

Exploratory studies of novel sodium-ion battery systems

U.S. DEPARTMENT OF

ENERGY

Energy Efficiency & Renewable Energy

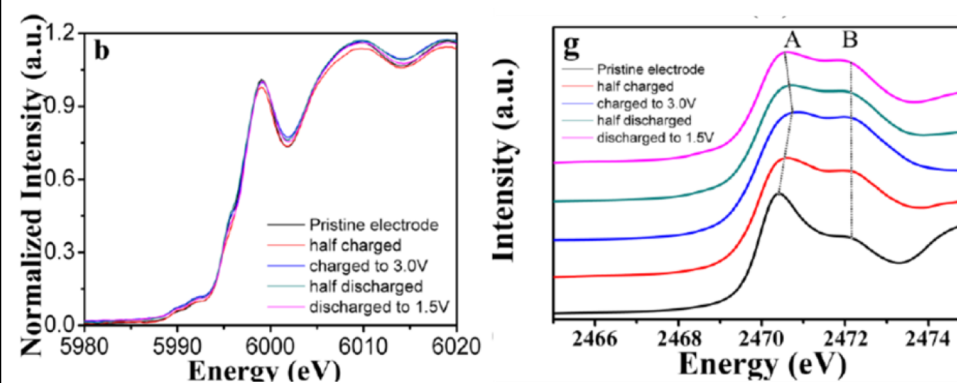
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Objective:

- To develop new advanced in situ material characterization techniques and apply these techniques (sodium-ion battery systems).
 - To provide guidance in development of Na-ion battery systems with high energy and power density, low cost, good safety characteristics and long life.
- ## Impact:
- The results of this project will accelerate the deployment of electrical vehicles.

Title of Graph:

ex situ XAS Studies of Cr (b) and S (g) valance state during various charge-discharge stages



Accomplishments:

- NaCrS₂ as an anionic redox cathode material for sodium ion batteries has been studied using XRD and XAS.
- Air-stable O3-Type cathode materials NaNi_{0.45}Cu_{0.05}Mn_{0.4}Ti_{0.1}O₂ as cathode materials for Na-ion batteries have been studied using synchrotron based XANES and EXAFS.
- Honeycomb ordered Na₃Ni_{1.5}M_{0.5}BiO₆ (M = Ni, Cu, Mg, Zn) as high voltage layered cathode materials for sodium-ion batteries have been studied

FY 19 Milestones:

- Q1: Complete In situ XRD studies of new low-cost P2-type iron based cathode materials (Na_{0.7}[Cu_{0.15}Fe_{0.3}Mn_{0.55}]O₂) during cycling.
- Q2: Complete the Synchrotron based XAS studies of (Na_{0.7}[Cu_{0.15}Fe_{0.3}Mn_{0.55}]O₂) at different SOCs .
- Q3: Complete the soft x-ray absorption (sXAS) studies of (Na_{0.7}[Cu_{0.15}Fe_{0.3}Mn_{0.55}]O₂) at different SOCs
- Q4: Complete In situ XRD studies of new stabilized global P2 phase cathode material (Na_{0.72}[Li_{0.24}Mn_{0.76}]O₂)for sodium-ion batteries during charge-discharge cycling.
- FY19 Deliverables:** Develop and apply synchrotron based XRD, XAS and TXM techniques to study the structural changes of new electrode materials for Na-ion batteries.

Funding:

— FY19: \$400,000, FY18: \$400,000, FY17: \$500,00