National Aeronautics and Space Administration

Power Generation and Storage

Internal Short Circuit Testing Device to Improve Battery Designs

Introduces various types of internal short circuits that trigger thermal runaway in test batteries

Batteries, such as lithium-ion for example that are sold for consumer use in portable electronic devices and other applications such as electrical cars, occasionally fail in the field over time. These cells have typically passed a wide variety of safety tests, such as those required by governmental shipping regulations and other certification organizations. Nevertheless, they sometimes fail by overheating, which triggers thermal runaway in the battery. This action may engulf the entire device such as a cellular phone or tablet-type devices. To better understand these failure modes, innovators at the NASA Johnson Space Center and the DOE National Energy Renewable Laboratory have developed a battery test device, which introduces latent flaws into the test batteries to produce an internal short circuit. This device can help battery manufacturers and testers determine which battery design will best minimize the spread of a thermal runaway-induced fire in the battery or bank of batteries.

BENEFITS

- Enhanced Energy Storage Safety: Develop new designs to pack and store each cell
- Customizable: Introduces multiple types of internal short circuits
- Adaptable: Easily integrated into test units

APPLICATIONS

- Energy Storage
- Battery Safety
- Electric Vehicles

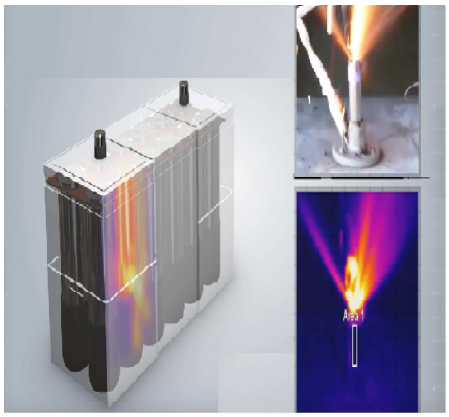
technology solution

THE TECHNOLOGY

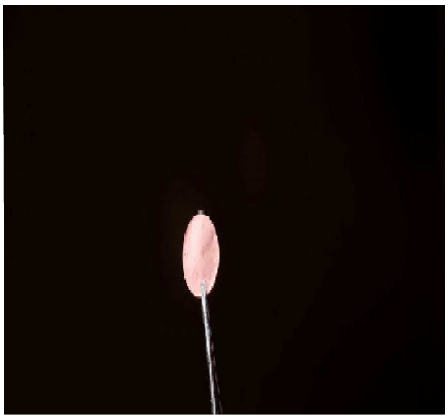
Astronauts' lives depend on the safe performance and reliability of lithium-ion (Li-ion) batteries when they are working and living on the International Space Station. These batteries are used to power everything such as communications systems, laptop computers, and breathing devices. Their reliance on safe use of Li-ion batteries led to the research and development of a new device that can more precisely trigger internal short circuits, predict reactions, and establish safeguards through the design of the battery cells and packs. Commercial applications for this device exist as well, as millions of cell phones, laptops, and electronic drive vehicles use Li-ion batteries every day. In helping manufacturers understand why and how Li-ion batteries overheat, this technology improves testing and quality control processes.

The uniqueness of this device can be attributed to its simplicity. In a particular embodiment, it is comprised of a small copper and aluminum disc, a copper puck, polyethylene or polypropylene separator, and a layer of wax as thin as the diameter of one human hair. After implantation of the device in a cell, an internal short circuit is induced by exposing the cell to higher temperatures and melting the wax, which is then wicked away by the separator, cathode, and anode, leaving the remaining metal components to come into contact and induce an internal short. Sensors record the cell's reactions. Testing the battery response to the induced internal short provides a 100% reliable testing method to safely test battery containment designs for thermal runaway.

This jointly developed and patented technology is available for your company to license and develop into a commercial product. NASA does not manufacture products for commercial sale.



Battery is being tested by inducing the Internal Short Circuit method to one of the cells while introducing heat.



Dime-sized coin made of aluminum and copper is used to induced shot circuits in lithium-ion batteries.

PUBLICATIONS

Patent No: 9142829

More Information

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