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(54) **COMPARTMENTALIZED TRACTION BATTERY PACK AND COMPARTMENTALIZING METHOD**

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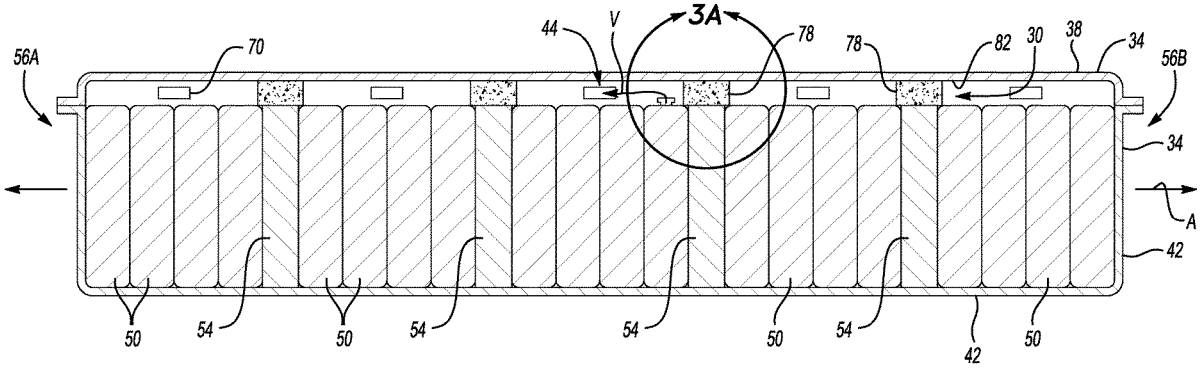
(57) **ABSTRACT**

A traction battery pack assembly includes an enclosure assembly that provides an interior area, at least one cell stack having a plurality of battery cell groups and a plurality of dividers disposed along a cell stack axis, and a plurality of compressible barriers attached to the enclosure assembly. Each compressible barrier within the plurality of compressible barriers is configured to contact a respective divider within the plurality of dividers.



