Hard X-ray Multimodal Imaging at 5 to 50 nanometers

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The Hard X-ray Nanoprobe (HXN) at the NSLS-II is a scanning x-ray microscopy facility offering world-leading spatial resolutions. A specialized instrument called nano-Mii (Nanoscale Multimodal Imaging Instrument), developed at the NSLS-II, offers sophisticated multimodal imaging capabilities with flexibility of using either x-ray zoneplate or multilayer Laue lense (MLL) as a focusing optic. The zoneplate module of the instrument, with an operating energy range from 6 to $\sim$12 keV, is a preferred choice for in-situ experiments or Bragg ptychography investigation. The MLL module, offering a focused beam size of $\sim$12 nm at 12 through 20 keV is used for high-resolution imaging. Virtually all experiments are carried out by simultaneously collecting fluorescence and transmission data, where the transmission data can be visualized through differential phase contrast (DPC) and/or ptychography analysis. A few notable developments include capability of performing fluorescence tomography with a voxel size of 20 nm and ptychography imaging (in transmission or Bragg channel) with sub-5 nm pixel/voxel sizes. The presentation will include the recent developments and exciting science applications that push the frontiers of the nanoscale x-ray imaging.