Multimodal Approach Gives New Insights Of Lithium-Sulfur Batteries

Scientific Achievement
Scientists successfully employed a multimodal approach to study a new type of lithium-sulfur battery & gave a new description of its chemistry.

Significance and Impact
Lithium-sulfur (Li-S) batteries are promising new electrochemical energy storage devices but their fundamental chemistry needs to be understood.

Research Details
– Conductive metal sulfide additives such as CuS in a Li-S battery can improve sulfur cathode conductivity.
– Mechanistic understanding is important to mitigate the possible & unwanted secondary reactions.
– The battery was studied under working conditions (operando) at various beamlines at NSLS-II (see Fig.):
  • X-ray diffraction at beamline 28-ID-2 (see B) resolved the cathode structural evolution during the battery cycling.
  • X-ray microscopy at beamline 5-ID (see C) monitored the Cu species migration from cathode to anode.
  • X-ray spectroscopy at beamline 8-ID (see D) determined the chemical evolution of cathode materials.

To fully understand the fundamental behavior and the reaction mechanisms of lithium-sulfur batteries with S/CuS hybrid electrode, the scientists used three different synchrotron techniques to study the chemistry, structure and morphology of the battery.


Work was performed at Brookhaven National Laboratory and Stony Brook University.