Materials Characterization Using High-Energy Synchrotron X-Rays

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To address our expanding transportation and energy production and storage needs, the microstructure and chemistry of promising new materials need to be understood while they undergo synthesis and operating conditions. Multiple techniques utilizing high-energy x-rays enable one to determine the crystallographic phases present and their organization. A suite of characterization tools enabling one to understand and influence engineered materials are available at the 1-ID beamline at the Advanced Photon Source. These range from traditional powder diffraction from complex sample environments (thermal-mechanical loading, battery cells, and chemical labware) to more advanced techniques that combine diffraction and microscopy (high-energy diffraction microscopy and diffraction tomography). Examples will be discussed to highlight and demonstrate a variety of problems that can be examined.