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Aging-related changes in the Lithium Distribution of 18650-type Li-ion batteries

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Electrochemical cycling of lithium-ion batteries is supplemented by the active transport of lithium ions and electrons, which are exchanged between the cathode and anode material. Besides material properties, such exchange is facilitated by cell parameters like electrode dimensions and geometry, current density, temperature, pressure, reaction rate etc. Such parameters are neither uniformly distributed nor static in general and, therefore, serve as stabilizing factor of heterogeneous states in Li-ion batteries typically reflected in the lithium concentration distribution in the electrodes [1, 2].

In previous studies it was shown that with cell aging the distribution of the lithium-ions in the graphite anode of 18650-type lithium-ion batteries changes [3]. In this contribution, a set of cells at different state-of-health was measured with spatially resolved neutron powder diffraction. The results have shown changes of the lithium distribution over the lifetime of a commercial 18650-type lithium-ion battery.

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, 2021. 4(2): p. 327-335.
3. Mühlbauer, M.J., et al., Inhomogeneous distribution of lithium and electrolyte in aged Li-ion cylindrical cells. Journal of Power Sources, 2020. 475: p. 228690.

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