US 20240213565A1

(19) United States

(12) Patent Application Publication

Boddakayala et al.

(10) Pub. No.: US 2024/0213565 A1

(43) Pub. Date: Jun. 27, 2024

(54) **THERMAL MITIGATION SYSTEMS FOR TRACTION BATTERY PACKS**

(71) Applicant: **FORD GLOBAL TECHNOLOGIES, LLC**, Dearborn, MI (US)

(72) Inventors: **Bhaskara Rao Boddakayala**, Troy, MI (US); **Eric Poirier**, Brownstown, MI (US)

(21) Appl. No.: **18/069,254**

(22) Filed: **Dec. 21, 2022**

Publication Classification

(51) **Int. Cl.**

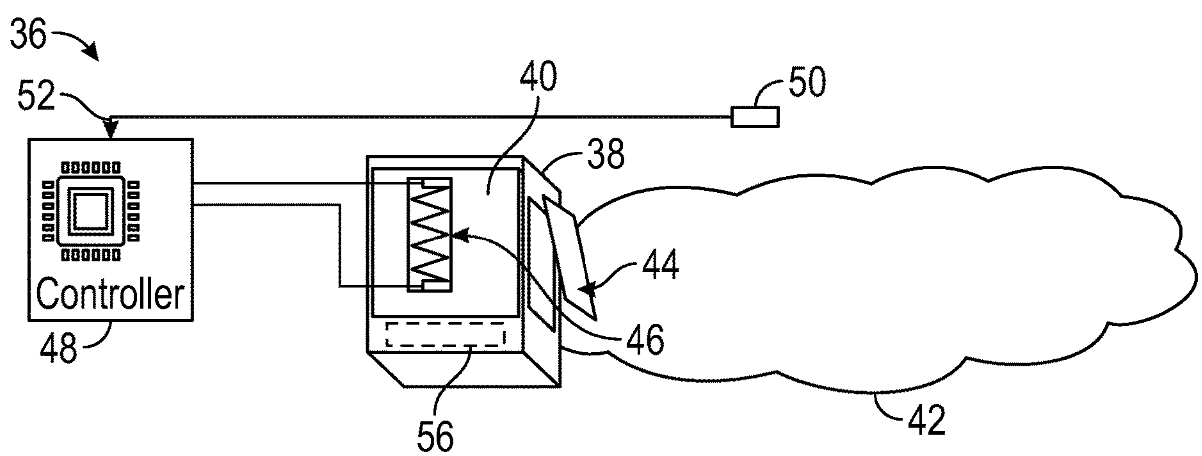
H01M 10/625	(2006.01)
H01M 10/48	(2006.01)
H01M 10/613	(2006.01)
H01M 10/6561	(2006.01)
H01M 50/342	(2006.01)

(52) **U.S. Cl.**

CPC ***H01M 10/625*** (2015.04); ***H01M 10/486*** (2013.01); ***H01M 10/613*** (2015.04); ***H01M 10/6561*** (2015.04); ***H01M 50/3425*** (2021.01); *H01M 2200/20* (2013.01); *H01M 2220/20* (2013.01)

(57) **ABSTRACT**

Thermal mitigation systems are provided for traction battery packs. An exemplary thermal mitigation system may include a cartridge containing a nitrogen releasing material, and a heating element. The heating element may be activated to cause the nitrogen releasing material to release a nitrogen gas for actively mitigating battery thermal events. Another exemplary thermal mitigation system may include one or more passive release devices that are mounted to a battery array. A nitrogen releasing material may be activated via heat generated within the battery array to release a nitrogen gas from a polymeric encapsulating material of the passive release device to passively mitigate battery thermal events.



