University of Nebraska Lincoln | NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

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## Conducting Spinel Materials for Energy Storage Applications


**Abstract:**

We propose to study the fundamental mechanism of the electrical conduction of conducting spinel, a family of transition metal oxides that are promising as electrodes materials in low-cost, high-efficiency energy storage such as the electro-chemical supercapacitors. The overarching goal of this project is to elucidate the conduction mechanism and to optimize the electrical conduction of conducting spinel using the preparation conditions for the application of energy storage. The specific science objectives are: 1) Prepare epitaxial thin film samples of spinel materials (focusing on nickel cobaltate NiCo2O4) with precision control of conditions. 2) Determine and gain fundamental understanding of the dependence of the crystal structure, microstructure, and electronic structure of spinel materials on the growth conditions, using diffraction and spectroscopy methods. 3) Elucidate the mechanism of the electrical conduction and its response to external stimuli. The success of the project will provide guidance for finding electro-chemically active and electrically conductive transition metal oxides as inexpensive electrode materials. This is critical for realizing low-cost, high efficiency, and fast conversion energy storage for large scale installations, to fully utilize the fast-growing renewable but intermittent energy sources, such as wind and solar.