

High energy synchrotron powder diffraction beamlines for in situ and operando experiments: status, opportunities and challenges

Wenqian Xu¹

¹N/A

wenqianxu@anl.gov

Synchrotron X-ray powder diffraction beamlines nowadays are mostly used for in situ and operando experiments. Many of the beamlines operate in an X-ray photon energy much higher than can be achieved by lab sources, in order to take advantage of the high penetrating power, which allows for greater flexibility for sample environment designs and tolerance of sample size and geometry, and is very important to the simulation of functioning conditions for operando research. The increasing Brilliance of the X-ray source and the advance of fast area detectors keep pushing data collection to higher temporal resolution, which at one side provides us with finer detail of how structures evolve or how reactions proceed. On the other side, the increasing amount of data accumulated in each experiment is becoming challenge for efficient and comprehensive analysis. Thanks to the increasing computing power and the boom of AI technology, more resources and research directions are being devoted to advanced software and automated experiment, and will eventually bring materials research at beamlines up to the next level. This presentation will give an overview of the current status of in situ and operando experiments at synchrotron high energy beamlines, introduce recent developments and advances at the Structural Science (SRS) group beamlines at the Advance Photon Source, and examine the challenges and opportunities.