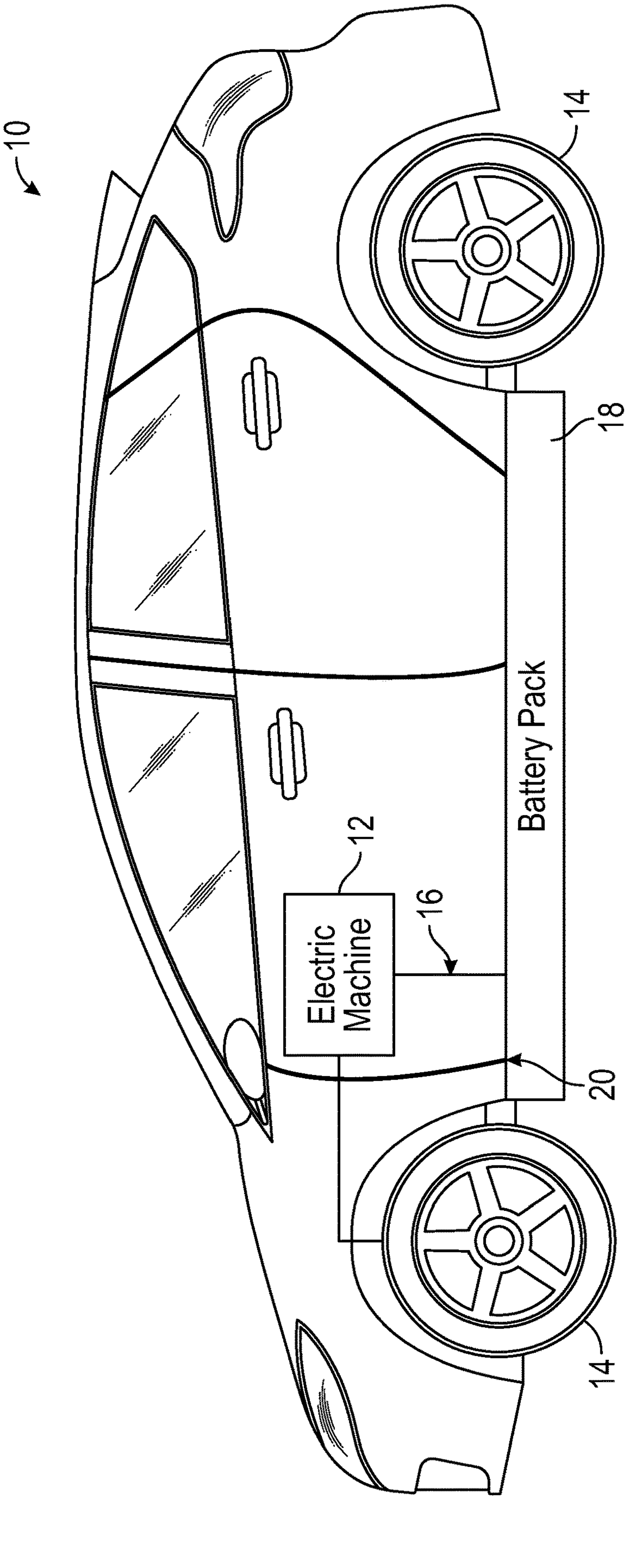


FIG. 1

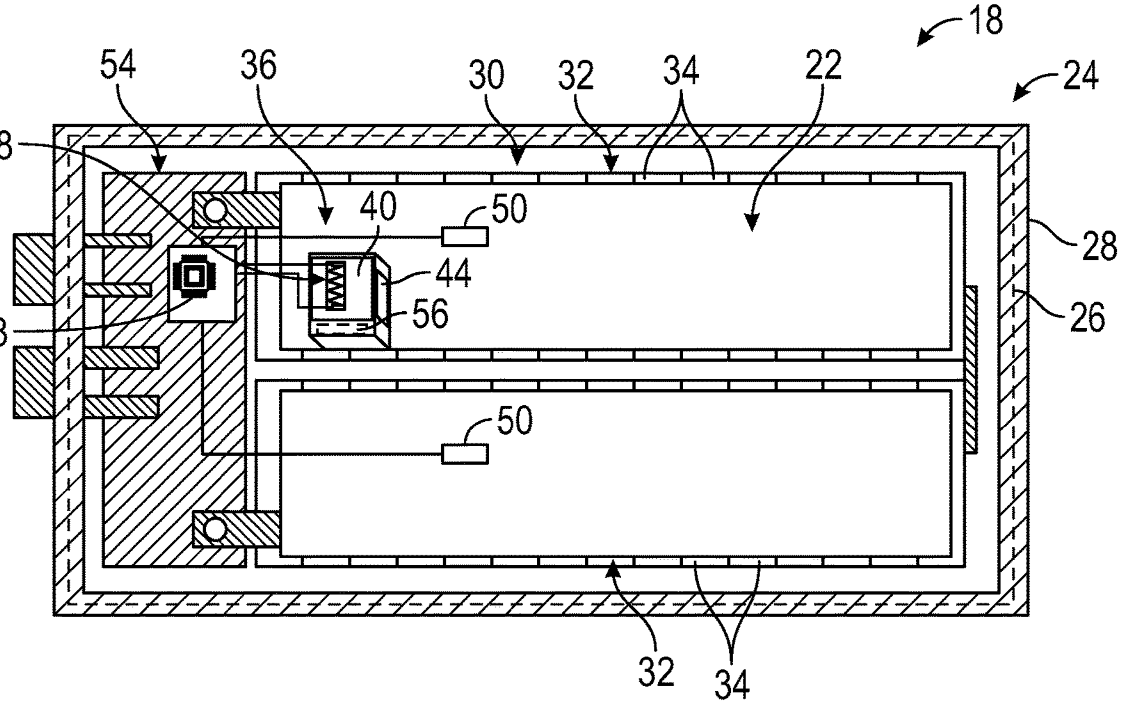

18
24
54
36
30
32
34
22
38
40
50
44
56
48
28
26
50
32
34

FIG. 2

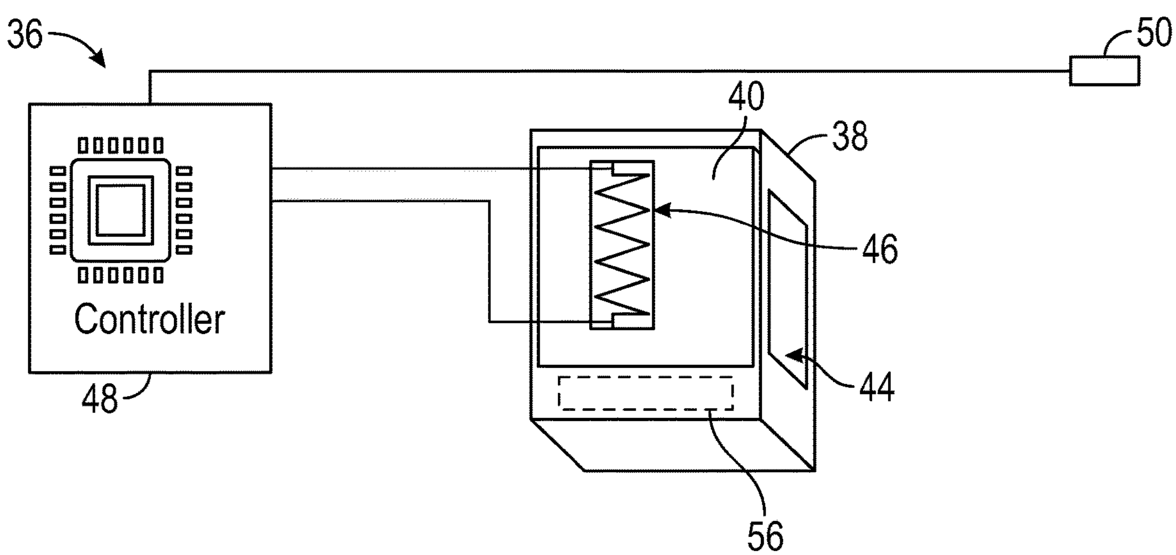

36
50
40
38
46
Controller
48
44
56

FIG. 3

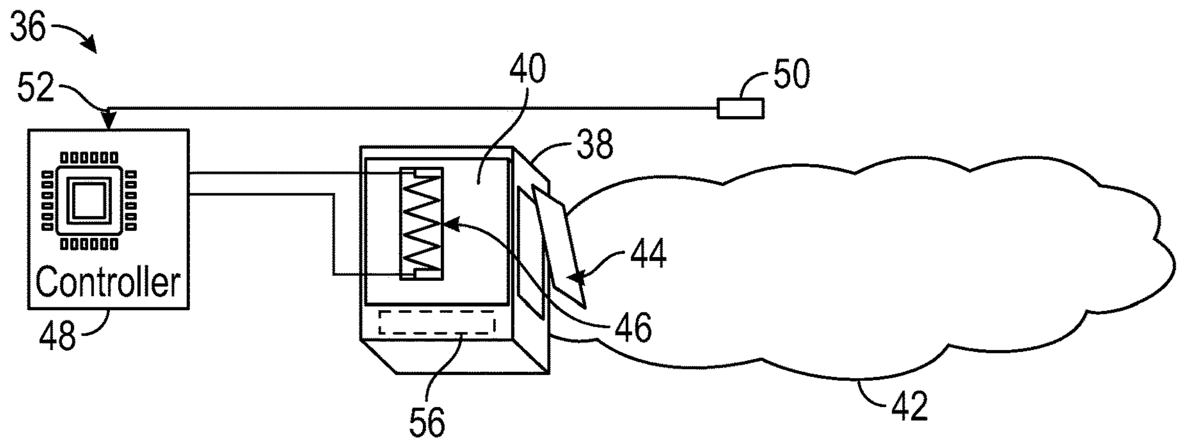

36
52
40
50
38
Controller
44
48
46
56
42

FIG. 4

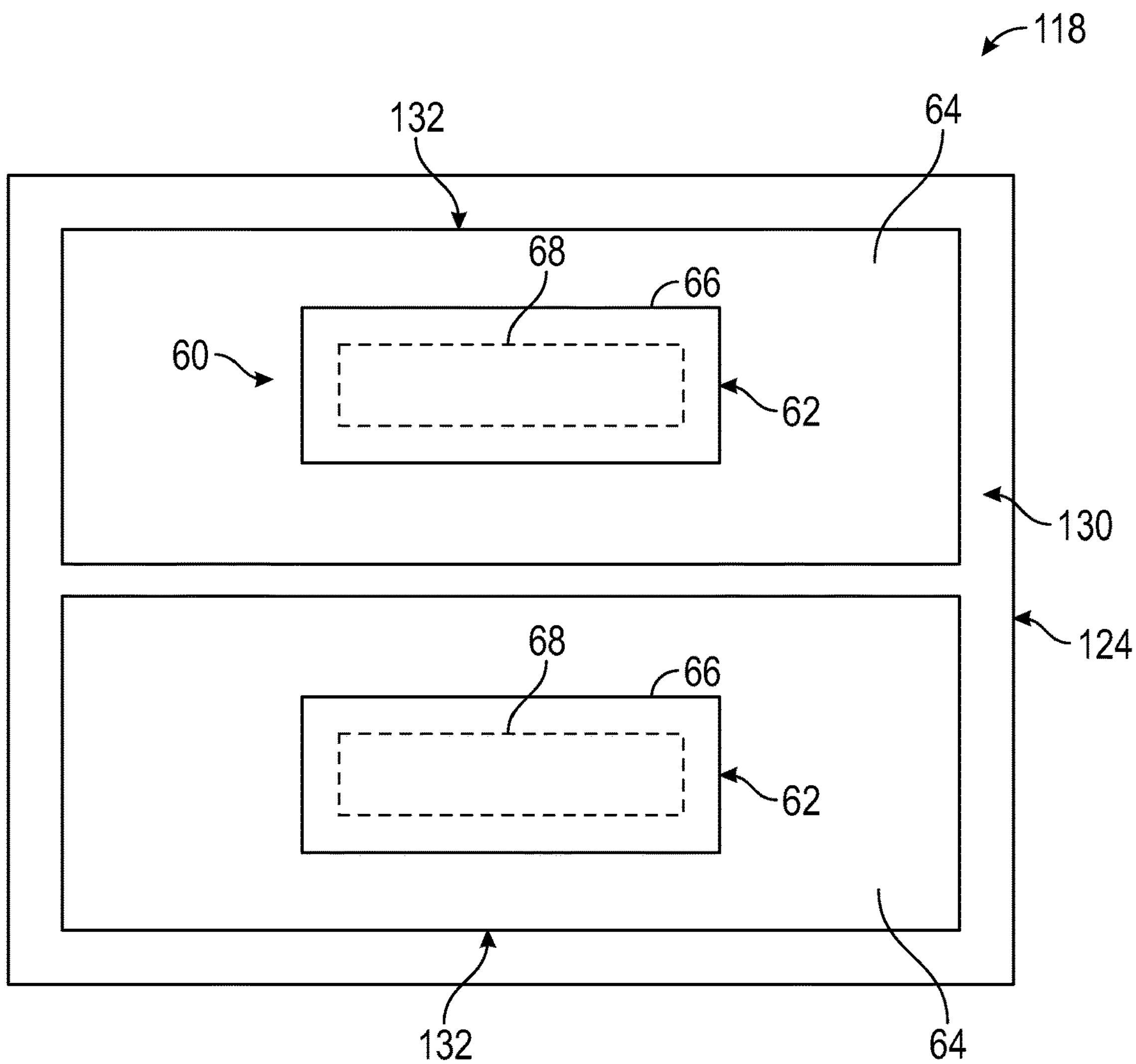

118
132
64
68
66
60
62
130
124
68
66
62
132
64

FIG. 5

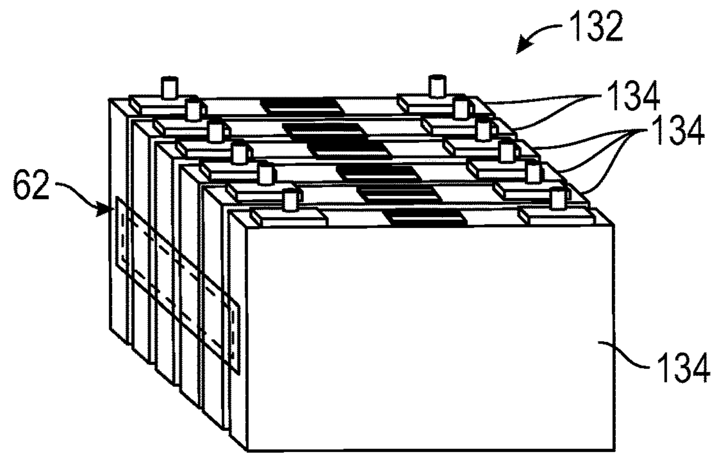


FIG. 6

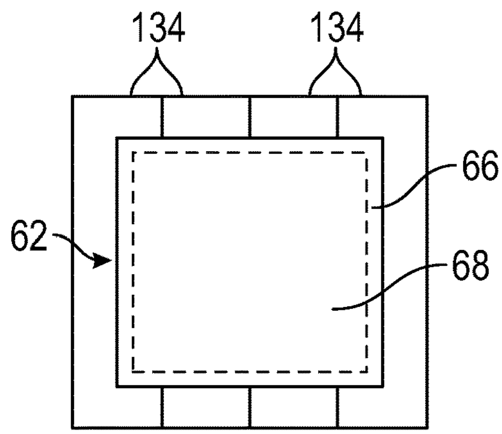


FIG. 7

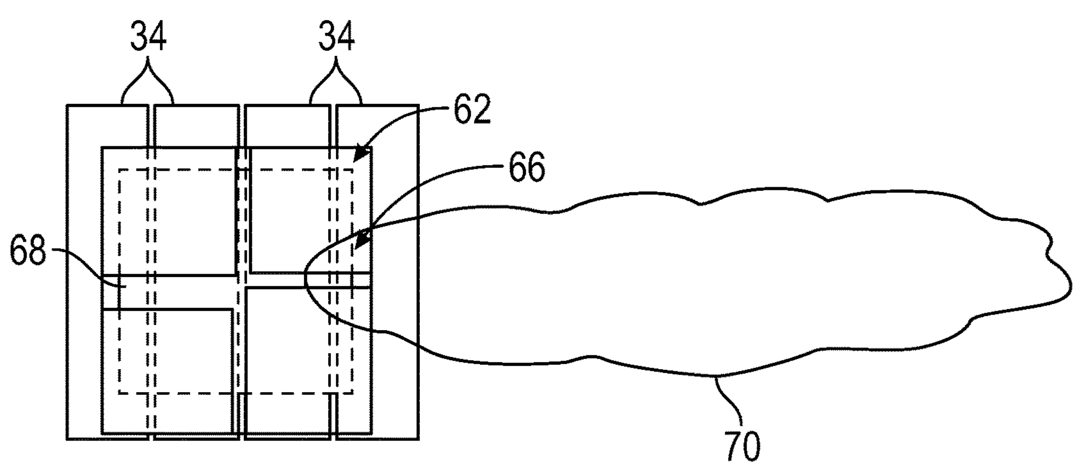


FIG. 8

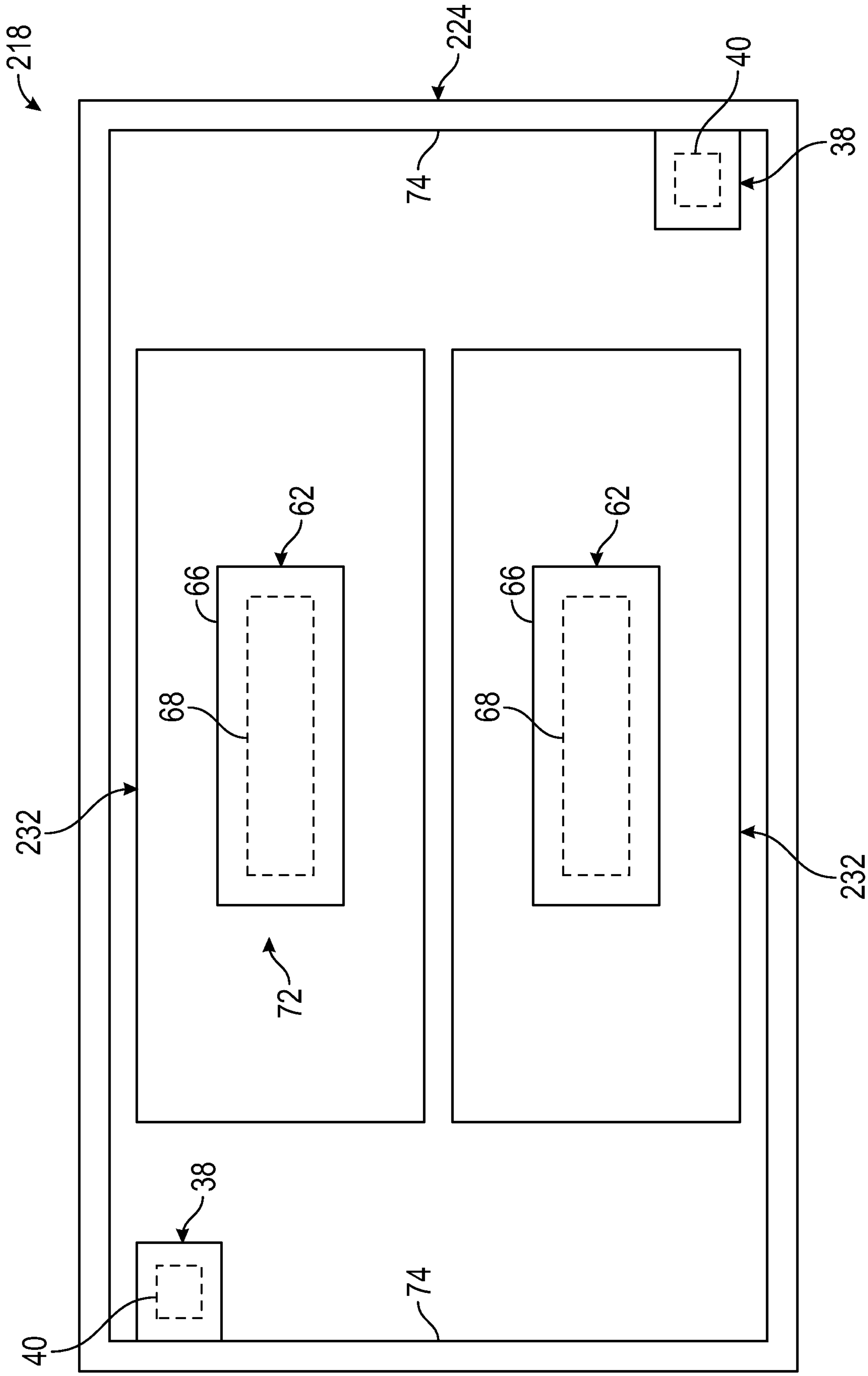


FIG. 9

THERMAL MITIGATION SYSTEMS FOR TRACTION BATTERY PACKS

TECHNICAL FIELD

[0001] This disclosure relates generally to traction battery packs, and more particularly to thermal mitigation systems for mitigating battery thermal events within traction battery packs.

BACKGROUND

[0002] Electrified vehicles include a traction battery pack for powering electric machines and other electrical loads of the vehicle. The traction battery pack includes a plurality of battery cells and various other battery internal components that support electric vehicle propulsion.

SUMMARY

[0003] A thermal mitigation system for a traction battery pack according to an exemplary aspect of the present disclosure includes, among other things, a cartridge containing a nitrogen releasing material, a heating element housed within the cartridge, and a controller configured to control the heating element for causing the nitrogen releasing material to release a nitrogen gas when a temperature within the traction battery pack exceeds a predefined temperature threshold.

