In Situ and Operando Studies of Silver Ferrite Electrode Materials

Scientific Achievement
A new atomic stacking order was revealed in silver ferrite materials with insight into electrode (de)lithiation via ex situ, in situ, and operando measurements.

Significance and Impact
Re-chargeable, lithium-based batteries are used as lightweight power sources in many devices, and understanding their fundamental behavior can increase their efficiency as power sources.

Research Details
- Ex situ, in situ, and operando techniques were utilized to investigate electrochemically reduced (discharged) and oxidized (charged) electrodes and provided insight into the lithiation/de-lithiation mechanism of silver ferrite.
- X-ray powder diffraction at NSLS-II beamline 28-ID-2 (XPD) was used to characterize the layer structure of silver ferrite.
- A stacking-fault model matched well with the diffraction data.
- In situ x-ray fluorescence nanoprobe mapping at beamline 3-ID (HXN) at NSLS-II was used to spatially resolve the discharge process.

(Left) Side-view of the AgFeO$_2$ layered structure showing the iron atoms in brown, silver atoms in silver, and oxygen atoms in red. (Right) Iron x-ray fluorescence nanoprobe images collected from in situ cells at open circuit voltage (OCV) and discharged to 0.3 V.


Work was performed at Brookhaven National Laboratory.