Electronic Supplementary Material (ESI) for Energy & Environmental Science.

Supplemental Information

Profiling the Nanoscale Gradient in Stoichiometric Layered Cathode Particles for Lithium-ion Batteries

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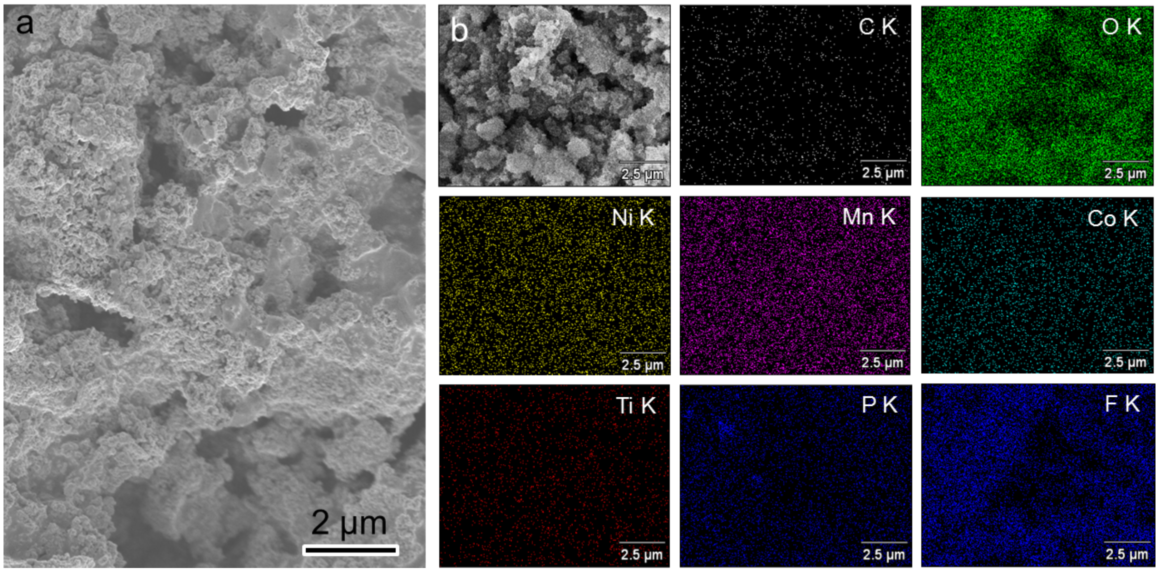

Figure S1. SEM and EDS mapping of a carbon- and binder-free NMC electrode after exposure to electrolytic solution (1 M $LiPF_6$ dissolved in EC: DMC 1:2) and being dried naturally in a He-filled glovebox. The presence of P and F is due to residual $LiPF_6$ at the surface.

