

Evaluating Surface Properties on High-Density Positive Electrodes for Li-ion Batteries

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ABSTRACT

Ni-rich layered oxides ($\text{LiNi}_x\text{Mn}_y\text{Co}_z\text{O}_2$, $x + y + z = 1$, $x \geq 0.6$) holds considerably strong prospect for electric vehicle batteries, but their widespread adoption is limited mainly by the degradation associated with lattice oxygen loss, transition metal dissolution, side reaction and the growth of an unstable cathode electrolyte interphase (CEI). To mitigate this, surface nano coating of Li_3PO_4 , LiNbO_3 etc., are reportedly proven to be promising candidates.

Herein, in this work, we synthesized NMC811 through the sol-gel method using citric acid as a chelating agent followed by surface modification with different materials using a wet-coating approach to evaluate the effect of their coating on their electrochemical performance. X-ray diffraction followed by Le Bail refinement was performed to assess the presence of phase impurities and structural parameters. X-ray diffraction method were recorded at different annealing temperatures for optimizing the synthesis conditions. Scanning electron microscopy (SEM) and Energy dispersive X-ray spectroscopy (EDX) were employed to examine the surface morphology and coating distribution on the NMC811 particles. Galvanostatic charge-discharge measurements were subsequently carried out under identical testing conditions to systematically compare the electrochemical behavior of the pristine and coated NMC811 electrodes and compare their performance with commercial electrode materials. To get more insight on the variation of the oxidation state of transition metals, ex-situ X-ray photoelectron spectroscopy on Ni, Co, Mn k-edges has been performed on the ROCK beamline at SOLEIL.

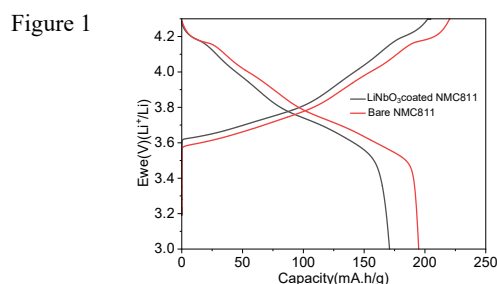


Figure 1: Cycling profiles of pristine (red) and surface-modified electrodes (black) in half-cell configuration with Li metal and LP30 electrolyte in the voltage range of 3.0 V- 4.3 V vs Li^+/Li

REFERENCES

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