

# High-Energy X-ray Nanoprobe Beamline: Visualizing Heterogeneous and Hierarchical Structures of Complex Materials

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**Abstract:** The ability to understand physical and chemical properties of materials at tiny length scales is essential to many important problems in physics, materials science, geology, and engineering. The extraordinarily high brightness of the APS-U offers great opportunities to explore the structure and structural evolution of heterogeneous materials containing high-Z elements, such as the fission products in nuclear waste, using high-energy X-ray non-resonant and resonant techniques. We propose to develop a high-energy (up to 60 keV) nanoprobe facility to address these problems using imaging, scattering and spectroscopy techniques with an unprecedented spatial resolution of better than 150 nm at 60 keV. The imaging modes integrated in the nanoprobe facility include nano-XRD and nano-PDF (both resonant and non-resonant), nano-XRF, and nano-spectroscopy of XANES and EXAFS, all necessary to extract structural information of complex materials.