Reconstruction of microstructure from insufficient random section images : Application to battery electrodes

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Performances of a lithium-ion battery are significantly affected by a microstructure of an electrode consist of active materials, conducting additives, and polymeric binders. Nowadays, researchers have modified a microstructure of the electrodes as well as its materials to achieve high energy and power density. [1] Here, we proposed a method to reconstruct the microstructure of the electrode from insufficient random cross-section images obtained by a focused ion beam scanning electron microscope (FIB-SEM), for quantitative structural analysis . The particle size distribution was estimated with regularization by simple optimization followed by probabilistic transformation. [2] Furthermore, various structural information such as an tortuosity and effective ion conductivity were extracted employing random walk simulation.

[1] Pikul, J. H., Zhang, H. G., Cho, J., Braun, P. V., & King, W. P. (2013). Nature communications, 4, 1732.
[2] Blödner, R., Mühlig, P., & Nagel, W. (1984). Journal of Microscopy, 135(1), 61-74.