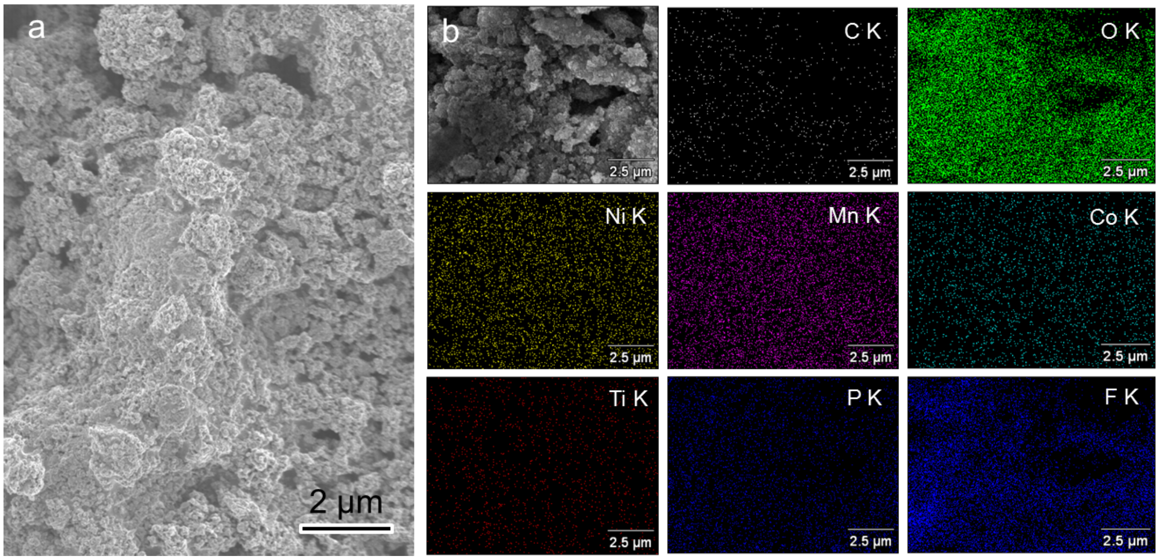

Figure S2. SEM and EDS mapping of a carbon- and binder-free NMC electrode in the charged state, rinsed by DMC and dried naturally in a He-filled glovebox. The presence of P and F is due to residual $LiPF_6$ and a surface reaction layer.

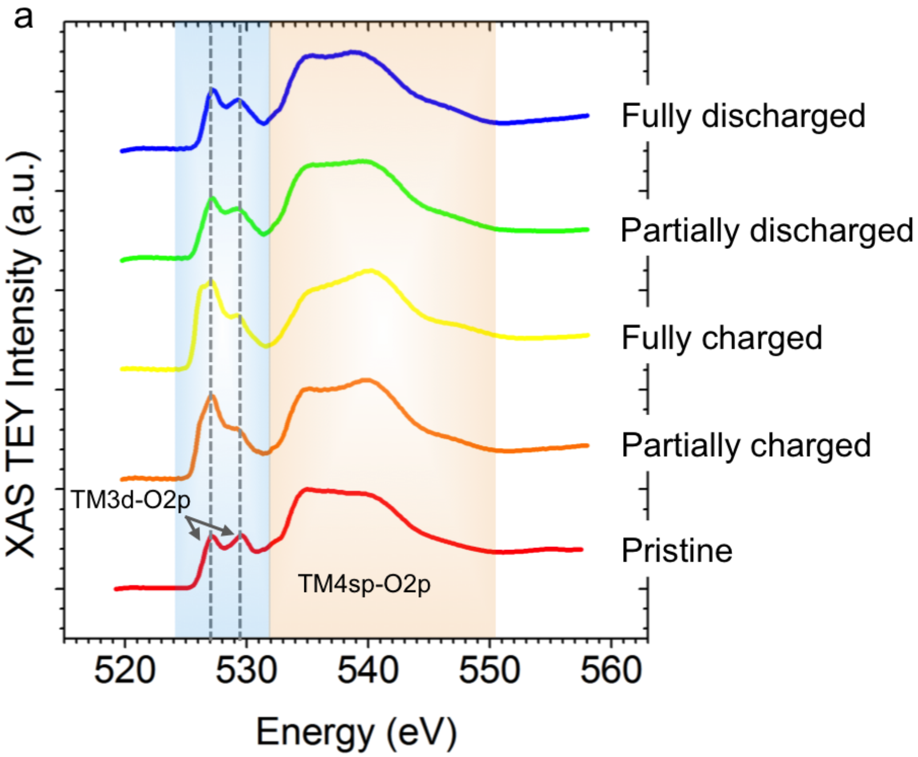

Figure S3. XAS/TEY O K-edge spectra of battery electrodes with various SOCs. The pre-edge features associated with the TM3d-O2p hybridization states in the TMO_6 crystal field are indicated by the two dashed lines in the figure. From the bottom to the top, x≈1, 0.6, 0.2, 0.7 and 0.9 in $Li_xNi_{0.4}Mn_{0.4}Co_{0.18}Ti_{0.02}O_2$).

