Supporting Information

Structural underpinnings of the enhanced cycling stability upon Al-substitution in $LiNi_{0.45}Mn_{0.45}Co_{0.1-y}Al_yO_2$ positive electrode materials for Li-ion batteries

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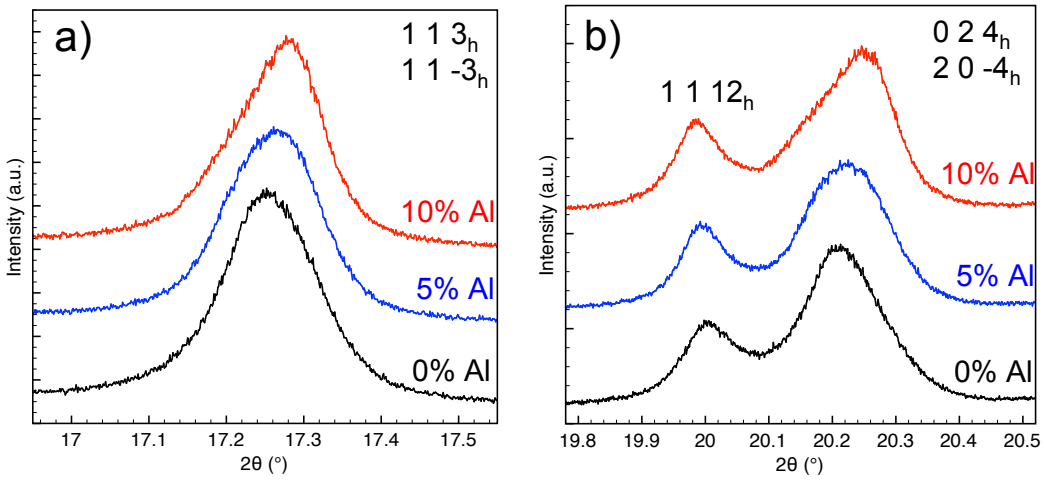

Figure S1: Peak splitting is observed with high values of Al-substitution, indicating a structural distortion within the transition metal planes.

