Comprehensive study on high-performance LiNiO$_2$ cathode

Scientific Achievement
Synchrotron x-ray characterization elucidated essential role of Li excess in electrochemical performance of LiNiO$_2$ cathodes.

Significance and Impact
Provides insight into the surface chemistry of LiNiO$_2$ and sheds light on the design of Ni-rich layered oxide cathodes for Li-ion batteries.

Research Details
– Stoichiometric LiNiO$_2$ cathodes with excellent electrochemical performance were synthesized using a solid-state method.

– High quality X-ray diffraction data at NSLS-II beamline 28-ID-2 (XPD) revealed the stoichiometry of LiNiO$_2$ with a minimal amount of cation disordering in all synthesized samples (< 2% Ni on Li site).

– The difference in the electrochemical performance of these cathode materials is correlated with the formation of NiO-type phase at the surface, as confirmed by XPS (ALS) and soft XAS (SSRL).

Synchrotron X-ray diffraction measurements on the as-synthesized LiNiO$_2$ powders (a), the particle size distribution based on SEM microscopy (b) and the electrochemical performances (c) and (d).


Work was performed at Brookhaven National Laboratory, Lawrence Berkeley National Laboratory, and Stanford National Accelerator Laboratory.