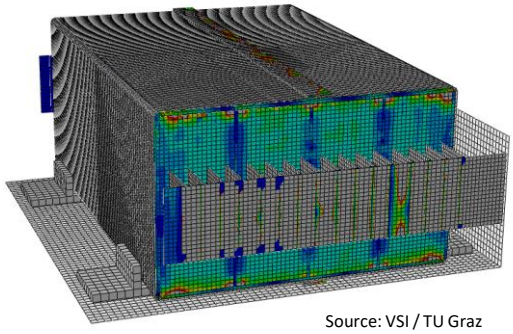
Vehicle Safety Insitute

Thermal propagation of Li-Ion cells considering breathing and swelling mechanisms

Background

In (hybrid) electric vehicles with **Li-Ion batteries** thickness of the battery cells increases reversible due to intercalation during charging and discharging ("**breathing**") and non-reversible due to ageing effects ("**swelling**"). The **thickness change** results in variable pretension forces in the battery module and an asymmetric pressure distribution over the cell body. This may influence **crash safety** of a battery module.



Source: VSI / TU Graz

Your goal in this thesis is to describe the **heat transfer** between components in a battery module under consideration of **breathing & swelling** mechanisms by the use of experimental data and numerical simulations.

Tasks

- **Get familiar** with the subjects breathing & swelling of Li-Ion batteries
- **Understand** the connection of thermal propagation and breathing & swelling
- **Develop** experimental setups and conduct experiments
- **Implement your ideas** in numerical models to simulate thermal behavior of a battery
- **Cooperate** with renowned industry partners

Literature

- Grandjean, T. et al. (2017): *Large format lithium ion pouch cell full thermal characterisation for improved electric vehicle thermal management*. In: *Journal of Power Sources* 359, S. 215–225.

- Maleki, H. et al. (2014): *Li-Ion polymer cells thermal property changes as a function of cycle-life*. In: *Journal of Power Sources* 263, S. 223–230.

Recommended as

- Master thesis for Mechanical Engineers

Organizational

- Start: anytime
- Scholarship: min. € 2.500,- for successful completion of the thesis
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