

US Patent & Trademark Office

Patent Public Search | Text View

United States Patent Application Publication

20250266564

Kind Code

A1

Publication Date

August 21, 2025

Inventor(s)

Choi; Hongjun et al.

Battery Cell and Battery Module Including the Same

Abstract

A battery cell according to an embodiment of the present invention includes a battery case including an electrode assembly mounted in a storage portion and a sealing portion having a structure in which an outer periphery thereof is sealed; and an electrode lead electrically connected to an electrode tab included in the electrode assembly and protruding in an outer direction of the battery case via the sealing portion. The sealing portion includes a gas discharge portion, a part of the sealing portion in which the gas discharge portion is not located is formed in a first sealing pattern, the gas discharge portion is formed in a second sealing pattern, and the first sealing pattern and the second sealing pattern are different from each other.

Inventors:	Choi; Hongjun (Daejeon, KR), Kim; Dongyeon (Daejeon, KR), Kong; Jinhak (Daejeon, KR)
Applicant:	LG Energy Solution, Ltd. (Seoul, KR)
Family ID:	1000008617749
Assignee:	LG Energy Solution, Ltd. (Seoul, KR)
Appl. No.:	18/685818
Filed (or PCT Filed):	October 11, 2022
PCT No.:	PCT/KR2022/015261

Foreign Application Priority Data

KR	10-2021-0136429	Oct. 14, 2021
KR	10-2022-0127087	Oct. 05, 2022

Publication Classification

Int. Cl.: H01M50/342 (20210101); H01M50/105 (20210101); H01M50/178 (20210101)

U.S. Cl.:

CPC H01M50/3425 (20210101); H01M50/105 (20210101); H01M50/178 (20210101); H01M2200/20 (20130101)

Background/Summary

TECHNICAL FIELD

Cross-Reference to Related Application

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2021-0136429 filed in the Korean Intellectual Property Office on Oct. 14, 2021, and Korean Patent Application No. 10-2022-0127087 filed in the Korean Intellectual Property Office on Oct. 5, 2022, the entire contents of which are incorporated herein by reference.

[0002] The present invention relates to a battery cell and a battery module including the battery cell, and more particularly, to a battery cell including a gas discharge portion to which a sealing pattern vulnerable to a sealing strength is applied, and a battery module including the battery cell.

BACKGROUND ART

[0003] As technology development and demand for mobile devices increase, demand for secondary batteries as an energy source has been rapidly increasing. In particular, secondary batteries are of great interest as energy sources for power devices such as electric bicycles, electric vehicles, and hybrid electric vehicles as well as mobile devices such as mobile phones, digital cameras, laptops, and wearable devices.

[0004] These secondary batteries are classified into cylindrical batteries and angular batteries in which an electrode assembly is embedded in a cylindrical or angular metal can, and pouch-type batteries in which an electrode assembly is embedded in a pouch-type case made of an aluminum laminate sheet according to the shape of a battery case. Here, electrode assemblies embedded in the battery case are power generating devices including a positive electrode, a negative electrode, and a separator structure interposed between the positive electrode and the negative electrode and capable of charging and discharging, and are classified into a jelly-roll type in which long sheet-type positive and negative electrodes coated with an active material are wound with a separator interposed therebetween, and a stack type in which a plurality of positive and negative electrodes are sequentially stacked with a separator interposed therebetween.

[0005] Among these, in particular, the usage of the pouch-type battery having a structure in which a stack or stack/folding type electrode assembly is embedded in a pouch-type battery case of an aluminum laminate sheet is gradually increasing owing to a low manufacturing cost, a small weight, and an easily deformable form.

[0006] However, as the energy density of battery cells has been increasing recently, there is a problem in that the amount of gas generated inside the battery cells also increases. In the case of the battery cell according to the related art, since there is no component through which gas generated inside the battery cell may be discharged, the battery cell may have a venting phenomenon due to the generation of gas. In particular, when the venting phenomenon occurs in the battery cell according to the related art, gas is discharged to a part vulnerable to sealing. Such a gas is a flammable gas and may heat adjacent cells, leading to ignition and explosion of adjacent cells.

[0007] Accordingly, there is an increasing need to develop a battery cell in which gas discharge is effectively performed when the venting phenomenon of the battery cell occurs and safety is

improved by inducing the gas discharge in a specific direction.

DISCLOSURE

Technical Problem

[0008] The present invention has been made in an effort to provide a battery cell including a gas discharge portion to which a sealing pattern vulnerable to a sealing strength is applied, and a battery module including the battery cell.

[0009] The problem to be solved by the present invention is not limited to the above-mentioned problem, and problems not mentioned will be clearly understood by those skilled in the art from the present specification and the accompanying drawings.