[0004] In a further non-limiting embodiment of the foregoing thermal mitigation system, the nitrogen releasing material includes guanidine nitrate ($C(NH_2)_3NO_3$).

[0005] In a further non-limiting embodiment of either of the foregoing thermal mitigation systems, the nitrogen releasing material includes sodium azide (NaN_3).

[0006] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the cartridge includes a vent patch that is configured to open to release the nitrogen gas when a pressure inside the cartridge exceeds a predefined pressure threshold.

[0007] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the vent patch is comprised of a different material than the cartridge.

[0008] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the vent patch includes polytetrafluoroethylene (PTFE), and the cartridge includes a polycarbonate.

[0009] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, a desiccant is housed within the cartridge.

[0010] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the controller is a 12V controller circuit that is independent or part of a battery management system of the traction battery pack.

[0011] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the cartridge is comprised of a polycarbonate.

[0012] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the nitrogen releasing material is configured to decompose to release the nitrogen gas.

[0013] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, a thermal sensing device is mounted to a battery array of the traction battery pack and is configured to detect the temperature within the battery array.

[0014] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the thermal sensing device is a thermistor or a thermocouple.

[0015] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, a passive release device is mounted to a battery array of the traction battery pack.

[0016] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the passive release device includes a polymeric encapsulating material and a nitrogen releasing material encapsulated within the polymeric encapsulating material.

[0017] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the nitrogen releasing material is configured to release a nitrogen gas when the temperature within the traction battery pack exceeds the predefined temperature threshold.

[0018] A thermal mitigation system for a traction battery pack according to another exemplary aspect of the present disclosure includes, among other things, a battery array, and a passive release device mounted to the battery array. The passive release device includes a polymeric encapsulating material and a nitrogen releasing material encapsulated within the polymeric encapsulating material. The nitrogen releasing material is configured to release a nitrogen gas when a temperature within the traction battery pack exceeds a predefined temperature threshold.

[0019] In a further non-limiting embodiment of the foregoing thermal mitigation system, the nitrogen releasing material includes guanidine nitrate ($C(NH_2)_3NO_3$).

[0020] In a further non-limiting embodiment of either of the foregoing thermal mitigation systems, the polymeric encapsulating material is configured as a polyethylene laminated pouch.

