

X-ray Visions: Operando Insights Into Functional Energy Materials

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Our need for clean energy drives widespread materials research, from energy storage in lithium-ion batteries to efficient catalytic conversions of chemical fuels to the capture of CO₂ from the air around us. Breakthroughs can be driven by discoveries of new materials or advances in the tools that we use to understand how these materials form, function, and fail. Our research uses advanced characterization tools to probe the structure of energy materials *in situ*, as they function or react. This allows us to identify how their functional behaviors are governed by their structure and chemistry. These fundamental insights serve as a road map towards next-generation clean energy solutions.

This presentation will describe new approaches that we have developed to study reactions as they happen using operando high energy synchrotron X-ray scattering and pair distribution function analysis. Through innovations in experimental approach and data analytics, we can decouple how key structural and chemical transformations are coupled across multiple length scales.