Technical Solution

[0010] An embodiment of the present invention provides a battery cell including a battery case including an electrode assembly mounted in a storage portion and a sealing portion having a structure in which an outer periphery thereof is sealed; and an electrode lead electrically connected to an electrode tab included in the electrode assembly and protruding in an outer direction of the battery case via the sealing portion, the sealing portion includes a gas discharge portion, a part of the sealing portion in which the gas discharge portion is not located is formed in a first sealing pattern, the gas discharge portion is formed in a second sealing pattern, and the first sealing pattern and the second sealing pattern are different from each other.

[0011] In the first sealing pattern, indentation and protrusion may be repeated in a longitudinal direction of the sealing portion, and, in the second sealing pattern, indentation and protrusion may be repeated in a width direction of the sealing portion.

[0012] The first sealing pattern and the second sealing pattern may be the same in an interval between an indented part and a protruding part.

[0013] An interval between an indented part and a protruding part of the second sealing pattern may be greater than an interval between an indented part and a protruding part of the first sealing pattern.

[0014] In the sealing portion, the gas discharge portion may be located on the outer periphery where the electrode lead is located.

[0015] In the outer periphery where the electrode lead is located, the gas discharge portion may be located in a part where the electrode lead is not located.

[0016] A sealing strength of the gas discharge portion may be smaller than a sealing strength of the sealing portion.

[0017] Another embodiment of the present invention provides a battery module including the above-described battery cell.

[0018] The battery cell may be stacked in a direction in which the gas discharge portion is adjacent to a bottom surface thereof.

[0019] In the battery cell, the gas discharge portion may be formed in a lower side of the electrode lead in the sealing portion.

Advantageous Effects

[0020] According to embodiments, the present invention provides a battery cell including a gas discharge portion to which a sealing pattern vulnerable to a sealing strength is applied, and a battery module including the battery cell, thereby effectively performing gas discharge when a venting phenomenon of the battery cell occurs and improving safety by inducing the gas discharge in a specific direction.

[0021] The effects of the present invention are not limited to the above-mentioned effects, and effects not mentioned will be clearly understood by those skilled in the art from the present specification and the accompanying drawings.

Description

DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 is a top view of a battery cell according to an embodiment of the present invention.

[0023] FIG. 2(A) is an enlarged view of one end of a battery cell of FIG. 1, and FIG. 2(B) is a cross-sectional view taken along cutting line A-A' or cutting line B-B' of FIG. 2(A).

[0024] FIG. 3(A) is a diagram showing a sealing pattern of a sealing portion of FIG. 2(A), and FIG. 3(B) is a diagram illustrating a sealing pattern of a gas discharge portion of FIG. 2(B).

[0025] FIG. 4 is an enlarged view of one end of a battery cell according to a comparative example.

[0026] FIG. 5 is a view showing a cross section taken along cutting line a-a' of FIG. 4.

MODE FOR INVENTION

[0027] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. However, the present invention may be embodied in several different forms, and is not limited to the embodiment described herein.

[0028] In order to clearly describe the present invention, parts irrelevant to the description are omitted, and the same reference numerals are denoted by the same or similar components throughout the specification.

[0029] In addition, since the size and thickness of each component shown in the drawings are arbitrarily shown for convenience of explanation, the present invention is not necessarily limited to those as shown. In the drawings, the thickness is shown enlarged to clearly express the various layers and regions. Also, in the drawings, for convenience of explanation, the thicknesses of some layers and regions are exaggerated.

[0030] In addition, throughout the specification, when a portion "includes" a certain component, it means that the portion may further include other components without excluding other components unless otherwise stated.

[0031] In addition, throughout the specification, when it is referred to as "on a plane", it means when the target portion is viewed from above, and when it is referred to as "on a cross-section", it means when a cross section of the target portion cut vertically is viewed from the side.

[0032] Hereinafter, a battery cell according to an embodiment of the present invention will be described.

[0033] FIG. 1 is a top view of a battery cell according to an embodiment of the present invention.

[0034] A battery cell **100** according to an embodiment of the present invention includes a battery case **200** including a sealing portion **250** of a structure in which an electrode assembly **110** is mounted in a storage portion **210** and an outer periphery is sealed, and an electrode lead **300** electrically connected to an electrode tab included in the electrode assembly **110** and protruding in an outer direction of the battery case **200** via the sealing portion **250**.

[0035] The battery case **200** may be a laminate sheet including a resin layer and a metal layer. More specifically, the battery case **200** may be made of the laminate sheet, and may include an outer resin layer forming the outermost shell, a barrier metal layer preventing penetration of a material, and an inner resin layer for sealing.