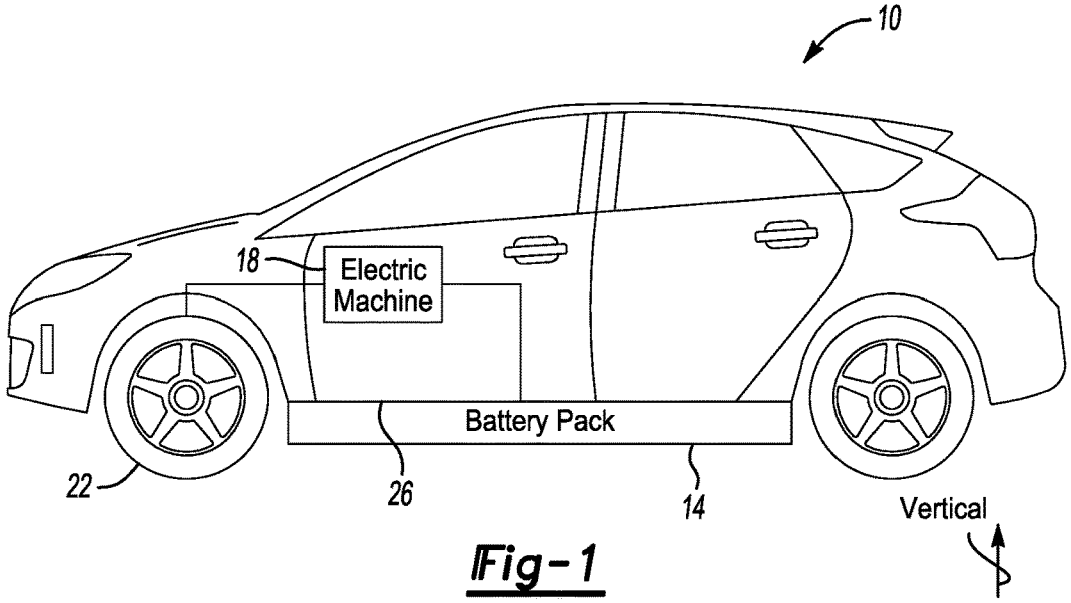
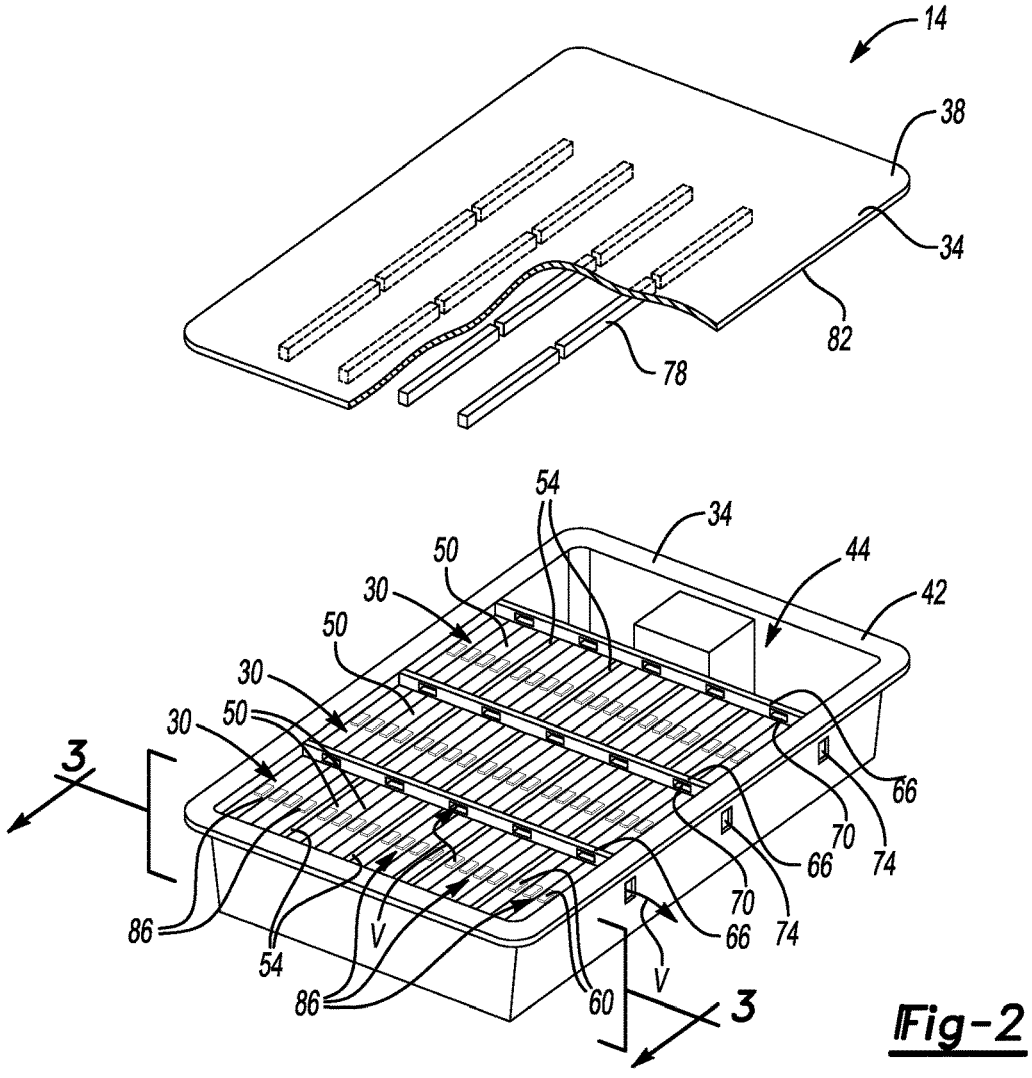

10
18
Electric Machine
Battery Pack
22
26
14
Vertical

Fig-1


14
38
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82
78
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34
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44
42
30
50
30
50
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V
86
60
V
3

