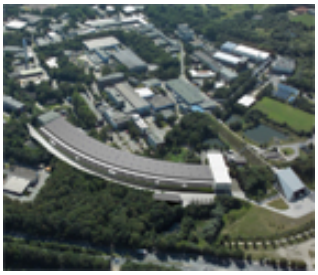

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Advancing HP-SR Research at HPCAT and HPSynC

Monday 18 May 2009 14:00 (45 minutes)

A plethora of high-pressure (HP) synchrotron radiation (SR) techniques has been developed and established at the HPCAT beamline of APS to explore the rich behavior of materials under pressure. These include HP x-ray emission spectroscopy which provides information on the filled electronic states of the HP samples, HP x-ray Raman spectroscopy which probes HP chemical bonding changes of the light elements, HP electronic inelastic x-ray scattering spectroscopy which accesses the high energy electronic phenomena, including electronic band structure, Fermi surface, excitons, plasmons, and their dispersions, HP resonant inelastic x-ray scattering spectroscopy which probes shallow core excitations, multiplet structures, and spin-resolved electronic structure, HP nuclear resonant x-ray spectroscopy which provides phonon densities of state and time-resolved Mössbauer information, HP x-ray diffraction which determines the fundamental structures and densities of single-crystal, polycrystalline, nanocrystalline, and non-crystalline materials, and HP radial x-ray diffraction which yields deviatoric elastic and rheological information. These tools, integrated with hydrostatic or uniaxial media, laser and resistive heating, and cryogenic cooling, have enabled investigations of structural, vibrational, electronic, and magnetic properties over an extensive P-T range.
To take full advantage of the rapid advancing SR brilliance, resolutions (in energy, size, and time), polarization, and coherence, a single beamline like HPCAT has its technical and organizational limitations. The extreme synchrotron capabilities, including the maximum energy to hundreds of keV, the maximum spatial resolution in tens of nanometer, the maximum energy resolution to sub-meV, and the maximum time resolution to follow the advances of a shock-wave front, would require specialized beamlines incompatible with the dedicated, HP, multi-purpose beamline. A new infrastructure, HPSynC, has been established to bridge the HP research and most APS specialized beamlines, thus unleashing the full power of the multidisciplinary HP science.

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