Contribution ID: **238** Type: **Oral Presentation**

Perspectives on the Crystal Growth of Oxygen and Manganese Compensated Li-Rich Layered Nanoparticles

Friday, 12 July 2019 11:40 (20 minutes)

The charge compensation of both transition metal (Mn) and oxygen in the redox reactions has driven possession of high specific capacity in Li-rich layered oxide. Although these Li-rich electrodes could achieve higher reversible capacity in energy storage systems due to the oxygen anion participating in electrochemical reaction, that is not the case because of the irreversible oxygen reaction that occurs during the initial charge cycle, resulting in structural instability due to oxygen evolution and phase transition. This study shows the impact of transition metal and oxygen compensation during nucleation and crystal growth of layered nanospherical particles. Snapshots for the Mn-compensated nanosphere display a multi-grained crystal with grain boundaries and clusters of Li-O. On the contrary, the oxygen-compensated nanosphere resulted in single crystals with minimized oxygen loss. Microstructures derived from the oxygen compensated structure illustrate domination of layered LiMnO2 polymorph whilst the loss of oxygen in Mn-compensated nanostructure promotes formation of a spinel phase owing to Mn3+ atoms migrating to the Li-layers. Understanding such reactions will contribute immensely to the design of high capacity lithium ion batteries for large scale applications.

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N/A

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Session Classification: Physics of Condensed Matter and Materials

Track Classification: Track A - Physics of Condensed Matter and Materials