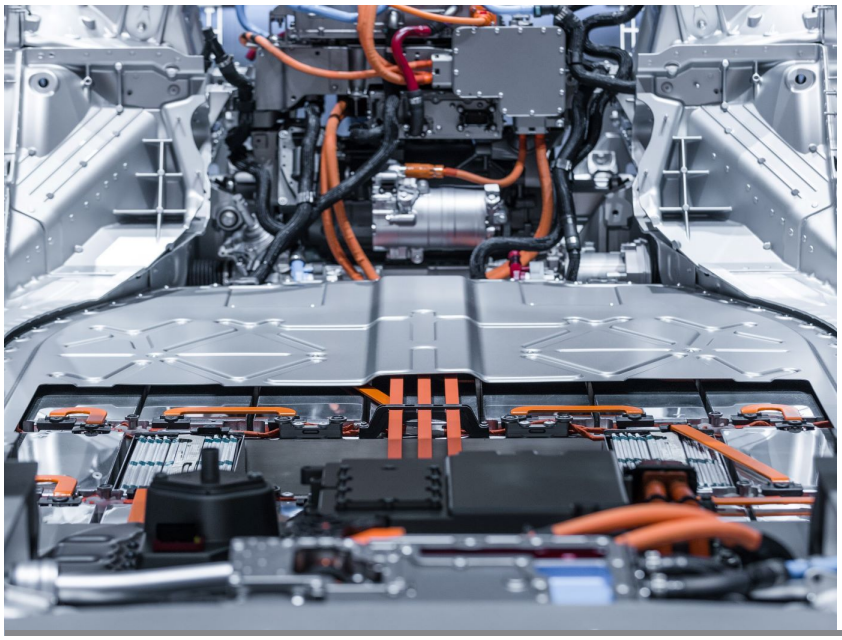

National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Power Generation and Storage

Triggering Li-ion Battery Cells with Laser Radiation

Non-invasive method precisely triggers thermal runaway

Innovators at NASA Johnson Space Center have developed a high-powered infrared (IR) laser that can trigger Li-ion battery cells into thermal runaway (TR) without perforating the battery's can wall like previous methods. Inducing TR in a battery cell allows engineers to test and improve the safety performance of overheated batteries that can potentially catch fire or explode. The primary advantage of this method is the heat energy delivered by the laser can be localized to the exact target spot on the battery cell minimizing thermal biasing to adjacent cells. This laser method does not require any internal modification of the test subject cell design nor require patch heating to trigger a short-circuit. Triggering Li-ion Cells with Laser Radiation could work on any commercial battery cell design with only exterior surface treatment required, which can be done by the user.

BENEFITS

- No internal modifications required to the test cell
- Helps determine response to localized internal short circuit that resembles defect-induced catastrophic field failures
- Method easily replicated by battery developers for battery safety verification tests
- IR laser method can test battery assemblies with minimal thermal biasing to adjacent cells

THE TECHNOLOGY

This technology is based upon a 120-watt IR laser is coupled to a fiber optic cable that is routed from the output of the laser into a series of focusing optics which directs energy onto a battery cell mounted to a test stand. When activated, heat from the laser penetrates the metal housing, heating the internals of the cell. At a specific temperature, the separator in the first few layers of the cell melts allowing the anode and cathode to make contact and initiates an internal short circuit. The internal short circuit then propagates throughout the battery eventually causing thermal runaway. The lower the wavelength of the laser used to produce the thermal runaway, the more heat-energy will be absorbed into the cell producing a faster result. The fiber optic cable can be terminated into a series of optics to focus the laser at a specific target, or the fiber optic cable can be stripped bare and placed next to the target to heat an isolated location. This method can also be used on a wide variety of cells, including Li-ion pouch cells, Li-ion cylindrical cells and Li-ion Large format cells.

The innovation Triggering Li-ion Cells with Laser Radiation is at TRL 6 (which means a system/subsystem prototype has been demonstrated in a relevant environment) and the related patent application is now available to license and develop into a commercial product. Please note that NASA does not manufacture products itself for commercial sale.

Shown: The red arrows highlight the radial direction of TR propagation, and the yellow arrows highlight the direction of peeling and shift of the electrode assembly.

APPLICATIONS

The technology has several potential applications:

- All human-occupied vehicular transport applications that require a high level of rigor in determining margins of safety (automotive, aircraft, sea vessels, spacecraft)

PUBLICATIONS

Patent Pending

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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