[0021] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the polymeric encapsulating material is configured to break open to release the nitrogen gas when a pressure inside the polymeric encapsulating structure exceeds a predefined pressure threshold.

[0022] In a further non-limiting embodiment of any of the foregoing thermal mitigation systems, the passive release device is mounted to a battery cell or an array support structure of the battery array.

[0023] 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.

[0024] The various features and advantages of this disclosure will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] FIG. **1** schematically illustrates an electrified vehicle.

[0026] FIG. **2** illustrates select portions of a traction battery pack that includes a thermal mitigation system.

[0027] FIG. **3** schematically illustrates an exemplary thermal mitigation system of a traction battery pack.

[0028] FIG. **4** illustrates the thermal mitigation system of FIG. **3** during a battery thermal event of a traction battery pack.

[0029] FIG. **5** illustrates another exemplary thermal mitigation system for a traction battery pack.

[0030] FIG. **6** illustrates an exemplary mounting location of a passive release device of the thermal mitigation system of FIG. **5**.

[0031] FIG. **7** illustrates an exemplary passive release device of the thermal mitigation system of FIG. **5**.

[0032] FIG. **8** illustrates the passive release device of FIG. **7** during a battery thermal event of a traction battery pack.

[0033] FIG. **9** illustrates yet another exemplary thermal mitigation system for a traction battery pack.