[0036] The electrode assembly **110** may have a structure of a jelly-roll type (winding type), a stack type (stack type), or a combination type (stack/folding type). More specifically, the electrode assembly **110** may include a positive electrode, a negative electrode, and a separator disposed therebetween.

[0037] The electrode lead **300** is electrically connected to an electrode tab (not shown) included in the electrode assembly **110** and protrudes in the outer direction of the battery case **200** via the sealing portion **250**. In addition, a lead film **400** is located at a part corresponding to the sealing portion **250** in at least one of upper and lower portions of the electrode lead **300**.

[0038] Accordingly, the lead film **400** together with the sealing portion **250** may prevent a short circuit from occurring in the electrode lead **300** during thermal fusion or press fusion, and improve

sealability between the sealing portion **250** and the electrode lead **300**.

[0039] Hereinafter, the sealing portion of the battery cell according to the embodiment of the present invention will be mainly described. However, one end of the battery cell will be mainly described here, but it is not necessarily limited thereto, and the same or similar description will be provided even in the case of the opposite end.

[0040] FIG. **2(A)** is an enlarged view of one end of a battery cell of FIG. **1**, and FIG. **2(B)** is a cross-sectional view taken along cutting line A-A' or cutting line B-B' of FIG. **2(B)**. FIG. **3(A)** is a diagram showing a sealing pattern of a sealing portion of FIG. **2(A)**, and FIG. **3(B)** is a diagram illustrating a sealing pattern of a gas discharge portion of FIG. **2(B)**.

[0041] Referring to FIGS. **1** and **2(A)**, in the battery cell **100** according to the present embodiment, the sealing portion **250** includes a gas discharge portion **250V**. That is, the gas discharge portion **250V** may be formed by replacing a part of the sealing portion **250**. In other words, the gas discharge portion **250V** may be inserted into a part of the sealing portion **250**.

[0042] More specifically, in the sealing portion **250**, the gas discharge portion **250V** may be located on an outer periphery where the electrode lead **300** is located. That is, the gas discharge portion **250V** may be located in the sealing portion **250** that seals the outer periphery where the electrode lead **300** is located.

[0043] Accordingly, in general, in the battery cell **100**, a part of the sealing portion **250** where the sealing strength is the weakest is the part where the electrode lead **300** is located, but in the case of the present invention, the gas discharge portion **250V** is formed in the outer periphery where the electrode lead **300** is located, thereby preventing gas discharged when the internal pressure of the battery cell **100** increases from being discharged to the part of the sealing portion **250** where the electrode lead **300** is located.

[0044] For example, in the outer periphery where the electrode lead **300** is located, the gas discharge portion **250V** may be located in a part where the electrode lead **300** is not located. That is, the gas discharge portion **250V** may be located in the sealing portion **250** that seals the part where the electrode lead **300** is not located in the outer periphery where the electrode lead **300** is located. However, the location of the gas discharge portion **250V** is not limited thereto, and the gas discharge portion **250V** may be formed at a location considering a direction to induce gas discharge.

[0045] Accordingly, as shown in FIG. **2(A)**, the gas discharged when the internal pressure of the battery cell **100** increases may not be discharged to the part of the sealing portion **250** where the electrode lead **300** is located, and may be discharged through the gas discharge portion **250V** located in a part other than the part where the electrode lead **300** is located. That is, the gas discharge portion **250V** may induce a discharge direction of the gas discharged when the internal pressure of the battery cell **100** increases in a specific direction.

[0046] In addition, in the battery cell **100** of the present embodiment, the sealing strength of the gas discharge portion **250V** may be smaller than the sealing strength of the sealing portion **250**.

Accordingly, when the internal pressure of the battery cell **100** increases, the gas discharge portion **250V** may be damaged prior to the sealing portion **250**. That is, when the internal pressure of the battery cell **100** increases, the gas discharge portion **250V** may be damaged prior to the sealing portion **250**, and thus, the gas discharge portion **250V** may serve as a passage through which gas is discharged.

[0047] Referring to FIG. **2(A)**, the part of the sealing portion **250** where the gas discharge portion **250V** is not located may be formed in a first sealing pattern, and the gas discharge portion **250V** may be formed in the first sealing pattern. Here, the first sealing pattern and the second sealing pattern may be different from each other. Here, the sealing pattern may mean a sealing region having a certain pattern.