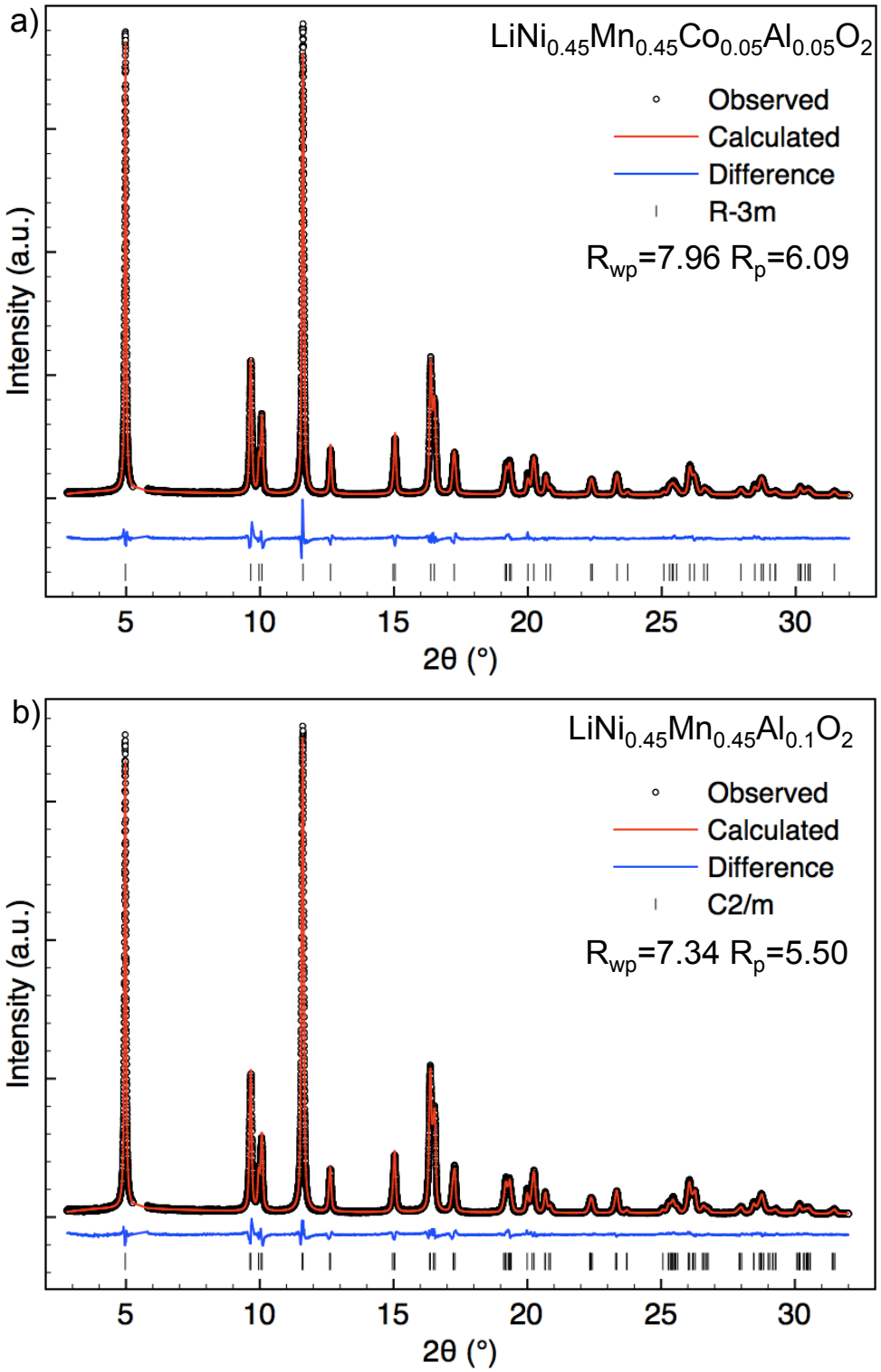

Figure S2: High-resolution XRD patterns and Rietveld refinements for $LiNi_{0.45}Mn_{0.45}Co_{0.1-y}Al_yO_2$ with a) y=0.05 and b) y=0.10.