DETAILED DESCRIPTION

[0034] This disclosure details thermal mitigation systems for traction battery packs. An exemplary thermal mitigation system may include a cartridge containing a nitrogen releasing material and a heating element. The heating element may be activated to cause the nitrogen releasing material to release a nitrogen gas for actively mitigating battery thermal events. Another exemplary thermal mitigation system may include one or more passive release devices that are mounted to a battery array. A nitrogen releasing material may be activated via heat generated within the battery array to release a nitrogen gas from a polymeric encapsulating material of the passive release device to mitigate battery thermal events. These and other features are discussed in greater detail in the following paragraphs of this detailed description.

[0035] FIG. **1** schematically illustrates an electrified vehicle **10**. The electrified vehicle **10** may include any type of electrified powertrain. In an embodiment, the electrified vehicle **10** is a battery electric vehicle (BEV). However, the concepts described herein are not limited to BEVs and could extend to other electrified vehicles, including, but not limited to, hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEV's), fuel cell vehicles, etc. Therefore, although not specifically shown in the exemplary embodiment, the powertrain of the electrified vehicle **10** could be equipped with an internal combustion engine that can be employed either alone or in combination with other power sources to propel the electrified vehicle **10**.

[0036] In the illustrated embodiment, the electrified vehicle **10** is depicted as a car. However, the electrified vehicle **10** could alternatively be a sport utility vehicle (SUV), a van, a pickup truck, or any other vehicle configuration. Although a specific component relationship is illustrated in the figures of this disclosure, the illustrations are not intended to limit this disclosure. The placement and orientation of the various components of the electrified vehicle **10** are shown schematically and could vary within the scope of this disclosure. In addition, the various figures accompanying this disclosure are not necessarily drawn to scale, and some features may be exaggerated or minimized to emphasize certain details of a particular component or system.

[0037] In an embodiment, the electrified vehicle **10** is a full electric vehicle propelled solely through electric power, such as by one or more electric machines **12**, without any assistance from an internal combustion engine. The electric machine **12** may operate as an electric motor, an electric generator, or both. The electric machine **12** receives electrical power and can convert the electrical power to torque for driving one or more wheels **14** of the electrified vehicle **10**.

[0038] A voltage bus **16** may electrically couple the electric machine **12** to a traction battery pack **18**. The traction battery pack **18** is an exemplary electrified vehicle battery. The traction battery pack **18** may be a high voltage traction battery pack assembly that includes a plurality of battery cells capable of outputting electrical power to power the electric machine **12** and/or other electrical loads of the electrified vehicle **10**. Other types of energy storage devices and/or output devices could alternatively or additionally be used to electrically power the electrified vehicle **10**.

[0039] The traction battery pack **18** may be secured to an underbody **20** of the electrified vehicle **10**. However, the traction battery pack **18** could be located elsewhere on the electrified vehicle **10** within the scope of this disclosure.

[0040] Referring now to FIG. **2**, the traction battery pack **18** may include a battery system **22** housed within an interior area **30** of an enclosure assembly **24**. The enclosure assembly **24** of the traction battery pack **18** may include an enclosure cover **26** (shown in phantom) and an enclosure tray **28**. The enclosure cover **26** may be secured (e.g., bolted, welded, adhered, etc.) to the enclosure tray **28** to provide the interior area **30** for housing the battery system **22**.

[0041] The battery system **22** may include one or more battery arrays **32** (e.g., groupings of battery cells **34**) arranged within the interior arear **30**. Once electrically coupled, the battery cells **34** of the battery arrays **32** may supply electrical power for powering various components of the electrified vehicle **10**. Although two battery arrays **32** are shown, the battery system **22** could include one or more battery arrays **32** within the scope of this disclosure. Thus, the total number of battery cells **34** included as part of the battery system **22** is not intended to limit this disclosure.

[0042] In an embodiment, the battery cells **34** are prismatic, lithium-ion cells. However, battery cells having other geometries (cylindrical, pouch, etc.) and/or chemistries (nickel-metal hydride, lead-acid, etc.) could alternatively be utilized within the scope of this disclosure.

[0043] From time to time, one or more battery cells **34** of the traction battery pack **18** can experience a battery thermal event in which pressure and thermal energy of the one or more battery cells **34** increases. The pressure and thermal energy increase can be due to an overcharge condition, an overdischarging condition, or a short circuit event, for example. The pressure and thermal energy increase can cause the battery cell **34** experiencing the thermal event to release gas and/or effluents. The gases may be released as a result of an applied force or a thermal event, and can either cause or exacerbate an existing battery thermal event. A relatively significant amount of heat can be generated during battery thermal events, and this heat can sometimes cascade from array-to-array and/or cell-to-cell within the traction battery pack **18**/array. The traction battery pack **18** may therefore be equipped with a thermal mitigation system **36** for mitigating the effects of battery thermal events.

[0044] An exemplary thermal mitigation system **36** for use within the traction battery pack **18** is further illustrated with reference to FIGS. **3** and **4** (with continued reference to FIG. **2**). As discussed in greater detail below, the thermal mitigation system **36** may actively respond to a battery thermal event (e.g., by releasing nitrogen (N2) gas) when a temperature within the traction battery pack 18 exceeds a predefined temperature threshold.

[0045] The thermal mitigation system **36** may include one or more cartridges **38** that house a nitrogen releasing material **40**. The cartridge **38** may be mounted at any location inside the enclosure assembly **24** of the traction battery pack **18**. In an embodiment, the cartridge **38** includes a box-like or cuboid shape. However, the size and the shape of the cartridge **38** are not intended to limit this disclosure.

[0046] The cartridge **38** may be made of a plastic material. In an embodiment, the plastic material includes polycarbonate. However, other plastic materials may also be suitable for constructing the cartridge **38**.

[0047] The nitrogen releasing material **40** may be contained inside the cartridge **38** during normal operation of the traction battery pack **18** (see FIG. **3**). The nitrogen releasing material **40** may be a sheet or a film or could take any other form or geometry. The nitrogen releasing material **40** may be selectively activated to release a nitrogen (N2) gas **42** from the cartridge **38** (see FIG. **4**). The nitrogen releasing material **40** may be activated by being heated to a temperature that exceeds its decomposition temperature (e.g., about 240 degrees C.). In this disclosure, the term "about" means that the expressed quantities or ranges need not be exact but may be approximated and/or larger or smaller, reflecting acceptable tolerances, conversion factors, measurement error, etc. The released N2 gas **42** reduces the oxygen content inside the traction battery pack **18**, thereby hindering combustion and actively mitigating battery thermal events when the temperature within the traction battery pack **18** exceeds the predefined temperature threshold.

