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Studies of Phase Diagrams in $Li_{1-x}CoO_2$ and $Li_{1-x}NiO_2$ Cathode Materials during Cycling

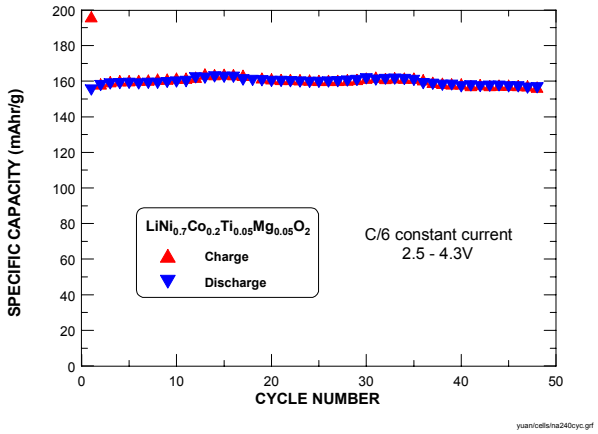
B. Y. Liaw (Univ. of Hawaii), D. H. Doughty (SNL), X.Q. Yang (BNL), and J. McBreen (BNL)

Beamline(s): X18A

Introduction: Layered cobalt and nickel-oxide-based active materials are the most widely used cathodes in commercial lithium ion cells because of high specific energy, good energy density, and reliable cell performance. More recently, it was found that cell performance often more depends on cycle capability of the cathode than anode. To improve cathode performance, we need to evaluate and understand the performance characteristics at different lithium contents or states-of-charge. Therefore, it is important to study the phase diagrams and phase relationships in these cathode systems. The literature information on the phase diagrams, especially on the phase relationships of both cobalt and nickel oxide-based cathode systems is still not very clear, in some case is even confusing. We intended to clarify some of the issues of the phase relationships in such systems with the aids from both thermodynamic aspects and spectroscopic studies.

Methods and Materials: $LiCoO_2$ and $LiNiO_2$ samples were purchased from FMC Corp. The cathodes were incorporated into cells with a Li foil negative electrode, a Celgard separator and a 1 M $LiPF_6$ electrolyte in a 1:1 EC:DMC solvent (LP 30 from EM Industries Inc.). In situ XRD spectra were collected on beam line X18A (using λ=1.195 Å wavelength). The step size of 2θ scan was 0.02 degrees. The XRD spectra were collected in transmission mode.

Results: Layered cobalt and nickel-oxide-based active materials are the most widely used cathodes in commercial lithium ion cells because of high specific energy, good energy density, and reliable cell performance.



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