general positive electrode current collector for batteries can be adopted. The positive electrode current collector **11a** may have at least one shape selected from foil-like, plate-like, mesh-like, punched metal-like shapes and a foam. The positive electrode current collector **11a** may be formed of a metal foil or a metal mesh. Particularly, a metal foil has excellent handleability. The positive electrode current collector **11a** may consist of a plurality of foils. Metals constituting the positive electrode current collector **11a** include at least one selected from Cu, Ni, Cr, Au, Pt, Ag, Al, Fe, Ti, Zn, Co, V, Mg, Pb, Ge, In, Sn, Zr, and stainless steel. Particularly, from the viewpoint of ensuring oxidation resistance, the positive electrode current collector **11a** may comprise Al. The positive electrode current collector **11a** may comprise, on the surface thereof, some coating layer for the purpose of adjusting resistance. For example, the positive electrode current collector **11a** may have a carbon coating layer. The positive electrode current collector **11a** may be a metal foil or substrate plated or vapor-deposited with a metal described above. When the positive electrode current collector **11a** consists of a plurality of metal foils, there may be some layer between the plurality of metal foils. The thickness of the positive electrode current collector **11a** is not particularly limited, and for example, may be 0.1 μm or more or 1 μm or more, and may be 1 mm or less or 100 μm or less.

1.5 Negative Electrode Current Collector

[0038] As shown in FIGS. **1** and **2**, the battery **100** can comprise a negative electrode current collector **11** in contact with the negative electrode active material layer **11d**. A portion of the negative electrode current collector **11** can protrude from the power generating portion **10** to form a current collecting portion separate from the above current collecting portion **20**. For the negative electrode current collector **11**, any general negative electrode current collector for batteries can be adopted. The negative electrode current collector **11e** may be foil-like, plate-like, mesh-like, punched metal-like, or a foam. The negative electrode current collector **11e** may be a metal foil or a metal mesh, and alternatively, may be a carbon sheet. Particularly, a metal foil has excellent handleability. The negative electrode current collector **11** may be formed of a plurality of foils or sheets. Metals constituting the negative electrode current collector **11** include at least one selected from Cu, Ni, Cr, Au, Pt, Ag, Al, Fe, Ti, Zn, Co, V, Mg, Pb, Ge, In, Sn, Zr, and stainless steel. Particularly, from the viewpoint of ensuring reduction resistance and the viewpoint of making alloying with lithium difficult, the negative electrode current collector **11** may comprise at least one metal selected from Cu, Ni, and stainless steel. The negative electrode current collector **11e** may comprise, on the surface thereof, some coating layer for the purpose of adjusting resistance. For example, the negative electrode current collector **11e** may have a carbon coating layer. The negative electrode current collector **11e** may be an aluminum foil having a carbon coating layer. The negative electrode current collector **11e** may be a metal foil or substrate plated or vapor-deposited with a metal described above. When the negative electrode current collector **11e** consists of a plurality of metal foils, there may be some layer between the plurality of metal foils. The thickness of the negative electrode current collector **11e** is not particularly limited, and for example, may be 0.1 μm or more or 1 μm or more, and may be 1 mm or less or 100 μm or less.

2. Current Collecting Portion

[0039] In the current collecting portion **20**, a plurality of current collectors **11a** protruding from the power generating portion **10** are electrically connected. For example, protrusions of the plurality of current collectors **11a** are bent and bundled to each other, whereby the current collecting portion **20** can be formed.

[0040] In the prior art, in order to ensure capacity and insulate, an electrolyte layer is arranged on top of a sagging portion of the first electrode active material layer, and further thereon and inward from the sagging portion of the first electrode active material layer is formed a sagging portion of the second electrode active material layer. Additionally, in the prior art, in order to prevent the electrode active material layer from slipping off, the current collector (tab) is bent outward from the sagging portion to form the current collecting portion. As a result, structural efficiencies of the

current collecting portion and around the sagging portions are worsened.

