Exploratory studies of novel sodium-ion battery systems

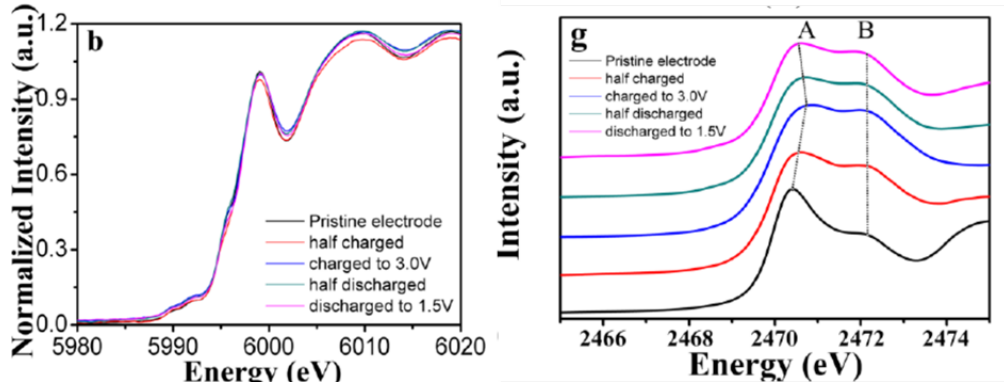
U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

PI/Co-PI:Xiao-Qing Yang (BNL) and Seongmin Bak (BNL)

- ***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 batteries 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:

- $NaCrS_2$ as an anionic redox cathode material for sodium ion batteries has been studied using XRD and XAS.
- Air-stable O3-Type cathode materials $NaNi_{0.45}Cu_{0.05}Mn_{0.4}Ti_{0.1}O_2$ as cathode materials for Na-ion batteries have been studied using synchrotron based XANES and EXAFS.
- Honeycomb ordered $Na_3Ni_{1.5}M_{0.5}BiO_6$ (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 ($Na_{0.7}[Cu_{0.15}Fe_{0.3}Mn_{0.55}]O_2$) during cycling.
- Q2: Complete the Synchrotron based XAS studies of ($Na_{0.7}[Cu_{0.15}Fe_{0.3}Mn_{0.55}]O_2$) at different SOCs .
- Q3: Complete the soft x-ray absorption (sXAS) studies of ($Na_{0.7}[Cu_{0.15}Fe_{0.3}Mn_{0.55}]O_2$) at different SOCs
- Q4: Complete In situ XRD studies of new stabilized global P2 phase cathode material ($Na_{0.72}[Li_{0.24}Mn_{0.76}]O_2$)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