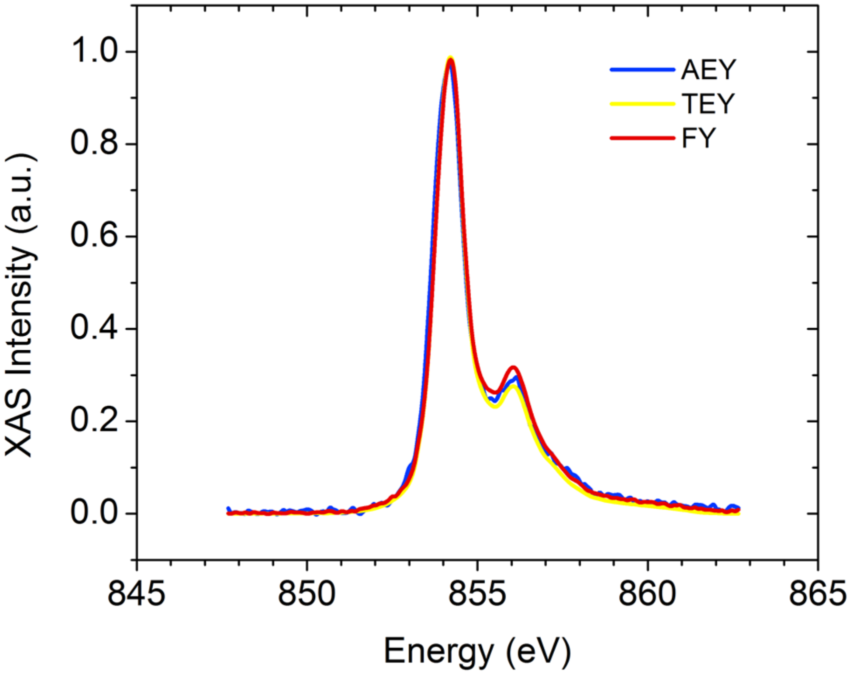

Figure S4. XAS Ni L3-edge spectra of a battery electrode in the fully discharged state (x ≈ 0.9 in $Li_xNi_{0.4}Mn_{0.4}Co_{0.18}Ti_{0.02}O_2$).

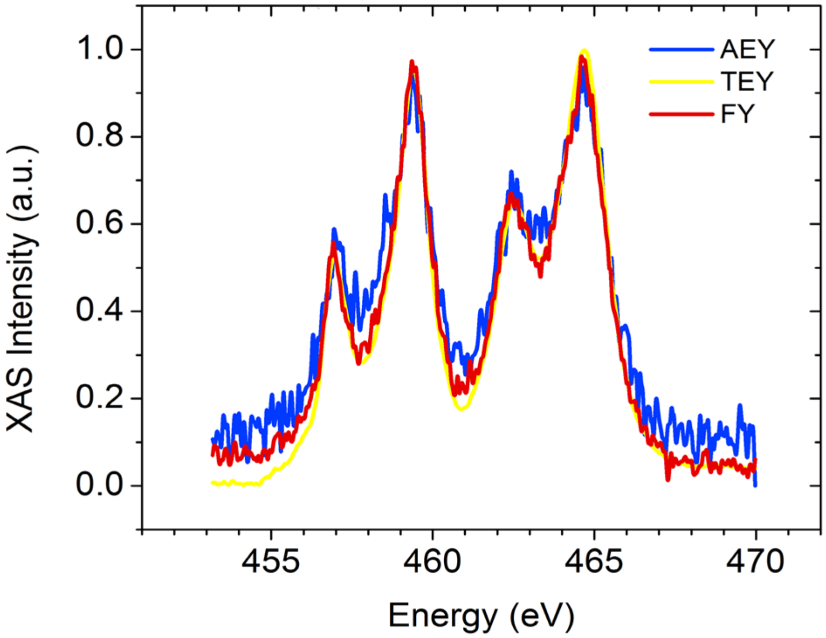

Figure S5. XAS Ti L-edge spectra of a battery electrode in the fully charged state (x ≈ 0.2 in $Li_xNi_{0.4}Mn_{0.4}Co_{0.18}Ti_{0.02}O_2$), where the most surface sensitive Auger electrons were detected for AEY collection.