Performance Impact of Surface Chemistries Developed During Ambient Exposure on Layered Oxides

Scientific Achievement

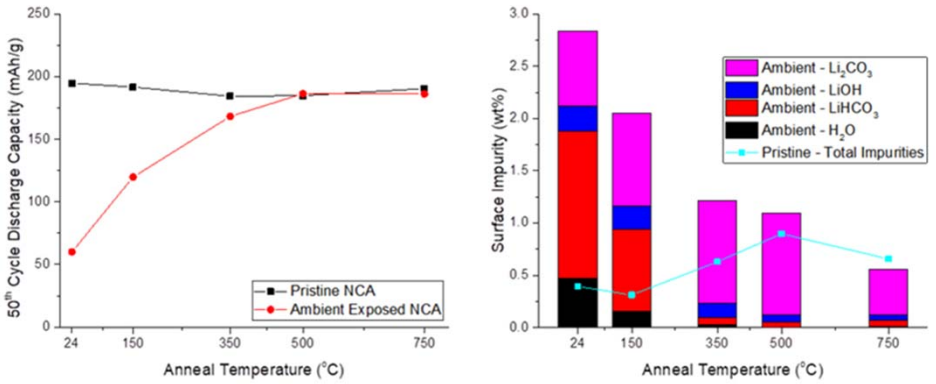
Characterized the growth of surface species on layered positive electrode materials upon exposure to ambient air and established specific impact of each specie on the electrochemical performance.

Significance and Impact

- **First to identify relative impact of each surface specie induced by ambient exposure on the electrochemical performance of batteries**
- **Showed widely held previous held belief that surface Li_2CO_3 developed during ambient exposure is detrimental to cycle life is incorrect.**
- **Practical importance as material may have partial exposure during processing and handling**

Research Details

- Exposed $Li_1Ni_{0.80}Co_{0.15}Al_{0.05}O_2$ (NCA) materials to ambient air, dry air, dry CO_2
- Characterized surface species through FTIR, TGA, Titration, XPS, XRD
- Identified development of H_2O, $LiHCO_3$, LiOH and Li_2CO_3
- Systematically eliminated each specie via thermal treatment to identify specific impact of each specie on performance



Findings: The 50th cycle discharge capacity as a function on annealing temperature for "pristine" and NCA material exposed to ambient air for 2 weeks. (L) A breakdown of the surface impurity species on Ambient exposed materials as a function of anneal, and the total impurity species on "pristine" materials (R)

Reference:

N. Faenza, L. Bruce, N. Pereira, Z. Lebens-Higgins, I. Plitz, N. Pereira, F. L. Piper, and G.G. Amatucci, "Growth of Ambient Induced Surface Impurity Species on Layered Positive Electrode Materials and Impact of Electrochemical Performance" J. Electrochem. Soc., 164 A3727-A3741 (2017); *doi:10.1149/2.0921714jes*

100% of effort was NECCES DOE EFRC

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