7th SRIS Colloquium
TOHOKU FORUM for CREATIVITY
- Thematic Program 2026 Pre-event -

Multimodal Synchrotron X-ray Insights into Materials Kinetics for Energy Applications

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Abstract

Understanding the kinetics of materials is crucial for predicting their evolution under processing and operating conditions, particularly in energy-related applications where morphology, chemistry, and structure change dynamically across multiple length scales. Synchrotron X-ray techniques—integrating imaging, spectroscopy, and diffraction as a multimodal approach—offer unique capabilities to capture these transformations *in situ* and *operando*. This talk will highlight recent progress in applying synchrotron-based X-ray microscopy, complemented by multimodal analyses, to a range of functional systems for energy-related applications. Examples include electrochemical energy storage materials, where *in situ* studies reveal electrode evolution during cycling; thermochemical energy storage systems, where X-ray probes track morphological changes and phase transitions during redox cycling; and bicontinuous nanomaterials created by dealloying, where autonomous experiments integrating scattering and spectroscopy resolve structural evolution in real time. I will also discuss molten salts, where multimodal X-ray methods uncover interfacial processes under extreme conditions relevant to next-generation nuclear reactors and solar power plants. Together, these studies demonstrate how synchrotron X-ray approaches provide critical insights into materials kinetics, guiding the design of advanced energy materials.

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SRIS Building, Entrepreneur Hall

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『*Towards New Scientific Horizons with Synchrotron Radiation*』

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