Processing of Thick Electrodes for Li-Ion Batteries with Increased Microstructure Homogeneity

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ISCST - 20180918AM-B-MD5

Presented at the 19th International Coating Science and Technology Symposium, September 16-19, 2018, Long Beach, CA, USA†.

Extended Abstract:

Anodes for lithium-ion batteries are particulate films building a complex microstructure consisting of the active material - usually graphite - and the functional additives, such as binder and carbon black. During drying, the active material forms a porous network, while the additives are distributed within this network. Drying parameters highly influence the distribution of additives within these films, leading to increased inhomogeneities for higher drying rates. This behavior has also been found when processing thick electrodes, which have grown in importance due to their potential to lower prices and increase the volumetric capacity of lithium-ion batteries.

This work aims at processing thick anodes for lithium-ion batteries. Slurry mixing intensity has been varied resulting in slightly different particle sizes and thus pore size distributions. This has been found to affect drying behavior and thereby binder migration resulting in different mechanical properties of the dry electrodes while the overall composition was kept equal.

In Figure 1 the cross sections of two dry electrodes are compared, that differ only in their slurry preparation method not in their composition. A slightly smaller active material particle size and a decreased porosity can be detected at the electrode prepared at higher shear rate.

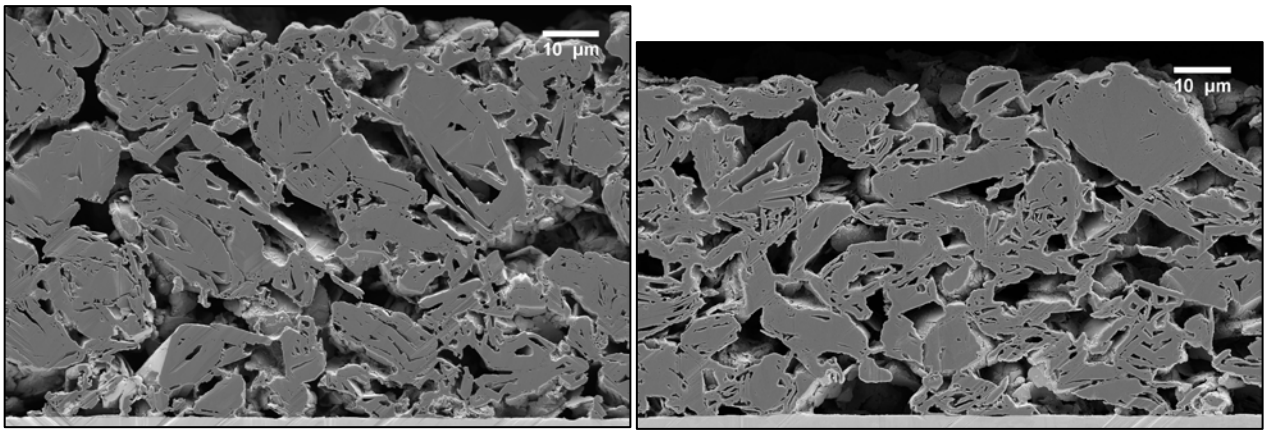

Figure 1: SEM cross section of state of the art lithium ion battery anodes. Lowly sheared anode with slightly bigger active material particles and a higher porosity (left) compared to a highly sheared anode with reduced porosity (right). Material composition is the same for both anodes.

Thick anodes prepared from slurries mixed at higher shear rates have proven to show less binder migration during drying compared to those mixed at lower shear rates. Thus, a way to process thicker electrodes is suggested and its influence on battery performance is evaluated.

The authors acknowledge financial support by the Federal Ministry of Education and Research (BMBF) via the ProZell cluster project HighEnergy (contract number 03XP0073B).