

ASK THE EXPERT

Enhancing Battery Safety: Early Detection of Thermal Runaway



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Once the domain of consumer electronics like laptops and mobile phones, lithium-ion batteries now power everything from medical devices and autonomous drones to energy storage systems and electric vehicles (EVs). The lithium-ion battery proliferation is driving the rapid expansion of the Battery Energy Storage Systems (BESS) market, which develops, deploys, and operates systems that store electrical energy for later use.

While powerful and useful, lithium-ion batteries are also susceptible to thermal runaway, a chain reaction that starts when internal heat builds up quickly and battery cells rupture, increasing the chance of fire or explosion. As the Battery Energy Storage Systems market continues to grow, the risk of lithium-ion battery-related fires is expanding exponentially.

Focused on solving complex challenges, Honeywell has been tracking the rapid uptick in lithium-ion battery usage and the related product and user safety trends. Wanting to help eliminate or minimize the risk to human life and physical assets, Honeywell developed the Battery Safety Electrolyte Detector (BES LITE) for the early detection of thermal runaway in Battery Energy Storage Systems.

In this “Ask the Expert,” Honeywell product manager **Sai Kiran Wupadrasta** explains the market needs that drove the development of BES LITE, how the sensor works, why it’s different from any other detection product on the market, and how it’s helping to improve lithium-ion battery safety across a wide range of products and applications.

What was the market need or challenge that drove the development of the BES LITE detection system?

A: Honeywell has made great strides in the general lithium-ion battery safety market, where our product lineup includes a battery safety aerosol sensor and battery safety pressure sensors that cater to the EV battery safety market. So, we understood that the lithium-ion batteries powering EVs are fairly ubiquitous at this point and power a wide range of products. For example, they're found in autonomous drones, electric two-wheelers, electric lawnmowers, and Battery Energy Storage Systems. These applications are growing by the day, and we recognized an opportunity to expand our battery safety portfolio to other domains by introducing the BES LITE to the marketplace.

What was different about the design and development of this new detection product?

A: The BES LITE was designed specifically for non-automotive markets where there is ongoing concern over lithium-ion battery safety. Where there's been a major — and very visible — focus on the EV market in this regard, we also know that autonomous drones, laptops, aerospace applications, and e-bikes are all powered by lithium-ion batteries. At the same time, more Battery Energy Storage Systems are being built around the globe. The Battery Energy Storage Systems require battery safety sensors, as evidenced by the many reports of fires and other problems within these systems. We saw this as an opportunity to develop a safety sensor that detects thermal runaway in advance and not after the fact. This is an arena we knew we could play in, so we jumped in.

How have companies traditionally managed heat and fire detection for lithium-ion batteries?

A: For the most part, battery safety issues have been dealt with by detecting thermal runaway, or uncontrolled chain reaction where internal heat escalates rapidly, potentially leading to cell rupture, fire, or explosion. The problem is that these solutions



can tell you that a problem is occurring, but by then, it's already too late in the process to take any corrective actions or countermeasures to preserve assets or improve user safety.

How does BES LITE differ from this traditional approach?

A: The BES LITE detects the electrolyte vapor venting that happens before thermal runaway occurs. As lithium-ion battery cells are damaged by overcharging or overheating, they release electrolyte gases. The BES LITE detects these gases and outputs a warning signal for the user to take precautions, steps, or measures to avoid an even bigger problem. Depending on the type and rate of abuse, the early detection time may vary from seconds to minutes.

Battery Energy Storage Systems traditionally install gas sensors at the container level to monitor for thermal runaway events. Essentially, when battery cells degrade, they release electrolyte vapors that fill the battery pack and eventually escape into the surrounding container. What sets BES LITE apart is its ability to detect thermal runaway much earlier by being installed directly inside the individual battery packs. This innovative approach enhances safety by enabling prompt responses to potential hazards.

The product is small and compact enough to fit into small battery packs. This enables easy integration in any tight space and makes the product very useful for applications like unmanned drones, which have very tight space and weight requirements.

Are there any other unique features of this new thermal runaway detection solution?

A: Yes, it has a simple three-state analog output that's easy to integrate into any application. In the nominal state, you'd have a 2.5-voltage output, and if you have this detection, you'll get a 5-voltage output. So, what the battery management system must do when it receives a 5-voltage output from BES LITE is immediately trigger the necessary countermeasures to safeguard assets and inform the personnel of the problem. The third state is the diagnostics state, when the voltage is 0V. BES LITE detects only electrolyte vapor. It is compatible with all lithium-ion battery chemistries and cell types. Finally, the BES LITE is less power-consuming, so it's great for any application that has limited power availability.

What key benefits can companies expect from using BES LITE?

A: The top benefit we offer our customers is the earlier detection of thermal events, which ultimately leads to enhanced asset protection. Our sensors are designed with resistance to cross-gas interference and Siloxane poisoning, making them suitable for critical applications where reliability is essential.

An added advantage is that these sensors are specifically engineered to detect only electrolyte vapors. This means there's no risk of false positive alarms. Such accuracy is a significant win for companies, as it ensures that only the pertinent threats are identified.

Unlike conventional sensors that monitor various elements involved in the thermal runaway process, BES LITE focuses solely on advanced thermal runaway detection through the detection of battery electrolyte vapors. This precision allows necessary countermeasures to be triggered at exactly the right time, ensuring safety measures are neither activated too late nor too early.

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