

Addressing industrial problems using x-ray diffraction at the Advanced Photon Source

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Advanced characterization methods at the APS permit unique studies of a wide variety of industrially-relevant materials and processes through many different x-ray probes, but here we focus only on the methods of powder diffraction and strain scanning. The complementary powder diffraction beamlines at 11-BM and 1-BM will be presented, both of which provide a level of detail and sensitivity unmatched in commercial lab-based diffractometers. 11-BM uses a unique analyzer detection system to yield the high Q-resolution, while 1-BM uses area-detectors to provide large angular coverage with rapid temporal resolution. For both instruments, powder samples can be evaluated under non-ambient conditions including high/low temperatures (80-1200 K), and under elevated pressures (<10 GPa). Industrial applications from these beamlines include drug discovery, catalysis and investigations of novel complex oxides. Non-destructive strain scanning at beamline 1-ID using high-energy x-rays ($E \sim 80\text{keV}$) will also be presented. Through the use of microfocusing, a conical slit system, and an area detector, sample volumes down to a few hundred um^3 can be probed for elastic strain (through peak shifts) and plastic strain (through peak widths). Selected studies on engineered surface gradients will be shown. These instruments are available to industry both for research intended for publication (at no cost) and for proprietary work that will not be disclosed (where cost recover is mandated).