Drying influence on film properties of lithium-ion battery electrodes

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Lithium-ion batteries are prevalently used as power supply in consumer products but are receiving more and more attention for stationary energy storage and mobility applications. Besides new enhanced materials, the investigation of processing conditions has a great potential for optimization of electrode morphology and performance. Composite electrodes for lithium-ion batteries are produced typically by a coating and subsequent solidification step in a roll-to-roll process.

For this contribution the processing of electrodes with different particulate active materials and a polymeric binder was investigated. The electrode materials were dispersed in a solvent and coated on metal foils as current collector. The solvent was removed by a drying step and the electrode layer solidified. In this process step a porous network is formed and defines the electrode morphology. The drying step was investigated in temperature controlled drying channels with known and constant gas flow conditions. Drying rates were varied by adapting drying temperatures and transfer coefficients. The results of numerical simulations of the drying curve are in good agreement with the experiments and are the basis to model the drying and solidification of the porous particle-polymer composites used as electrodes for lithium-ion batteries. The dry films were characterized and show an influence of solidification conditions on electrode properties. This underlines the critical role of processing for the further development of lithium-ion batteries.