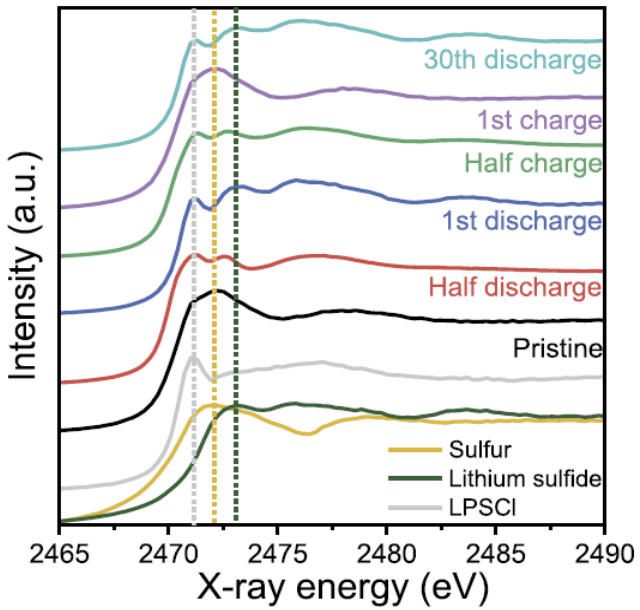
Improving Next Gen Solid-State Lithium Batteries with Halide Separation



Sulfur K-edge XANES spectra of the 5-hour ultra high speed-mixed composite S/LPSCl/C cathode at different discharge and charge states.

J. Lee, S. Zhou, V. C. Ferrari, C. Zhao, A. Sun, S. Nicholas, Y. Liu, C. Sun, D. Wierzbicki, D. Y. Parkinson, J. Bai, W. Xu, Y. Du, K. Amine, G.L. Xu. Halide segregation to boost all-solid-state lithium-chalcogen batteries. *Science* **388**,724-729(2025). DOI:10.1126/science.adt1882

Work was performed in part at NSLS-II

Scientific Achievement

Researchers discovered that mixing battery components at ultra-high-speed causes lithium halide compounds to form a protective layer around cathode particles in all-solid-state lithium-chalcogen batteries.

Significance and Impact

This fast, scalable technique improves performance, enabling a long cycle life at room temperature without extra coatings, paving the way for safer, cost-effective, longer-lasting solid-state batteries.

Research Details

- As cathode materials are mixed with halogen-containing electrolytes at 2000 rpm for a few hours, lithium halide compounds form a layer at the interface.
- The formation and performance of halide segregation was confirmed using X-ray diffraction and spectroscopy techniques at several beamlines.
- Batteries with this treatment showed almost 100% sulfur utilization and retained up to 93% of their capacity after 450 cycles at room temp.