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Lithium Distribution in 18650-type Li-ion batteries over its lifetime

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During electrochemical cycling of lithium-ion batteries, ionic and electron transfer occur simultaneous, i.e. lithium ions and electrons are exchanged between positive and negative electrodes. Besides the materials properties, such an exchange is influenced by cell characteristics, such as electrode dimensions and geometry, current density, temperature, pressure, reaction rate etc. In cell designs adopting high volumetric and gravimetric densities these parameters are neither uniformly distributed nor static in general and, therefore, serve as stabilizing factor of heterogeneous state in Li-ion batteries, which is typically reflected in the non-uniform distribution of the intercalated lithium in the electrodes [1, 2].

Previous studies revealed the modification of the distribution of the lithium-ions in the graphite anode of 18650-type lithium-ion batteries upon increasing cell aging [3]. In this contribution, this effect was investigated in detail on a set of quasi-identical commercial cells with different stabilized aging states applying spatially resolved neutron powder diffraction. Details of lithium distribution over the lifetime of a commercial 18650-type lithium-ion battery were determined.

1. Senyshyn, A., et al., *Sci. Rep.*, 2015. 5(1): p. 18380.
2. Petz, D., et al., *Batter. Supercaps*, 2021. 4(2): p. 327-335.
3. Mühlbauer, M.J., et al., *J. Power Sources*, 2020. 475: p. 228690.

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