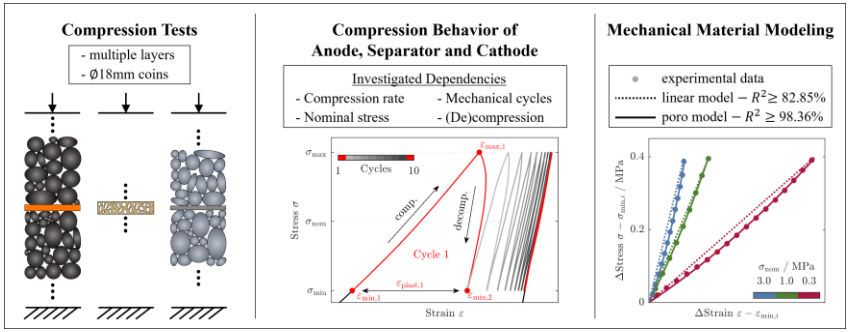
Mechanical Characterization and Modeling of Large-Format Lithium-Ion Battery Cell Electrodes and Separators for Real Operating Scenarios

Experimental

Compression tests on Graphite, NCA, and PE separators were performed, using 10 mechanical cycles instead of only 1 cycle.

- Plastic strain decreases more than 10x during 10 mech. cycles
- Higher nominal stress leads to stiffer material behavior
- No rate dependency could be confirmed

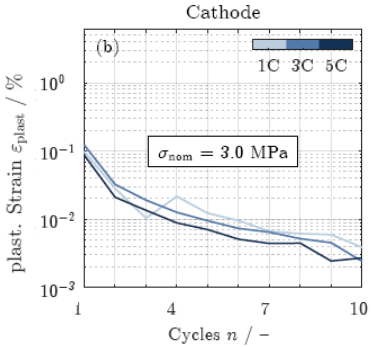


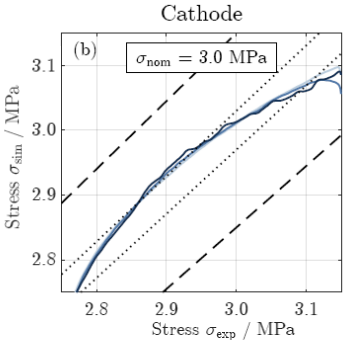
Modeling

2 material models were fitted to the exp. data.

- The poro-elastic model is superior to the linear-elastic model (Young's Modulus).
- Poro-elastic model shows overall error < 5% w.r.t. exp. data.

$$\sigma(\varepsilon) = (\sigma_0 + \sigma_t) \cdot \left(2 \cdot \varepsilon \cdot \frac{1 + \epsilon^0_{l/s}}{\kappa} + 1 \right) \cdot \exp\left[\varepsilon \cdot \frac{1 + \epsilon^0_{l/s}}{\kappa} \right] - \sigma_t$$





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