



Contribution ID: 34

Type: **not specified**

Insights into Materials with Hard X-rays: Capabilities of the BAMline

Monday, September 11, 2023 5:00 PM (25 minutes)

This contribution provides an overview of the BAMline synchrotron radiation beamline, which specializes in hard X-ray spectroscopy techniques for materials research. The BAMline offers X-ray absorption spectroscopy (XAS), x-ray fluorescence spectroscopy (XRF), and tomography to study materials' electronic structure, chemical composition, and structure. Key capabilities include standard and dispersive XAS for electronic structure, micro-XRF for elemental mapping, coded aperture imaging, and depth-resolved grazing exit XAS. The BAMline enables in situ characterization during materials synthesis and functions for energy, catalysis, corrosion, biology, and cultural heritage applications.

Ongoing developments like the implementation of machine learning techniques for experiment optimization and data analysis will be discussed. For instance, Bayesian optimization is being used to improve beamline alignment and scanning. An outlook to the future, where the BAMline will continue pioneering dynamic and multi-scale characterization, aided by advanced data science methods, to provide unique insights into materials research, will be given.

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