Fig-2

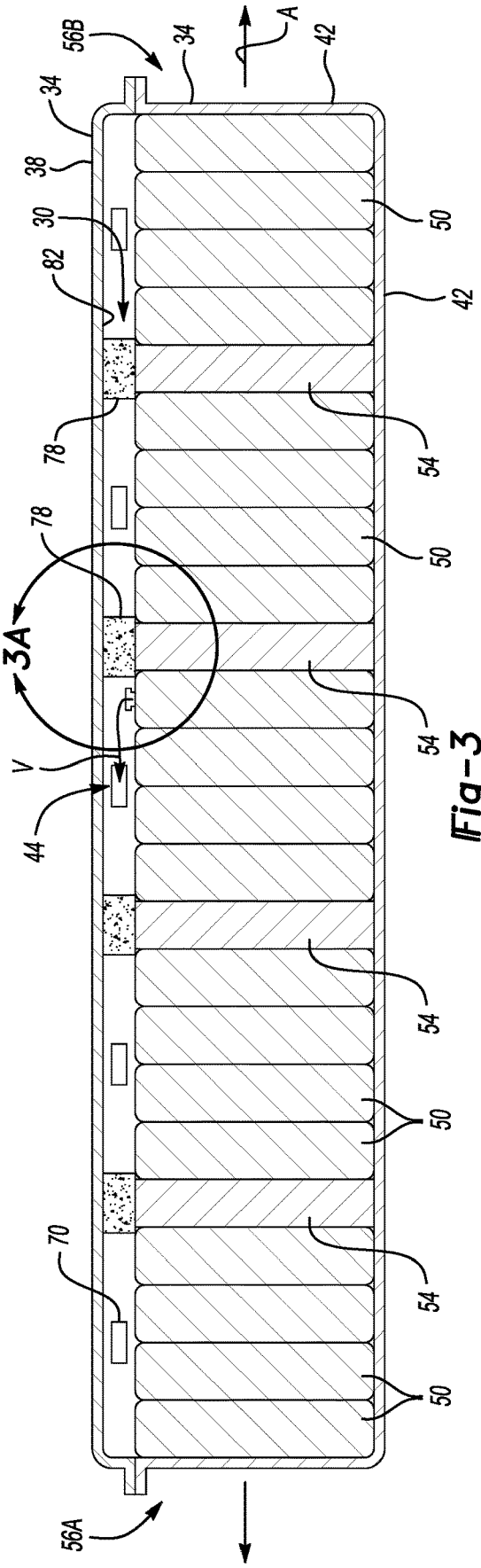

Fig-3

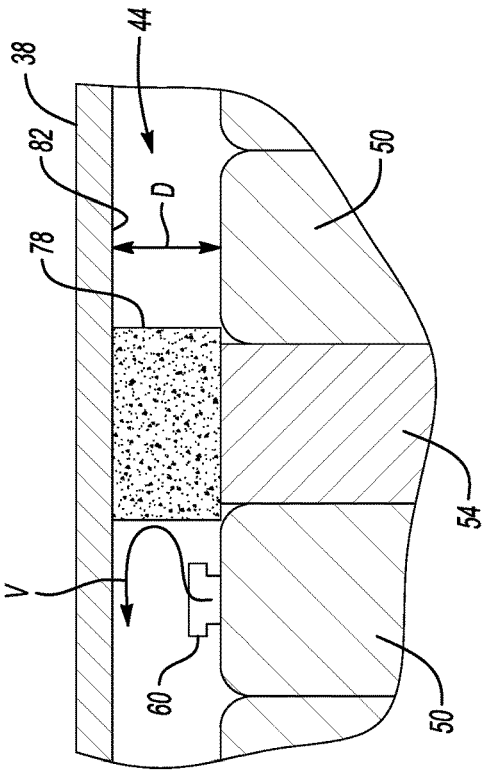

Fig-3A

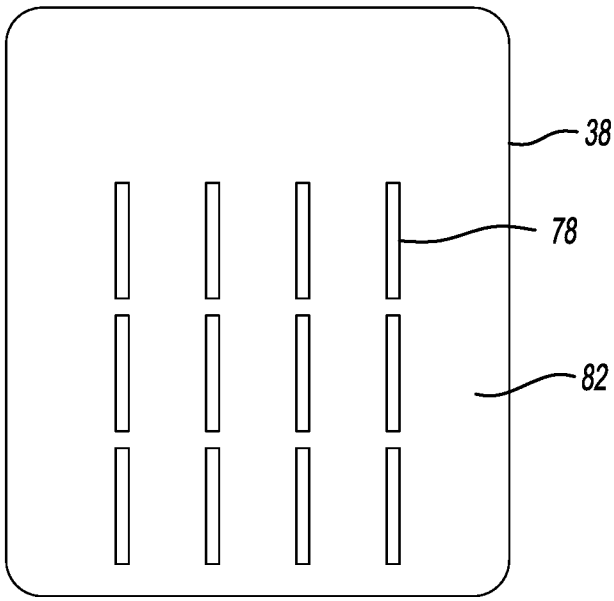

Fig-4

COMPARTMENTALIZED TRACTION BATTERY PACK AND COMPARTMENTALIZING METHOD

TECHNICAL FIELD

[0001] This disclosure relates generally to compartmentalizing areas of a traction battery pack to facilitate venting battery cells of the traction battery pack.