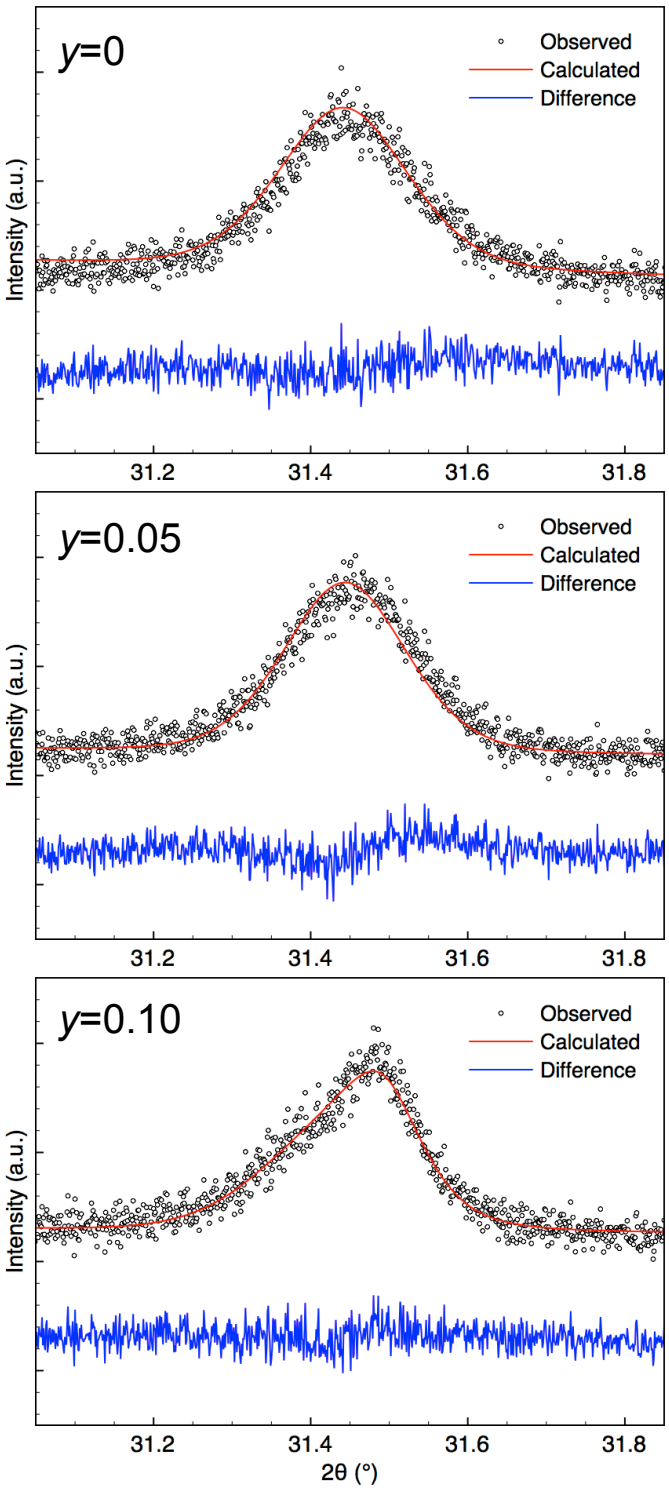

Figure S3: Magnification of the 1 2 11 reflection (*R-3m*) showing the Rietveld fits for a) *y*=0, b) *y*=0.05 and c) *y*=0.10. *R-3m* symmetry was used in (a) and (b), while *C2/m* was used for (c).

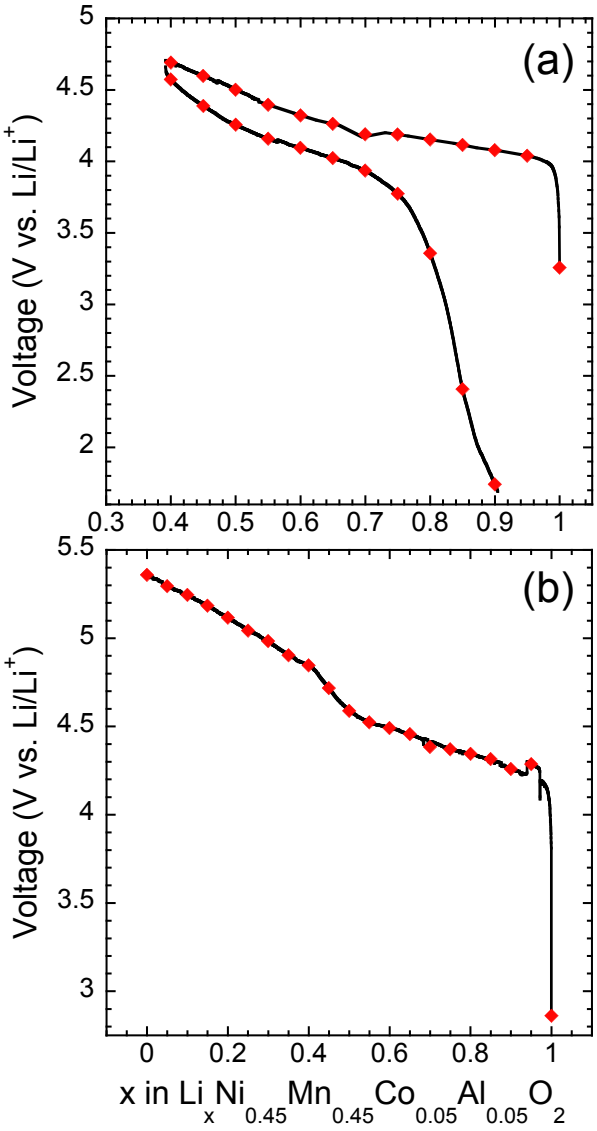

Figure S4: Voltage vs. x in $Li_xNi_{0.45}Mn_{0.45}Co_{0.05}Al_{0.05}O_2$ (y=0.05) for the first cycle during *in situ* XRD testing. Pouch cells were a) cycled, b) fully charged. The points at which diffraction data is presented are indicated.

