Synchrotron X-ray Tomography of Lithium Ion Battery Electrodes

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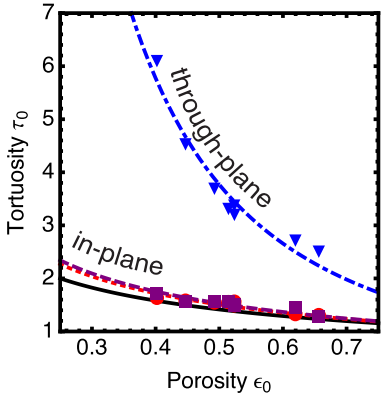
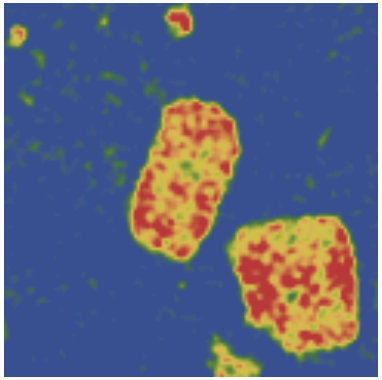
Reconstructing 3D porous electrodes



Quantifying electrode microstructure



Visualizing materials and electrodes during operation

Abstract:

Lithium ion batteries have revolutionized mobile electronics and are well suited to enable new applications such as electro-mobility and balancing the electric power grid. Lithium ion batteries have seen continuous improvement in energy density and lifetime, and methods to increase safety and reduce costs enter the markets. Great progress has been made in the last two decades to understand the phenomena governing the performance of battery materials. Qualitatively, electrode microstructure has been identified as a key property governing the charging and discharging rate, battery lifetime and failure of cells. However, detailed studies quantifying these relations have been hindered by experimental challenges. This is in part due to the limited experimental techniques available to battery researchers.

The goal of this talk is to apply x-ray tomography as a quantitative visualization technique to electrodes and materials that are relevant to industry today, as well as to materials that might replace them in the future.

The content of the following papers will be discussed:

- M Ebner, F Geldmacher, F Marone, M Stampanoni, V Wood, Adv. Energy Mater. 3, 845 (2013).
- DW Chung, M Ebner, DR Ely, V Wood, RE García, Modelling Simul. Mater. Sci. Eng. 21 (2013).
- M Ebner, DW Chung, RE García, V Wood, Adv Energy Mater 2013 DOI: 10.1002/aenm.201301278.
- M Ebner, F Marone, M Stampanoni, V Wood, Science 342, 716 (2013).