BACKGROUND

[0002] A traction battery pack of an electrified vehicle can include groups of battery cells arranged in one or more cell stacks. From time to time, pressure and thermal energy within one or more of the battery cells can increase. In response, gases and debris can be released from those battery cells.

SUMMARY

[0003] In some aspects, the techniques described herein relate to a traction battery pack assembly, including: an enclosure assembly that provides an interior area; at least one cell stack having a plurality of battery cell groups and a plurality of dividers disposed along a cell stack axis; and a plurality of compressible barriers attached to the enclosure assembly, each compressible barrier within the plurality of compressible barriers configured to contact a respective divider within the plurality of dividers.

[0004] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein the plurality of compressible barriers are foam compressible barriers.

[0005] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein the plurality of compressible barriers include rubber.

[0006] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein the plurality of compressible barriers are attached to the enclosure assembly with adhesive.

[0007] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein the enclosure assembly includes an enclosure cover, the plurality of compressible barriers attached to an underside of the enclosure cover.

[0008] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein each divider within the plurality of dividers separates a first group of battery cells within the plurality of battery cells from a second group of battery cells within the plurality of battery cells.

[0009] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein each compressible barrier within the plurality of compressible barriers is axially aligned with one of the dividers within the plurality of dividers along the cell stack axis.

[0010] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein each compressible barrier within the plurality of compressible barriers is compressed against one of the dividers within the plurality of dividers along the cell stack axis.

[0011] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein each compressible barrier within the plurality of compressible barriers is configured to block vent byproducts expelled from the first group of battery cells from moving adjacent to the second group of battery cells.

[0012] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein each compressible barrier within the plurality of compressible barriers extends longitudinally in a direction that is transverse to the cell stack axis.

[0013] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein each compressible barrier within the plurality of compressible barriers is compressed against one of the dividers within the plurality of dividers.

[0014] In some aspects, the techniques described herein relate to a traction battery pack assembly, wherein the plurality of compressible barriers are detached from the plurality of compressible barriers.

[0015] In some aspects, the techniques described herein relate to a method of compartmentalizing a battery pack, including: within an enclosure assembly, compressing a compressible barrier against a divider within a cell stack to block vent byproducts expelled from at least one first battery cell within a cell stack from flowing adjacent to at least one second battery cell within the cell stack.

[0016] In some aspects, the techniques described herein relate to a method, wherein the divider is disposed between the at least one first battery cell and the at least one second battery cell along a cell stack axis of the cell stack.

[0017] In some aspects, the techniques described herein relate to a method, wherein the compressible barrier is attached directly to the enclosure assembly.

[0018] In some aspects, the techniques described herein relate to a method, wherein the compressible barrier is attached directly to an underside of an enclosure cover of the enclosure assembly.

[0019] In some aspects, the techniques described herein relate to a method, wherein the compressible barrier is foam.

[0020] In some aspects, the techniques described herein relate to a method, wherein the compressible barrier is adhesively attached to the enclosure assembly.

[0021] The embodiments, examples and alternatives of the preceding paragraphs, the claims, or the following description and drawings, including any of their various aspects or respective individual features, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

BRIEF DESCRIPTION OF THE FIGURES

[0022] The various features and advantages of the disclosed examples will become apparent to those skilled in the art from the detailed description. The figures that accompany the detailed description can be briefly described as follows:

[0023] FIG. **1** illustrates a side view of an example electrified vehicle.

[0024] FIG. **2** illustrates an expanded, perspective view of a battery pack from the electrified vehicle of FIG. **1** and schematically showing cell stacks of the battery pack.

[0025] FIG. **3** illustrates a section view taken at line **3-3** in FIG. **2**.

[0026] FIG. **3**A illustrates a close-up of an area of FIG. **3**.

[0027] FIG. **4** illustrates an underside of an enclosure cover from the battery pack of FIG. **2**.

DETAILED DESCRIPTION

[0028] This disclosure details exemplary methods and systems of compartmentalizing an enclosure of a traction battery pack. The compartmentalizing can help to contain and direct gas and debris vented from one or more battery cells during a thermal event. Guiding the vented gas and debris away from other battery cells—other battery cells that are not venting—can help to prevent the thermal event from cascading to those other battery cells.