[0041] In the battery **100** according to the present embodiment, the current collecting portion **20** comprises an electrode mixture. “Electrode mixture” refers to a mixture constituting an electrode body **11**, and for example, is at least one of a positive electrode mixture constituting the positive electrode active material layer **11b** described above, a solid electrolyte mixture constituting the solid electrolyte layer when the electrolyte layer **11c** is a solid electrolyte layer, and a negative electrode mixture constituting the negative electrode active material layer **11d**. In one embodiment, the current collecting portion **20** may comprise a positive electrode mixture. In one embodiment, the current collecting portion **20** may comprise a negative electrode mixture. When the current collecting portion **20** comprises an electrode mixture, structural efficiency of the current collecting portion **20** can be improved, compared to when the current collecting portion **20** does not comprise an electrode mixture.

[0042] As shown in region X in FIGS. **1** and **2**, in the battery **100**, end portions of the positive electrode active material layer **11b**, electrolyte layer **11c**, and/or negative electrode active material layer **11d** extend into the current collecting portion **20**, and the positive electrode active material layer **11b**, electrolyte layer **11c**, and/or negative electrode active material layer **11d** extend to the bent portions of the current collectors **11a** in the current collecting portion **20**. In other words, in the battery **100**, the layers comprising the electrode mixture (positive electrode active material layer **11b** and/or negative electrode active material layer **11d**) in the current collecting portion **20** may be bent together with the current collectors **11a**.

[0043] In the battery **100**, the layers (positive electrode active material layer **11b**, electrolyte layer **11c**, and/or negative electrode active material layer **11d**) that are bent together with the current collectors **11a** may comprise a sagging portion. In FIG. **2**, an embodiment in which the positive electrode active material layer **11b** and the electrolyte layer **11c** have sagging portions **11bx** and **11cx**, respectively, is exemplified. However, the embodiment of the sagging portion is not limited thereto. “Sagging portion” refers to a sloped portion formed at an end portion of a layer when forming the layer by an application method (refer to, for example, Japanese Unexamined Patent Publication (Kokai) No. 2015-220216 and Japanese Unexamined Patent Publication (Kokai) No. 2014-096302). A sagging portion of the layer is generally thinner than portions other than the sagging portion of the layer. Therefore, the sagging portion of the layer is more easily bent than portions other than the sagging portion of the layer.

[0044] As shown in FIG. **2**, in the battery **100**, end portions of the layers (positive electrode active material layer **11b**, electrolyte layer **11c**, and/or negative electrode active material layer **11d**) that are bent together with the current collectors **11a** may be protected by a resin **11f**. Consequently, the end portions of the layers are less likely to peel or slip off even when the layers are bent together with the current collectors **11a**. The type of the resin **11f** is not particularly limited, and various curing resins can be adopted. The resin **11f** may be formed at the same time as the layers **11b** to **11d**, may be formed before the layers **11b** to **11d**, or may be formed after the layers **11b** to **11d**.

[0045] As shown in FIG. **1**, the current collecting portion **20** may comprise an electrode mixture within a range from a side face **10z** of the power generating portion **10** to a length L.sub.1. The current collecting portion **20** may have a length L.sub.2 from the side face **10z** of the power generating portion **10** to the tip (the portion most distant from the side face **10z** of the power generating portion **10** before connecting to a terminal) of the current collecting portion **20**. The length L.sub.1, for example, may be 1.0 mm or more and 10.0 mm or less. The length L.sub.2, for example, may be 1.1 mm or more and 100 mm or less. The ratio L.sub.1/L.sub.2 between the length L.sub.1 and the length L.sub.2, for example, may be 0.1 or greater and less than 1. When the dimensions of the current collecting portion **20** are within these ranges, structural efficiency of the battery **100** is likely to be further improved.

