Vehicle Safety Institute

Influence of air supply and venting gas on the failure of battery packs

Background

A risk for fire and explosion is inherent to high-energy batteries used in modern electric vehicles. Thermal runaway or fire can occur as a result of mechanical, thermal or electrical abuse conditions.
The thermal runaway and thermal propagation behavior of cell-(stacks) are commonly investigated in enclosed reactors flooded with inert gas or unconfined with unlimited supply of fresh air. However, in a realistic case a limited air supply may be present (e.g. when the battery housing becomes partially leaky). Thermal runaway propagation may differ from test with no air supply and from tests with unlimited air supply.

Goal

Draft test setups for conducting thermal runaway/propagation experiments with controlled fresh air supply, considering the latest scientific literature and real world battery failure in electric vehicles.

Questions

- Does the battery housing remain airtight in real world accidents?
- What is the most common reason for cell failure (internal short circuit, mechanical or thermal abuse) in real world?
- What are the boundary conditions commonly used when conducting thermal runaway/propagation experiments and which measurement equipment and test rigs are used?
- Based on scientific literature: Is there a difference in terms of caloric energy, peak temperature, gas composition, thermal-runaway propagation speed … between free-field experiments (uncontrolled/free ventilation) and reactor (no ventilation/inert)?
- What are possible approaches to investigate thermal runaway with controlled limited fresh air supply? Draft test setups.

Recommended as

- Master thesis for Mechanical Engineers

Organizational

- Start: anytime
- Scholarship: min. € 2.500,- for successful completion of the thesis
- Contact: florian.feist@tugraz.at, Andrey.Golubkov@v2c2.at ; Christiane.Essl@v2c2.at