[0029] With reference to FIG. **1**, an electrified vehicle **10** includes a battery pack **14**, an electric machine **18**, and wheels **22**. The battery pack **14** powers an electric machine **18**, which can convert electrical power to mechanical power to drive the wheels **22**.

[0030] The battery pack **14** is, in the exemplary embodiment, secured to an underbody **26** of the electrified vehicle **10**. The battery pack **14** could be located elsewhere on the electrified vehicle **10** in other examples.

[0031] The electrified vehicle **10** is an all-electric vehicle. In other examples, the electrified vehicle **10** is a hybrid electric vehicle, which selectively drives wheels using torque provided by an internal combustion engine instead of, or in addition to, an electric machine. Generally, the electrified vehicle **10** could be any type of vehicle having a battery pack.

[0032] With reference now to FIGS. **2-4**, the battery pack **14** includes a plurality of cell stacks **30** held within an enclosure assembly **34**. In the exemplary embodiment, the enclosure assembly **34** includes an enclosure cover **38** and an enclosure tray **42**. The enclosure cover **38** is secured to the enclosure tray **42** to provide an interior area **44** that houses the cell stacks **30**. The enclosure cover **38** can be secured to the enclosure tray **42** using mechanical fasteners (not shown), for example.

[0033] Each of the cell stacks **30** includes a plurality of battery cells **50** (or simply, "cells") and at least one divider **54** distributed along a respective cell stack axis A. The cell stacks **30** each extend from a first axial end **56**A to an opposite, second axial end **56**B.

[0034] Within each cell stack **30**, the battery cells **50** are stacked side-by-side relative to each other along the cell stack axis A. The battery cells **50** store and supply electrical power. Although specific numbers of the cell stacks **30** and cells **50** are illustrated in the various figures of this disclosure, the battery pack **14** could include any number of the cell stacks **30** having any number of individual cells **50**.

[0035] In an embodiment, the battery cells **50** are lithium-ion pouch cells. However, battery cells having other geometries (cylindrical, prismatic, etc.) other chemistries (nickel-metal hydride, lead-acid, etc.), or both could alternatively be utilized within the scope of this disclosure.

[0036] From time to time, pressure and thermal energy within one or more of the battery cells **50** can increase. The pressure and thermal energy increase can be due to an overcharge condition, for example. The pressure and thermal energy increase can cause the associated battery cell **50** to rupture and release vent byproducts, such as gas and debris, from within the battery cell **50**.

[0037] The vent byproducts can be released from the associated battery cell **50** through a designated vent **60** within the housing, such as a membrane that yields in response to increased pressure, or through a ruptured area of the associated battery cell **50**.

[0038] The battery pack **14**, in these examples, includes cross-member assemblies **66** disposed between cell stacks **30**. The example cross-member assemblies **66** extend longitudinally in a direction that is parallel to the cell stack axes A. The cross-member assemblies **66** and the cell stack axes A extend in a cross-vehicle direction (i.e., from a driver side to a passenger side).

[0039] In this example, the cross-member assemblies **66** include venting passageways and openings **70** to the venting passageways. Vent byproducts vented through the vent **60** of one or more of the battery cells **50** can move through at least one of the openings **70** into venting passageway. The gas and debris are communicated though the venting passageway through an enclosure vent **74** to an area outside the battery pack **14**. The openings **70**, the enclosure vent **74**, or both can be covered by respective membranes, for example, when venting is not needed. During venting, the vent byproducts can rupture the membranes so that the vent byproducts can flow from the battery **50**, through the openings **70** to the venting passageway and then through the enclosure vent **74**.

[0040] To help direct the gas and debris outward for the cell stack axis A though the openings **70** rather than along the axis adjacent to other battery cells **50**, barriers **78** are secured to the enclosure assembly **34**. In this example, the barriers **78** are secured to an underside **82** of the enclosure cover **38** of the enclosure assembly **34**.

[0041] The barriers **78** are compressible barriers. The barriers **78** can be foam or rubber, for example. The barriers **78** are attached directly to the enclosure assembly **34** with adhesive in this example. The barriers **78** can be considered PIA with the enclosure assembly **34**. The barriers **78** each extend longitudinally in a direction that is transverse, here perpendicular, to the cell stack axes A.