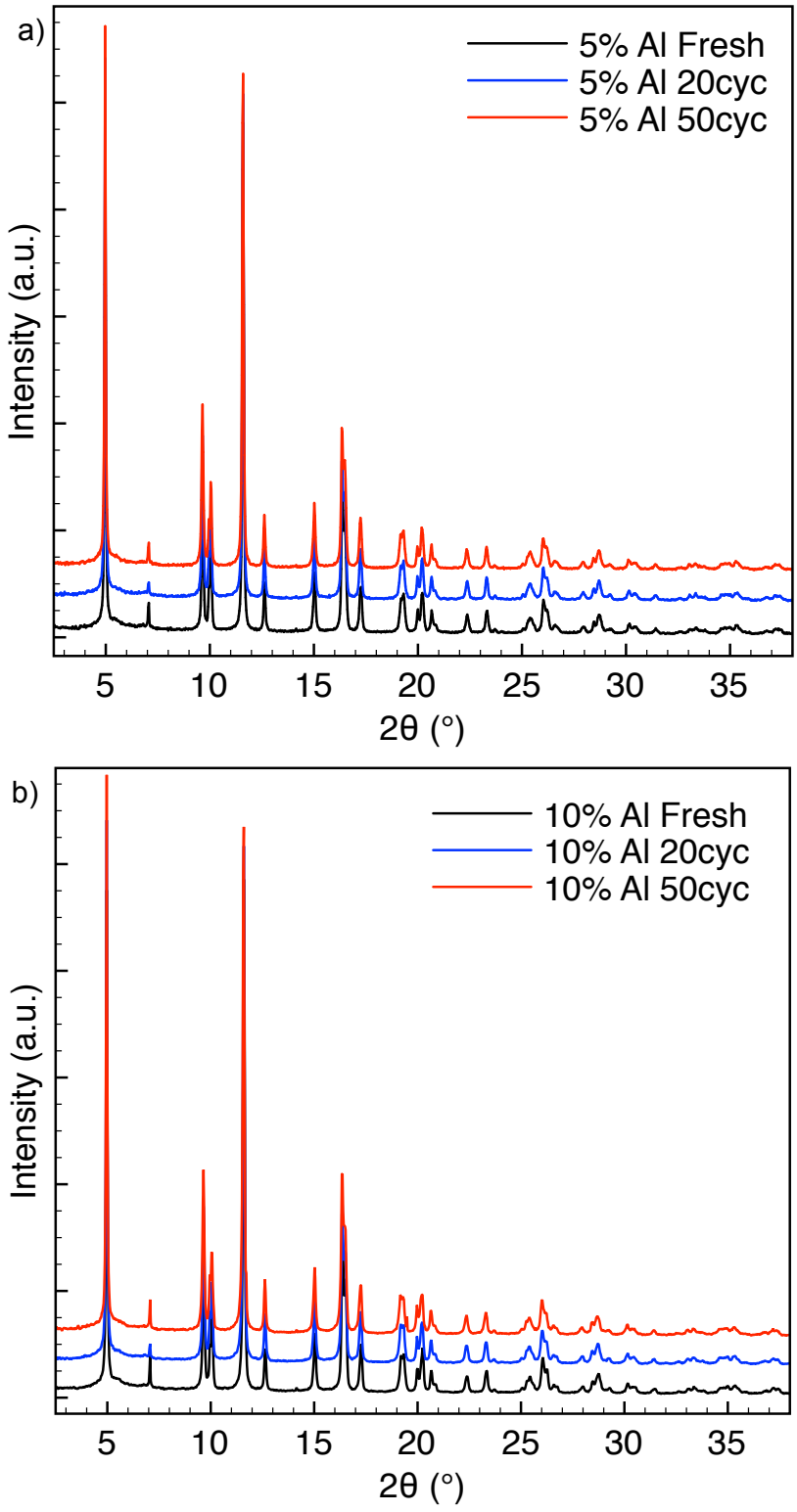

Figure S5: High-resolution XRD patterns of fresh and cycled $LiNi_{0.45}Mn_{0.45}Co_{0.1-y}Al_yO_2$ electrodes with a) y=0.05 and b) y=0.10. The small peak at ~7° 2θ is due to graphite.