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Non-destructive quantification of lithium and electrolyte losses in Li-ion batteries using neutron powder diffraction

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Lithium-ion batteries lose part of their capacity while they are cycled. This loss is due to various side effects like formation of the solid-electrolyte-interface (SEI), loss of active lithium, etc. The rates of side effects are spatially non-uniformly distributed, due to heterogeneously distributed parameters like temperature and current density. The loss of active lithium can be related to the formation of the SEI, whereas the role of the electrolyte in the SEI formation and its correlation to lithium losses remains not fully clear so far.
Aim of the current study is a non-destructive quantification of lithium and electrolyte, their spatial distributions throughout the cell and concentration changes vs. cell fatigue. High-resolution neutron diffraction independently reveals a direct correlation between losses of active lithium in the graphite anode and these of liquid electrolyte. A non-uniform character of the losses is probed by spatially resolved neutron powder diffraction, thereby displaying the non-trivial character of active lithium/electrolyte losses and complex dynamic of the capacity fading.

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