Fraunhofer EMI

Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI

SiKuBa: Safe and Sustainable Plastic-Based Battery Housings

Development of Methods for Virtual Design Against the Effects of Thermal Runaway

Fast Facts

Duration: 07/2023 – 06/2026

Funding Call: 7th Energy Research Programme

Funding Institution: Federal Ministry for Economic Affairs and Climate Action Germany

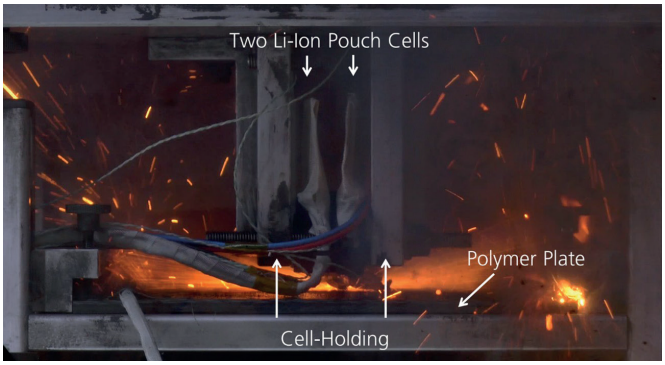
Project Management: Project Management Jülich (PTJ)

Consortium:

- Kautex Textron GmbH & Co. KG, Bonn
- Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI, Freiburg
- Farasis Energy Europe GmbH, Frickenhausen

Motivation

The safety of battery systems against the overheating of battery cells and the propagation of the resulting exothermic reaction on neighboring cells is currently primarily tested through time- and cost-intensive iterative experiments during the product development phase. Concepts for lightweight and sustainable battery housings made of plastics, which offer reduced weight, lower costs (due to higher functional integration potential and design flexibility), and increased sustainability due to a lower CO2 footprint compared to conventional metallic systems are available; however, the experimental proof of their safety is very time- and cost-intensive.



Thermal runaway of pouch cells, experimental investigation of its impact on nearby polymer structures. © Fraunhofer EMI

Scope of the Project

The SiKuBa project focuses on the development and validation of simulation models for designing safe plastic battery housings for thermal runaway scenarios. The consortium of the project consists of three partners:

- Kautex Textron GmbH & Co. KG (supplier for battery storage systems)
- Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI (research institute)
- Farasis Energy Europe GmbH (developer and producer of Lithium-Ion-Pouch-Cells)

The formation and spread of hazardous gases and particles, along with their interaction with structural elements, is investigated within the scope of the project.

Polymer based battery housing.
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Innovations and Perspective

To achieve the project objectives, the major phenomena (thermomechanical material behavior, cell degassing, etc.) are investigated on a laboratory scale, then numerically modeled and validated. At Fraunhofer EMI, numerical models are developed and physical experiments are conducted. The experimental investigations range from the characterization of the polymer material and the thermal runaway behavior of single cells to tests on realistic demonstrators. The primary focus on the modeling is the correct representation of significant heat transfer mechanisms at the housing level and the simulation of damage caused by heat input. The developed simulation methods will not only reduce development times and increase cost efficiency, but also enable the assessment of battery safety across various designs, materials, and load cases.

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