[0048] More specifically, the first sealing pattern of the sealing portion **250** and the first sealing pattern of the gas discharge portion **250V** may be patterns in which indentation and protrusion are

repeated in different directions. For example, as shown in FIG. 2(B), the first sealing pattern may have repeated indentation and protrusion in a longitudinal direction (cutting line A-A') of the sealing portion **250**, and the second sealing pattern may have repeated indentation and protrusion in a width direction (cutting line B-B') of the sealing portion **250**.

[0049] Referring to FIGS. 2 and 3(A), the sealing portion **250** may have the first sealing pattern in which indentation and protrusion are repeated in the longitudinal direction of the sealing portion **250**. At this time, the first sealing pattern may receive a bending load in a traveling direction of the pattern of the sealing portion **250**, as shown in FIG. 3(A). That is, the first sealing pattern May receive the bending load in the width direction of a part where indentation or protrusion is repeatedly formed. Accordingly, the sealing portion **250** having the first sealing pattern partially receives the bending load, and thus, the sealing strength thereof may be relatively high.

[0050] Otherwise, referring to FIGS. 2 and 3(B), the gas discharge portion **250V** may have the second sealing pattern in which indentation and protrusion are formed in the width direction of the sealing portion **250**. At this time, the second sealing pattern may receive a bending load in a direction perpendicular to the traveling direction of the pattern of the sealing portion **250**, as shown in FIG. 3(B). That is, the second sealing pattern may receive the bending load in the longitudinal direction of the indented or protruding part. Accordingly, the gas discharge portion **250V** having the second sealing pattern wholly receives the bending load in the indented or protruding part, and thus, the sealing strength thereof may be relatively low.

[0051] Accordingly, in the battery cell **100** of the present embodiment, the sealing strength of the gas discharge portion **250V** having the second sealing pattern may be smaller than the sealing strength of the sealing portion **250** having the first sealing pattern. That is, when the internal pressure of the battery cell **100** increases, the gas discharge portion **250V** may be damaged prior to the sealing portion **250**, and the gas discharge portion **250V** may serve as a gas discharge passage while inducing the discharge direction of gas.

[0052] In addition, the present embodiment has advantages in that a manufacturing process is simple and a manufacturing cost is reduced in that there is no separate member for gas discharge and the gas discharge portion **250V** having different sealing strength is formed only by a difference in the sealing pattern.

[0053] For example, in the first sealing pattern and the second sealing pattern, indented or protruding parts may have the same interval.

[0054] Accordingly, the manufacturing process may be easier and process efficiency may increase in that the first sealing pattern and the second sealing pattern are the same in the pattern interval but are merely different in the pattern forming direction.

[0055] As another example, the interval between the indented and protruding parts of the second sealing pattern may be greater than the interval between the indented and protruding parts of the first sealing pattern.

[0056] Accordingly, the sealing strength of the gas discharge portion **250V** having the first sealing pattern may be reduced. That is, when the internal pressure of the battery cell **100** increases, the gas discharge portion **250V** may be damaged within a faster time so that gas may be effectively discharged to the outside of the battery cell **100**.

[0057] However, the intervals between the indented and protruding parts of the first sealing pattern and the second sealing pattern are not limited thereto, and the first sealing pattern and the second sealing pattern may be formed at various intervals in addition to the above.

[0058] A battery module according to another embodiment of the present invention may include the battery cell **100** described above. In particular, in the battery module, the battery cell **100** may be stacked in a direction in which a side surface thereof on which the electrode lead **300** is not located contacts a bottom surface thereof. Here, the battery cell **100** may be stacked in a direction in which the gas discharge portion **250V** is adjacent to the bottom surface thereof. For example, the battery cell **100** may be stacked in a direction in which the gas discharge portion **250V** is located in a lower

side of the electrode lead **300**. That is, in the battery cell **100**, the gas discharge portion **250V** may be formed in the lower side of the electrode lead **300** in the sealing portion **250**.

[0059] Accordingly, in the present embodiment, the gas discharge portion **250V** of the battery cell **100** may be located adjacent to the bottom surface thereof, so that when the internal pressure of the battery cell **100** increases, gas discharged through the gas discharge portion **250V** may be discharged toward the bottom surface thereof. That is, in the present embodiment, gas discharged from some of the battery cells **100** is discharged toward the bottom surface, thereby minimizing the damage applied to the adjacent battery cells **100** caused by a high-temperature inflammable gas discharged from the battery cells **100** and also effectively delaying heat propagation to the adjacent battery cells **100**.

[0060] Meanwhile, one or more battery modules according to the present embodiment may be packaged in a pack case and may form a battery pack.

[0061] The battery module described above and the battery pack including the battery module may be applied to various devices. These devices are applicable to transportation means such as electric bicycles, electric vehicles, hybrid vehicles, etc., but the present invention is not limited thereto and is applicable to various devices capable of using the battery module and the battery pack including the battery module, which also belongs to the scope of the present invention.

