Investigation of Drying of highly-concentrated particulate granular systems for Battery Applications

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Motivation
State of the art electrode coating processes require relatively low solid contents (15-50 wt.%)
- long drying times
- high energy and investment costs
- high solvent content causes segregation of inactive electrode components

New Approach:
- usage of granules from energy-efficient extruder process as input material
- reduction of the solvent content in electrode-processing
- Storage stability of the input material over several weeks
- increase in production flexibility due to decoupling of material and electrode production
- Coating and calendering in one process step

Challenges
- highly-concentrated particulate granule system
- novel granule-based coating with compacted microstructure due to calendering step before drying

Understanding the drying-step of highly-concentrated particulate granule systems
Influence of novel granule-system on:
- film shrinkage - calendered film with low solvent content
- pore structure - different pore structure due to early calendering step
- binder migration - reduced solvent content and different microstructure
- post-drying - sorption behaviour of new material system

Experimental Approach
Gravimetric Drying Test
- drying under defined conditions
- investigation of the drying kinetics

Digital Microscope
- coating on transparent substrate
- investigation at the beginning of pore emptying
- breakthrough of air-filled pores on substrate

Methods

Gravimetric Drying Test: Exemplary representation of a drying curve
Digital Microscope: Progression of pore emptying of an electrode film viewed from below

BIB-preparation / freezing
Cryo-BIB-SEM: EDS carbon maps for four different film cross-sections at specific times

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