[0048] In an embodiment, the nitrogen releasing material **40** includes guanidine nitrate ($C(NH_2)_3NO_3$), which is a colorless, water-soluble salt. In another embodiment, the nitrogen releasing material **40** includes sodium azide (NaN_3), which is another colorless, water-soluble salt. Other nitrogen releasing materials may also be suitable within the scope of this disclosure.

[0049] The N2 gas **42** may be released from the cartridge **38** through a vent patch **44**. The vent patch **44** may open when a pressure inside the cartridge **38** exceeds a predefined pressure threshold. In an embodiment, the vent patch **44** is made of a non-permeable polymer film that is configured to rupture when the pressure inside the cartridge **38** exceeds the predefined pressure threshold. An exemplary non-permeable polymer film may include polytetrafluoroethylene (PTFE). However, other materials may also be utilized as part of the construction of the vent patch **44** within the scope of this disclosure.

[0050] The release of the N2 gas **42** from the cartridge **38** may be controlled by a heating element **46** and a controller **48**. The heating element **46** may be packaged inside the cartridge **38** and is operably connected to the controller **48**. In an embodiment, the heating element **46** includes a metallic wire (e.g., nichrome) that is encapsulated in a polyamide film (e.g., Kapton®). However, other heating elements are also contemplated.

[0051] One or more thermal sensing devices **50** may also be operably connected to the controller **48**. In an embodiment, one thermal sensing device **50** is mounted on or in the direct vicinity of one of the battery arrays **32** (see FIG. **2**) of the traction battery pack **18** and is configured to monitor a temperature of the respective battery array **32**, or a temperature of the air near the respective battery array **32**. In an embodiment, the thermal sensing devices **50** are thermistors. In another embodiment, the thermal sensing devices **50** are linear heat detection devices that are designed to short in the presence of heat. In yet another embodiment, the thermal sensing devices **50** are flex film thermocouples.

[0052] The thermal sensing devices **50** may be designed to communicate a signal **52** to the controller **48** when the temperature within the traction battery pack **18** exceeds the predefined temperature threshold. Temperatures that exceed the predefined temperature threshold may be indicative of battery thermal events. The controller **48** may thus be configured to detect overtemperature conditions of the traction battery pack **18** based on the signals **52** received from the thermal sensing devices **50**. When the detected temperature of one or more battery arrays **32** or the air near the arrays exceeds the predefined temperature threshold, the controller **48** may command that a current be sent to the heating element **46** that causes the heating element **46** to begin generating heat. The heat induces the nitrogen releasing material **40** to generate the N2 gas **42**, which thereby causes the pressure inside the cartridge **38** to rapidly increase. When the pressure increases beyond the predefined pressure threshold of the vent patch **44**, the vent patch **44** may break open and release the N2 gas into the interior area **30** of the traction battery pack **18** (or an interior area of battery array **32**) for mitigating the battery thermal event. For example, the N2 gas may reduce the oxygen content inside the traction battery pack **18**, and in so doing, reduce temperatures and/or reduce the array-to-array transfer of heat within the traction battery pack **18**.

[0053] The nitrogen releasing material **40** may be a moisture sensitive material. Therefore, a desiccant **56** may additionally be housed within the cartridge **38**. The desiccant **56** may be configured to absorb water molecules from surrounding air and thus decrease the overall moisture level inside the cartridge **38**. The desiccant **56** may include silicone dioxide or any other suitable absorption or adsorption material.

[0054] In some implementations, the controller **48** may be a 12V controller circuit of a battery management system (BMS) **54** (see FIG. **2**) of the traction battery pack **18**. In other implementations, the controller **48** may be a stand alone control unit operable to communicate with the BMS **54** as part of a control system of the traction battery pack **18**. The controller **48** may therefore be programmed with instructions for controlling certain aspects of the thermal mitigation system **36**.

[0055] FIG. **5** illustrates another exemplary thermal mitigation system **60** for a traction battery pack **118**. In this implementation, the thermal mitigation system **60** may be passive system that does not require the use of a controller for mitigating the effects of battery thermal events. As discussed in greater detail below, the thermal mitigation system **60** may actively mitigate battery thermal events by releasing N2 gas when a temperature within the traction battery pack **118** exceeds a predefined temperature threshold.

[0056] The thermal mitigation system **60** may include one or more passive release devices **62**. One or more of the passive release device **62** may be mounted directly to each battery array **132** of the traction battery pack **118**. The one or more passive release devices **62** may be mounted directly to an array support structure **64** (e.g., a top plate, side plate, end plate, etc.) of each battery array **132** (see FIG. **5**), or the one or more passive release devices **62** could be mounted directly to one or more battery cells **134** of each battery array **132** (see FIG. **6**). The battery arrays **132** may be positioned within an interior area **130** established by an enclosure assembly **124** of the traction battery pack **118**.

[0057] An exemplary passive release device **62** of the thermal mitigation system **60** is further illustrated with reference to FIGS. **7** and **8** (with continued reference to FIGS. **5-6**). The passive release device **62** may include a polymeric encapsulating material **66** and a nitrogen releasing material **68** encapsulated within the polymeric encapsulating material **66**.

[0058] In an embodiment, the polymeric encapsulating material **66** is configured as a polyethylene laminated pouch. However, other geometries and materials are contemplated within the scope of this disclosure, and therefore the size, shape, and material make-up of the polymeric encapsulating material **66** is not intended to limit this disclosure.