3. Additional Features

[0046] The battery **100**, in addition to the above features, may comprise any general feature of a

battery, for example, terminals or an outer packaging. Specifically, for the battery **100**, the above current collecting portion **20** may be connected to terminals, and the above features may be housed inside an outer packaging. Any publicly known terminal can be adopted as terminals of the battery. Any publicly known outer packaging can be adopted as the outer packaging of the battery. In addition, a plurality of batteries **100** may be optionally connected electrically and optionally stacked to form a battery pack. In this case, the battery pack may be housed inside a publicly known battery case. Examples of shapes of the battery **100** can include those of coin-type and laminate-type. The battery **100** may be a secondary battery. The battery **100** may be an all-solid battery.

4. Manufacturing Method of Battery

[0047] The battery **100** can be manufactured, for example, as follows.

[0048] (1) A positive electrode mixture constituting a positive electrode active material layer is dispersed in a solvent to obtain a positive electrode layer slurry. The solvent used in this case is not particularly limited, and water and various organic solvents can be used. The positive electrode layer slurry is applied onto a surface of a positive electrode current collector using a doctor blade, followed by drying, whereby a positive electrode active material layer is formed on the surface of the positive electrode current collector to obtain a positive electrode.

[0049] (2) A negative electrode mixture constituting a negative electrode active material layer is dispersed in a solvent to obtain a negative electrode layer slurry. The solvent used in this case is not particularly limited, and water and various organic solvents can be used. The negative electrode layer slurry is applied onto a surface of a negative electrode current collector using a doctor blade, followed by drying, whereby a negative electrode active material layer is formed on the surface of the negative electrode current collector to obtain a negative electrode.

[0050] (3) Layers are layered so that an electrolyte layer (solid electrolyte layer or separator) is sandwiched by the negative electrode and the positive electrode to obtain an electrode body comprising, in the order of, a negative electrode current collector, a negative electrode active material layer, an electrolyte layer, a positive electrode active material layer, and a positive electrode current collector.

[0051] (4) A plurality of electrode bodies are layered to obtain a power generating portion. In this case, a plurality of current collectors are set to protrude from a side face of the power generating portion.

[0052] (5) The current collectors protruding from the power generating portion are each bent together with the electrode mixture, and the plurality of current collectors are bundled to each other to form a current collecting portion.

[0053] (6) Additional members such as terminals are attached to the current collecting portion as needed. The power generating portion and the current collecting portion are housed in a battery case. In the case of an electrolyte solution battery, the battery case is filled therein with an electrolyte solution, each portion is immersed in the electrolyte solution, and the battery case is sealed, thereby obtaining a battery. Note that in the case of an electrolyte solution battery, prior to housing each portion in the battery case, the electrolyte solution may be contained in the negative electrode active material layer, the separator, and the positive electrode active material layer.

5. Application

[0054] The battery **100** has a wide range of applications. For example, the battery **100** can be suitably used in at least one type of vehicle selected from hybrid vehicle (HEV), plug-in hybrid vehicle (PHEV), and electric vehicle (BEV). Specifically, the technique of the present disclosure also has an aspect as a vehicle comprising the above battery **100** of the present disclosure.

REFERENCE SIGNS LIST

[0055] **100** battery [0056] **10** power generating portion [0057] **10x** one end face in layering direction [0058] **10y** other end face in layering direction [0059] **10z** side face [0060] **11** electrode body [0061] **11a** first electrode current collector [0062] **11b** first electrode active material layer

[0063] **11c** electrolyte layer [0064] **11d** second electrode active material layer [0065] **11e** second electrode current collector [0066] **11f** resin [0067] **20** current collecting portion

Claims

1. A battery, comprising a power generating portion and a current collecting portion, wherein the current collecting portion comprises an electrode mixture.
 2. The battery according to claim 1, wherein a layer comprising the electrode mixture is bent together with a current collector in the current collecting portion.
 3. The battery according to claim 2, wherein the layer that is bent together with the current collector comprises a sagging portion.
 4. The battery according to claim 2, wherein an end portion of the layer that is bent together with the current collector is protected by a resin.
 5. The battery according to claim 1, wherein the power generating portion comprises a positive electrode active material layer, a solid electrolyte layer, and a negative electrode active material layer.
 6. The battery according to claim 1, wherein the current collecting portion comprises a positive electrode mixture.
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