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Determination of anodic transition metal deposition with PGAA

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The performance degradation of graphite/LiNi_{1/3}Mn_{1/3}Co_{1/3}O₂ (NMC) lithium ion cells, charged and discharged up to 300 cycles at different operating conditions of temperature and upper cutoff potential (4.2V/25°C, 4.2V/60°C, 4.6V/25°C) was investigated. A combination of electrochemical methods with X-ray diffraction (XRD) both in situ and ex situ as well as neutron induced Prompt-Gamma-Activation-Analysis (PGAA) allowed us to elucidate the main failure mechanisms of the investigated lithium ion cells. PGAA was used to determine the amount of anodic transition metal deposition. In situ XRD was used to calibrate the structure-capacity relationship and revealed slow kinetics of the lithium re-insertion into the NMC-host lattice. Ex situ XRD was then used to extract the amount of remaining lithium from cathodes and compare it to electrochemically observed capacity losses. Additional electrochemical methods then round up the picture of the cell aging investigation. The focus of the presentation will be on the determination of the anodic transition metal deposition with the PGAA technique and its relation to the aging behavior of the cells under the investigated parameters.

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