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# Unravelling the failure mechanisms of high-voltage composite oxides for high-energy-density lithium-ion batteries

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As power requirements in all-electric vehicles (EVs) become more demanding, lithium ion battery (LIB) technology is expected to provide higher energy density. Implementation of high capacity and high-voltage electrodes would enhance the energy density of current LIBs. Layered lithium-manganese rich composite oxides (LMR) are identified as promising cathodes in high-energy density LIBs for EVs because of their ability to deliver high capacity (~240 mAh/g) and can be operated at high operating voltage (~4.7 V). However, practical usage of these electrodes are not feasible because of, i) first cycle irreversible capacity loss during high-voltage charging, ii) impedance rise during high-voltage hold, and iii) voltage fade after subsequent cycle which are mainly caused by structural degradation in the host LMR oxide. This presentation will focus on the findings to rationalize the structural degradation pathways in high-voltage LMR oxides by utilizing ORNL's state-of-the-art advanced materials diagnostic to unravel the i) oxygen release process during high-voltage charging, ii) lithium/nickel crystallographic site interchange during high-voltage hold, and iii) cation migration after subsequent cycling causing phase transformation.

## Biography

Debasish Mohanty has obtained his PhD in Chemistry from University of New Orleans, USA, and currently, he is a postdoctoral research associate in Materials Science Technology Division at Oak Ridge National Laboratory. His current research is focused on understanding the structure and structural degradation mechanism(s) in lithium-ion battery electrodes by applying materials diagnostic techniques and non-destructive quality control (QC) evaluation of lithium-ion battery electrodes. He has extensive experience in oxide (nano) materials synthesis and characterizing the oxide cathode materials by x-ray and neutron diffraction, magnetic susceptibility measurements, microscopy techniques.

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