Electrode coating via various slot-die coating techniques and associated performance

Jianlin Li[1], Zhijia Du[1], Yangping Sheng, Claus Daniel[1,2], and David Wood[1,2]

[1] *Energy and Transportation Science Division,, Oak Ridge National Laboratory, Oak Ridge, TN, 37832, USA*
[2] *Bredesen Center for Interdisciplinary Research and Graduate Education, University of Tennessee, Knoxville, TN 37996, USA*

Corresponding author: lij4@ornl.gov

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A much further increase in energy density of lithium-ion batteries is still required to extend the driving range of electric vehicles (EVs). One of the strategies to address this challenge is to engineer cell architechture and increase the volume ratio of active materials in the battery pack. To this end, two approaches can be adopted. One is increasing the active material ratio in the electrode formulation which can be realized by reducing the content of inactive material, such as binder and conductive additive. The other approach is to increase the electrode thickness, which allows for reduction of other inactive components in the cells, such as current collectors and separator. However, the latter approach creates challenges in preserving electrode coating quality when increasing electrode coating thickness. Commom problems include delamination of electrode from current collector (adhesion) and electrode cracking (cohesion). Maintaining electrode integrity and good adhesion to current collectors is essential.

This work investigates the processibility of electrode coatings via two slot-die coating protocols while maintaining constant electrode thickness. Two coating techniques are applied: single and dual slot-die coating. In the first protocol the electrode is coated in one trial by either the single or dual slot-die techniques. For comparison, in the second protocol the electrode is coated in two trials by the single slot-die technique, where the second layer is deposited on the first one after it has been pre-dried. The electrodes are characterized in terms of adhesion between electrode and current collector, electrode mophorlogy and microstructure, and electrochemical performance.

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