

Advanced X-ray Topographic Imaging Capabilities at APS Beamline 1-BM for Materials Characterization and Optics Development

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Synchrotron X-ray topography is a fast and powerful diffraction imaging technique for non-destructive characterization of single crystals and epitaxial structures. The 1-BM Optics and Detectors Testing Beamline (ODTB) of the Advanced Photon Source (APS) is a newly refurbished beamline that has both white- and monochromatic-beam topography infrastructures and equipment. After the shutdown of NSLS, the ODTB becomes the only and unique beamline with full X-ray topography capabilities in the US, for both academic and industrial users. A detailed introduction to this beamline will be presented in this talk, including the beamline infrastructure and the experimental setups and capabilities for white- and monochromatic-beam topography. In particular, I will introduce our further development of advanced diffraction and imaging techniques, including 1) high-precision double-crystal rocking curve imaging, 2) grazing-incidence asymmetric-crystal beam expanders for large-area topography, 3) four-bounce monochromators for general rocking curve measurements and imaging of semiconductors and epitaxial structures, 4) multiple-beam diffraction-based in-plane diffraction and imaging techniques [Huang *et al.*, Appl. Phys. Lett. **105**, 181903 (2014)], and 5) transition from X-ray films to digital detectors.