Ultrathin Lithium Conductor Coatings on LiNiO$_2$MnO$_2$O$_2$ for High Energy Li-ion Batteries

Joong Sun Park*, Chunjoong Kim*, Xiangbo Meng*, Jeffrey W. Elam*, Jordi Cabana*

a) Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division, University of California, Berkeley, CA 94720, USA
b) Argonne National Laboratory, Energy Systems Division, Argonne, IL 60439, USA

Spinels, along with their numerous metal oxide counterparts, have attracted significant interest as the positive electrode materials for rechargeable lithium-ion batteries due to their high potential, good cycling performance, and low cost. However, the potential where lithium is removed from the host phase is very high (~4.7 V vs Li$^+$/Li$^-$), which can lead to the formation of spurious reactions with the electrolyte solutions. To mitigate unfavorable side reactions with the electrolyte solutions, surface coating of the electrodes with an inactive metal oxide material has been shown to improve the performance of Li-ion batteries. Among various techniques, atomic layer deposition (ALD) has been used to deposit a thin coating of an inactive metal oxide to enhance both the durability and safety of lithium-ion batteries.

In order to systematically explore the effect of coating materials and the thickness of inactive layers on the electrochemical properties, the resulting samples were tested in both Li half cells and full cell employing graphite as an anode using constant current and rate capability experiments. In addition to electrochemical characterizations, we employed X-ray absorption spectroscopy (XAS) to better understand local electronic structure differences in ALD coated samples at different state of charge/discharge.

References