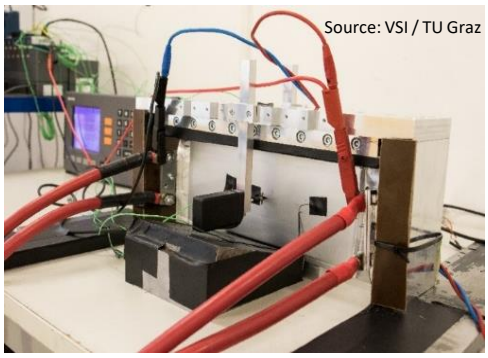
Vehicle Safety Insitute

Measurement and numerical modeling of swelling in Li-Ion battery cells for electric vehicles

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.



Your goal in this thesis is to describe the **deformation behavior** of **Li-Ion batteries** under consideration of different boundary conditions by the use of experimental data and numerical simulations.

Tasks

- **Get familiar** with the subject breathing & swelling of Li-Ion batteries
- **Understand** the connection between crash safety and breathing & swelling
- **Develop** experimental setups and conduct experiments
- **Implement your ideas** in a numerical model to simulate breathing & swelling
- **Cooperate** with renowned industry partners

Literature

- Cannarella, J.; Arnold, C. B. (2014b): *Stress evolution and capacity fade in constrained lithium-ion pouch cells*. In: *Journal of Power Sources* 245, S. 745–751.
- Oh, K.; Epureanu, B. I. (2016): *A novel thermal swelling model for a rechargeable lithium-ion battery cell.* In: *Journal of Power Sources* 303, S. 86–96.

Recommended as

- Master thesis for Mechanical Engineers

Organizational

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