[0059] The nitrogen releasing material **68** may be contained inside the polymeric encapsulating material **66** during normal operation of the traction battery pack **118** (see FIG. **7**). The nitrogen releasing material **68** may be a sheet or a film or could take any other form or geometry. The nitrogen releasing material **68** may be selectively activated to release a nitrogen (N2) gas **70** from the polymeric encapsulating material **66** (see FIG. **8**). For example, when a predefined temperature threshold inside the traction battery pack **118** is reached, the nitrogen releasing material **68** may decompose to release the N2 gas **70**. The release of the N2 gas **70** causes a pressure build-up within the polymeric encapsulating material **66**. When the pressure exceeds a predefined pressure threshold of the polymeric encapsulating material **66**, the polymeric encapsulating material **66** may break open and allow the N2 gas **70** to escape into the traction battery pack **118**. The released N2 gas **70** reduces the oxygen content inside the traction battery pack **118**, thereby hindering combustion and mitigating the effects of battery thermal events.

[0060] In an embodiment, the nitrogen releasing material **68** includes guanidine nitrate ($C(NH_2)_3NO_3$). In another embodiment, the nitrogen releasing material **68** includes sodium azide (NaN_3). Other nitrogen releasing materials may also be suitable within the scope of this disclosure.

[0061] FIG. **9** illustrates another exemplary thermal mitigation system **72** for a traction battery pack **218**. In this embodiment, the thermal mitigation system **72** may include a combination of the cartridges **38** that house the nitrogen releasing material **40** and the passive release devices **62**. The passive release devices **62** may be mounted in physical contact with battery arrays **232** of the traction battery pack **218**, and the cartridges **38** may be mounted remote from the battery arrays **232**, such as to an interior wall **74** of an enclosure assembly **224** of the traction battery pack **218**, for example.

[0062] The exemplary thermal mitigation systems of this disclosure are capable of rapidly releasing nitrogen gas in order to hinder combustion during battery thermal events. The proposed systems are simple to install yet effective at limiting the effects of battery thermal events.

[0063] Although the different non-limiting embodiments are illustrated as having specific components or steps, the embodiments of this disclosure are not limited to those particular combinations. It is possible to use some of the components or features from any of the non-limiting embodiments in combination with features or components from any of the other non-limiting embodiments.

[0064] It should be understood that like reference numerals identify corresponding or similar elements throughout the several drawings. It should be understood that although a particular component arrangement is disclosed and illustrated in these exemplary embodiments, other arrangements could also benefit from the teachings of this disclosure.

[0065] The foregoing description shall be interpreted as illustrative and not in any limiting sense. A worker of ordinary skill in the art would understand that certain modifications could come within the scope of this disclosure. For these reasons, the following claims should be studied to determine the true scope and content of this disclosure.

What is claimed is:

1. A thermal mitigation system for a traction battery pack, comprising:
- a cartridge containing a nitrogen releasing material;
- a heating element housed within the cartridge; and
- a controller configured to control the heating element for causing the nitrogen releasing material to release a nitrogen gas when a temperature within the traction battery pack exceeds a predefined temperature threshold.

2. The thermal mitigation system as recited in claim **1**, wherein the nitrogen releasing material includes guanidine nitrate ($C(NH_2)_3NO_3$).

3. The thermal mitigation system as recited in claim **1**, wherein the nitrogen releasing material includes sodium azide (NaN_3).

4. The thermal mitigation system as recited in claim **1**, wherein the cartridge includes a vent patch that is configured to open to release the nitrogen gas when a pressure inside the cartridge exceeds a predefined pressure threshold.

5. The thermal mitigation system as recited in claim **4**, wherein the vent patch is comprised of a different material than the cartridge.

6. The thermal mitigation system as recited in claim **5**, wherein the vent patch includes polytetrafluoroethylene (PTFE), and the cartridge includes a polycarbonate.

7. The thermal mitigation system as recited in claim **1**, comprising a desiccant housed within the cartridge.

8. The thermal mitigation system as recited in claim **1**, wherein the controller is a 12V controller circuit that is independent or part of a battery management system of the traction battery pack.

9. The thermal mitigation system as recited in claim **1**, wherein the cartridge is comprised of a polycarbonate.

10. The thermal mitigation system as recited in claim **1**, wherein the nitrogen releasing material is configured to decompose to release the nitrogen gas.

11. The thermal mitigation system as recited in claim **1**, comprising a thermal sensing device mounted to a battery array of the traction battery pack and configured to detect the temperature within the battery array.

12. The thermal mitigation system as recited in claim **11**, wherein the thermal sensing device is a thermistor or a thermocouple.

13. The thermal mitigation system as recited in claim **1**, comprising a passive release device mounted to a battery array of the traction battery pack.

14. The thermal mitigation system as recited in claim **13**, wherein the passive release device includes a polymeric encapsulating material and a nitrogen releasing material encapsulated within the polymeric encapsulating material.

15. The thermal mitigation system as recited in claim **14**, wherein the nitrogen releasing material is configured to release a nitrogen gas when the temperature within the traction battery pack exceeds the predefined temperature threshold.

16. A thermal mitigation system for a traction battery pack, comprising:

a battery array; and

a passive release device mounted to the battery array,

wherein the passive release device includes a polymeric encapsulating material and a nitrogen releasing material encapsulated within the polymeric encapsulating material,

wherein the nitrogen releasing material is configured to release a nitrogen gas when a temperature within the traction battery pack exceeds a predefined temperature threshold.

17. The thermal mitigation system as recited in claim **16**, wherein the nitrogen releasing material includes guanidine nitrate ($C(NH_2)_3NO_3$).

18. The thermal mitigation system as recited in claim **16**, wherein the polymeric encapsulating material is configured as a polyethylene laminated pouch.

19. The thermal mitigation system as recited in claim **16**, wherein the polymeric encapsulating material is configured to break open to release the nitrogen gas when a pressure inside the polymeric encapsulating structure exceeds a predefined pressure threshold.

20. The thermal mitigation system as recited in claim **16**, wherein the passive release device is mounted to a battery cell or an array support structure of the battery array.

* * * * *