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Dynamics of the Lithium-Distribution in commercial LFP|C lithium-ion batteries under charge/discharge

Operation of typical lithium-ion battery is supplemented by the continuous mass transfer, which affects the ionic transport through the electrodes and electrolyte. Ionic transfer is defined by different factors like electrode dimensions and geometry, current density, temperature, pressure, reaction rate etc. All these properties are not necessarily uniformly distributed and, therefore, can affect heterogeneities in lithium concentrations in the cell electrodes [1, 2].

Typically, the lithium distribution in the graphite anode was probed at cells in fully charged and well equilibrated state, leaving the evolution of lithium distribution under real cell charging unclear.

In the current work, the lithium-ion distribution in a graphite anode and a lithium-iron-phosphate cathode were studied using a combination of spatially-resolved neutron-powder diffraction (anode) and X-ray powder diffraction (cathode) during the cell charge/discharge. It will be shown, that different inhomogeneities occur on different length scale still complementing each other.

[1] Senyshyn, A., et al., Homogeneity of lithium distribution in cylinder-type Li-ion batteries. Scientific Reports, 2015. 5(1): p. 18380.

[2] Petz, D., et al., Heterogeneity of Graphite Lithiation in State-of-the-Art Cylinder-Type Li-Ion Cells. Batteries & Supercaps, 2020, in print

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