[0042] Each barrier **78** axially aligned with one of the divider **54** along a respective one of the cell stack axes. When the enclosure cover **38** is secured to the enclosure tray **42**, the barriers **78** contact, and compress against, a respective one of the dividers **54**. This compartmentalizes groups of battery cells **50** within the cell stacks **30**. The barriers **78** can be slightly oversized relative to a dimension D between the tops of the dividers **54** and the underside **82** of the enclosure cover **38** to ensure good contact and compression of the barriers **78**. In this example, the barriers **78** are detached from the dividers **54**. In other examples, an adhesive could be used to secure the barriers **78** to the dividers **54**.

[0043] Due to the barriers **78**, when one or more of the battery cells **50** vent, the vent byproducts V contact the barriers **78** and is redirected so that the vent byproducts V. flow through the openings **70** in the cross-member assemblies **66** rather than adjacent to other battery cells **50** in the cell stack **30**. Vent byproducts V flowing adjacent to other battery cells **50** can increase thermal energy levels in those battery cells **50** and lead to a cascading thermal event.

[0044] Each of the barriers **78** is configured to block vent byproducts expelled from the first group of battery cells from moving adjacent to the second group of battery cells.

[0045] In this example, the dividers **54** and the barriers **58** separate groups of four battery cells **50** within a given one of the cell stacks **30** from other groups of four battery cells **50** within that cell stack **30**. Thus, vent products V from a venting battery cell **50** flow adjacent to, at most, three other battery cells **50** within that group before moving through the openings **70**.

[0046] The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this disclosure. Thus, the scope of protection given to this disclosure can only be determined by studying the following claims.

What is claimed is:

1. A traction battery pack assembly, comprising:

an enclosure assembly that provides an interior area;

at least one cell stack having a plurality of battery cell groups and a plurality of dividers disposed along a cell stack axis; and

a plurality of compressible barriers attached to the enclosure assembly, each compressible barrier within the plurality of compressible barriers configured to contact a respective divider within the plurality of dividers.

2. The traction battery pack assembly of claim **1**, wherein the plurality of compressible barriers are foam compressible barriers.

3. The traction battery pack assembly of claim **1**, wherein the plurality of compressible barriers comprise rubber.

4. The traction battery pack assembly of claim **1**, wherein the plurality of compressible barriers are attached to the enclosure assembly with adhesive.

5. The traction battery pack assembly of claim **1**, wherein the enclosure assembly includes an enclosure cover, the plurality of compressible barriers attached to an underside of the enclosure cover.

6. The traction battery pack assembly of claim **1**, wherein each divider within the plurality of dividers separates a first group of battery cells within the plurality of battery cells from a second group of battery cells within the plurality of battery cells.

7. The traction battery pack assembly of claim **6**, wherein each compressible barrier within the plurality of compressible barriers is axially aligned with one of the dividers within the plurality of dividers along the cell stack axis.

8. The traction battery pack assembly of claim **6**, wherein each compressible barrier within the plurality of compressible barriers is compressed against one of the dividers within the plurality of dividers along the cell stack axis.

9. The traction battery pack assembly of claim **6**, wherein each compressible barrier within the plurality of compressible barriers is configured to block vent byproducts expelled from the first group of battery cells from moving adjacent to the second group of battery cells.

10. The traction battery pack assembly of claim **1**, wherein each compressible barrier within the plurality of compressible barriers extends longitudinally in a direction that is transverse to the cell stack axis.

11. The traction battery pack assembly of claim **1**, wherein each compressible barrier within the plurality of compressible barriers is compressed against one of the dividers within the plurality of dividers.

12. The traction battery pack assembly of claim **1**, wherein the plurality of compressible barriers are detached from the plurality of compressible barriers.

13. A method of compartmentalizing a battery pack, comprising:

within an enclosure assembly, compressing a compressible barrier against a divider within a cell stack to block vent byproducts expelled from at least one first battery cell within a cell stack from flowing adjacent to at least one second battery cell within the cell stack.

14. The method of claim **13**, wherein the divider is disposed between the at least one first battery cell and the at least one second battery cell along a cell stack axis of the cell stack.

15. The method of claim **13**, wherein the compressible barrier is attached directly to the enclosure assembly.

16. The method of claim **13**, wherein the compressible barrier is attached directly to an underside of an enclosure cover of the enclosure assembly.

17. The method of claim **13**, wherein the compressible barrier is foam.

18. The method of claim **13**, wherein the compressible barrier is adhesively attached to the enclosure assembly.

* * * * *