

Validation of existing approaches for modeling the crash-mechanical behavior of Li-ion cells

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Several approaches were made in predicting the quasi-static plastic behaviour of pouch, cylindrical and elliptic Li-ion cells since 2012 as summarized in the review by Kermani et al. [1]. In 2016 and 2017 the first high-velocity experiments were conducted and models have been derived [2] [3]. For automotive large format prismatic cells, no experiments and descriptive models have been reported [1]. Therefore the evaluation of existing models (isotropic/volumetric foam models, volume invariant models) is inevitable to determine their validity firstly and eventual need for action secondly.

A test series was carried out in order to investigate the crash-mechanical behaviour of prismatic cells and relevant findings are presented in extracts. In order to rate the accuracy of the existing approaches, respective constitutive models are implemented in Abaqus explicit materials and simulations of the experiments of prismatic cells are undertaken. True-predicted plots are used afterward for visualization of the qualitative correlation between experimental data and models. Calculating general statistic correlation coefficients gives quantitative criteria for assessing predictive quality. Limits in current approaches conclude the contribution.

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