Modelling of thermal runaway propagation in lithium-ion battery packs

Fact Sheet

Project Information

LiBTR
Grant agreement ID: 896195

Funded under
EXCELLENT SCIENCE - Marie Skłodowska-Curie Actions

Start date
3 November 2021
End date
2 November 2023

Total cost
€ 224 933,76

EU contribution
€ 224 933,76

Coordinated by
THE UNIVERSITY OF WARWICK
United Kingdom

Project description

Towards improving quality and safety of lithium-ion batteries

Lithium-ion batteries are commonly used for portable electronics, electric vehicles and grid energy storage. Despite progress in the field, the number of incidents and recalls is rising. Cell abuse can cause heat accumulation and consequent thermal reactions, inducing failure and thermal runaway followed by fires and explosions. The EU-funded LiBTR project plans to develop and validate a tool for modelling thermal runaway propagation in lithium-ion battery packs. The tool will be based on a 3D model called LibFOAM, which studies the electrical and thermal behaviour of lithium-ion batteries, and the fire simulation solver of the open source computational fluid dynamics code OpenFOAM.
Objective

Lithium-ion batteries (LIBs) are widely used in many applications, such as the customer electronics, electrifying transport and energy storage systems. However, despite endeavour and progresses, the number of incidents and recalls related to LIBs are far rising. Abuse operations can result in heat accumulation and consequent thermal reactions inducing failure and thermal runaway (TR), followed by fires and explosions. The TR of one single cell in a pack can trigger a reactions chain in adjacent cells. As a result, TR propagation will occur in the battery packs. The TR propagation initializing from single cell companied with the reactions chain can activate the TR of entire LIB packs and surroundings, resulting in catastrophic fire and explosion incidents.

The proposed research aims to develop and validate a predictive tool for TR propagation in LIB packs based on LibFOAM the single cell TR model developed by the host and FireFOAM, the fire simulation solver of open source CFD code OpenFOAM. The following specific research objectives are set towards achieving this goal:
- Calibrate LibFOAM for predicting the onset of TR in a single cell under different failure modes and establish the key influencing parameters;
- Extend LibFOAM by coupling it with FireFOAM to predict the release of gases prior to and following TR initiation in the triggering cell as well as the subsequent ignition and combustion of the released gases to obtain the resulting thermal environment within the cell groups;
- Further extend LibFOAM to predict TR propagation in battery modules and packs;
- Validated the extended LibFOAM with experimental data in the literature and data to be generated by the ER’s home institution as well as proprietary data from the UK Health and Safety Executive (HSE) in an ongoing collaborative project; and
- Use the validated LibFOAM to investigate the effects of different mitigation measures to inhibit TR propagation.

Fields of science

natural sciences › chemical sciences › electrochemistry › electric batteries

Programme(s)

H2020-EU.1.3. - EXCELLENT SCIENCE - Marie Skłodowska-Curie Actions

H2020-EU.1.3.2. - Nurturing excellence by means of cross-border and cross-sector mobility

Topic(s)
MSCA-IF-2019 - Individual Fellowships

Call for proposal

H2020-MSCA-IF-2019

See other projects for this call

Funding Scheme

MSCA-IF-EF-ST - Standard EF

Coordinator

THE UNIVERSITY OF WARWICK

Net EU contribution

€ 224 933,76

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Region

West Midlands (England) > West Midlands > Coventry

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation  Website  Participation in EU R&I programmes  H2020 collaboration network

Non-EU contribution

€ 0,00

EC signature date: 3 May 2020
Last update: 26 May 2022
Record number: 229611