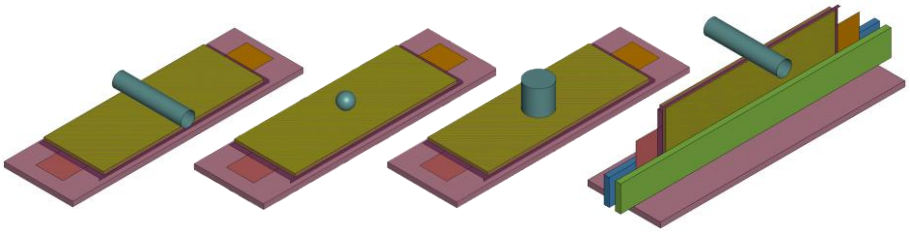
MSc – Thesis:

Beyond Uniaxial Loading: Simulative Assessment of Multiaxial Stress States in Battery Testing

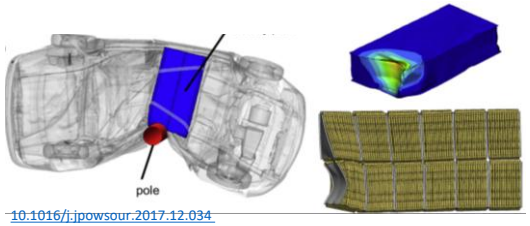
Battery4Life

Background:

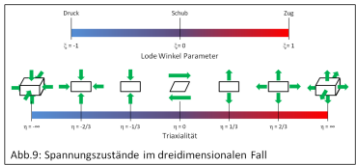
- With the introduction of new safety standards—such as the GB 38031-2025 effective July 1st—battery systems must withstand increasingly complex mechanical load cases, including hemispherical impact on the vehicle underbody. While such tests are often simplified as predominantly uniaxial loading at the cell level, the structural integration of battery packs leads to significantly more complex, multiaxial deformation states.
- At the same time, established mechanical abuse tests on cell level—such as cylindrical, spherical, or flat stamp indentation—are typically designed to represent simplified loading conditions, mainly categorized into in-plane and out-of-plane (through-thickness) directions.
- However, real crash scenarios induce combined stress states, where multiple loading directions interact. The transferability of conventional test results to these multiaxial conditions remains an open question in battery safety research.



VS.



10.1016/j.jpowsour.2017.12.034



https://ihf-ffm.de/wissen/materialversagen

Objective:

- **Investigate and quantify multiaxial stress states in typical battery abuse scenarios using suitable evaluation metrics and numerical simulation**

Tasks:

- Literature review on multiaxiality measures (e.g., triaxiality, principal stress orientation) and standard mechanical abuse test methods for battery cells respective models
- Evaluation of multiaxial stress states within these load cases
- Comparison of different loading scenarios with respect to their multiaxial characteristics
- Interpretation of results regarding transferability to real crash conditions
- Collaboration-possibility with industry partners in full-vehicle evaluations

Your Profile:

- Interest in battery safety and structural mechanics
- Basic knowledge of finite element simulation (preferably LS-DYNA)
- Structured and independent working style

Organizational Details:

- Start: anytime
- Duration: approx. 6 months
- Scholarship: €3,500 upon successful completion
- Contact: Alois Jauernig (alois.jauernig@battery4life.at)
  Markus Fasching (fasching@tugraz.at)

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