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Sensor System for the Early Detection of Thermal Runaway in Lithium-Ion Batteries

Low-cost sensors detect battery off-gassing before fires, enabling safer BMS systems.

Researchers at Purdue University have developed a chemical sensor for the early detection of toxic and flammable gases produced in potentially dangerous thermal runaway situations. Thermal runaway may be caused by overheating, overcharging, or short-circuiting in batteries and can lead to battery explosions or fires. Current technologies for detecting thermal runaway only measure temperature increases which may provide false-positives and insufficient time to prevent more dangerous outcomes. In the early stages of thermal runaway, indicator compounds are released from the battery cells; the Purdue technology detects these compounds to provide an earlier warning. The system can be implemented in lithium-ion batteries to enable the battery management systems (BMS) to avoid dangerous outcomes. This system is more accurate than current technologies as it detects specific compounds directly associated with thermal runaway.

Technology Validation: The developed polymeric sensor measured the concentrations of two volatile organic compounds (VOCs) released in thermal runaway, ethyl methyl carbonate and methyl formate, at 5, 15, and 30 ppm independently or in various combinations at room and elevated temperatures.

Advantages

- Low-cost

- Accurate

- Low power requirement

- Facile processing

Applications

- Integration into BMS of lithium-ion batteries

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Category
Chemicals & Advanced Materials/Polymer Science & Smart Materials
Energy & Power Systems/Energy Storage

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- Detection of VOCs produced in early thermal runaway

- Continuous monitoring and early detection of thermal runaway of Li-ion batteries at battery packs, battery storage facilities, parking lots, parking garages etc.

TRL: 3

Intellectual Property:

Provisional-Patent, 2022-02-09, United States | Utility Patent, 2023-02-08, United States