Characterization of Layered Transition Metal Oxide Na-ion Battery Cathode in a Neutral Aqueous Electrolyte

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Electrochemical energy storage devices play an ever increasing role in the advancement of many modern technologies such as portable or remote electronics, electric and hybrid electric vehicles, and grid energy storage. Presently Lithium-Ion based devices dominate in applications where high energy and power capabilities are required, though questions remain regarding their cost, safety, and sustainability. Sodium-ion based battery technologies have the potential to rival the performance of current Li-ion technologies, but at a lower cost due to the natural abundance of sodium. In addition, employing a neutral aqueous electrolyte mitigates many of the safety concerns of advanced battery technologies.

This work utilizes $Na_{1.0}Li_{0.2}Ni_{0.25}Mn_{0.75}O_{\delta}$, a layered transition metal oxide Na-ion cathode material already proven in aprotic electrolytes, in sodium sulfate derived electrolyte solutions. Our studies have focused on low rate cycle life and performance characterization, in addition to high rate cycling and electrochemical impedance spectroscopy (EIS) studies of the material. Furthermore, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), and X-ray diffraction (XRD) have been used to catalogue the effects of cycling, while inductively coupled plasma optical emission spectroscopy (ICP-OES) are used to determine the extent of dissolution of those transition metals contained within the cathode electrode.

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