[0062] FIG. **4** is an enlarged view of one end of a battery cell according to a comparative example. FIG. **5** is a view showing a cross section taken along cutting line a-a' of FIG. **4**.

[0063] Referring to FIG. **4**, a battery cell **10** according to the comparative example may include an electrode assembly **11** mounted in a battery case **20** and a sealing portion **25** formed by sealing an outer periphery of the battery case. Here, the battery cell **10** includes an electrode lead **30** electrically connected to an electrode tab included in the electrode assembly **11** and protruding in an outer direction of the battery case **20** via the sealing portion **25**.

[0064] Here, unlike the battery cell **100** of FIGS. **1** to **3**, in the battery cell **10** according to the comparative example, a separate sealing pattern may not be formed on the sealing portion **25**. That is, in the battery cell **10** of the comparative example, all parts of the sealing portion **25** may be sealed in a flat shape.

[0065] Referring to FIG. **5**, in the case of the battery cell **10** according to the comparative example, it may be seen that since a separate sealing pattern is not formed on the sealing portion **25**, the sealing portion **25** receives a bending load in a thickness direction of the battery cell **10**, and is damaged. In particular, a part of the sealing portion **25** where the electrode lead **30** is located, which is a part most vulnerable to a sealing strength, may be damaged. In addition, the part where the electrode lead **30** is located may be located very close to an electrode lead of an adjacent battery cell, and a high-temperature flammable gas discharged through the damaged part of the sealing portion **25** may quickly heat the adjacent battery cell. Accordingly, there is a problem in that heat propagation between the battery cells **10** may more easily occur in the battery module including the battery cell **10** according to the comparative example.

[0066] In contrast, referring to FIGS. **1** to **3**, the battery cell **100** according to the present embodiment may more easily discharge gas through the gas discharge portion **250V**. In addition, gas may be discharged in a direction induced in advance by the gas discharge portion **250V**, and thus, heat propagation between adjacent battery cells **100** may be prevented, and safety may be further improved.

[0067] Although the embodiments of the present invention have been described in detail above, the scope of the present invention is not limited thereto, and various modifications and improvements made by those of ordinary skill in the field to which the present invention pertains also belong to the scope of the present invention.

DESCRIPTION OF REFERENCE NUMERALS

[0068] **10, 100**: battery cell [0069] **11, 110**: electrode assembly [0070] **20, 200**: battery case [0071]

210: storage portion [0072] **250:** sealing portion [0073] **250V:** gas discharge portion [0074] **30,**
300: electrode lead [0075] **400:** lead film

Claims

- 1.** A battery cell comprising: a battery case including an electrode assembly mounted in a storage portion and a sealing portion having a structure in which an outer periphery of the battery case is sealed; and an electrode lead electrically connected to an electrode tab included in the electrode assembly, the electrode lead protruding in an outer direction of the battery case via the sealing portion, wherein the sealing portion includes a gas discharge portion, a part of the sealing portion in which the gas discharge portion is not located is formed in a first sealing pattern, the gas discharge portion is formed in a second sealing pattern, and, the first sealing pattern and the second sealing pattern are different from each other.
 - 2.** The battery cell of claim 1, wherein: in the first sealing pattern, indentations and protrusions are repeated in a longitudinal direction of the sealing portion, and in the second sealing pattern, indentations and protrusions are repeated in a width direction of the sealing portion.
 - 3.** The battery cell of claim 2, wherein: the first sealing pattern and the second sealing pattern have equal intervals between respective indentations and protrusions.
 - 4.** The battery cell of claim 2, wherein: an interval between the indentations and the protrusions of the second sealing pattern is greater than an interval between the indentations and the protrusions of the first sealing pattern.
 - 5.** The battery cell of claim 1, wherein: in the sealing portion, the gas discharge portion is located on a side of the outer periphery where the electrode lead is located.
 - 6.** The battery cell of claim 5, wherein: in the outer periphery where the electrode lead is located, the gas discharge portion is located in a part where the electrode lead is not located.
 - 7.** The battery cell of claim 1, wherein: a sealing strength of the gas discharge portion is smaller than a sealing strength of the sealing portion.
 - 8.** A battery module comprising a plurality of the battery cells of claim 1.
 - 9.** The battery module of claim 8, wherein: the battery cells are stacked in a direction in which the gas discharge portion is adjacent to a bottom surface of the battery cell.
 - 10.** The battery module of claim 9, wherein: in the battery cell, the gas discharge portion is formed in a lower side of the electrode lead in the scaling portion.
-