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The U.S. Department of Energy's

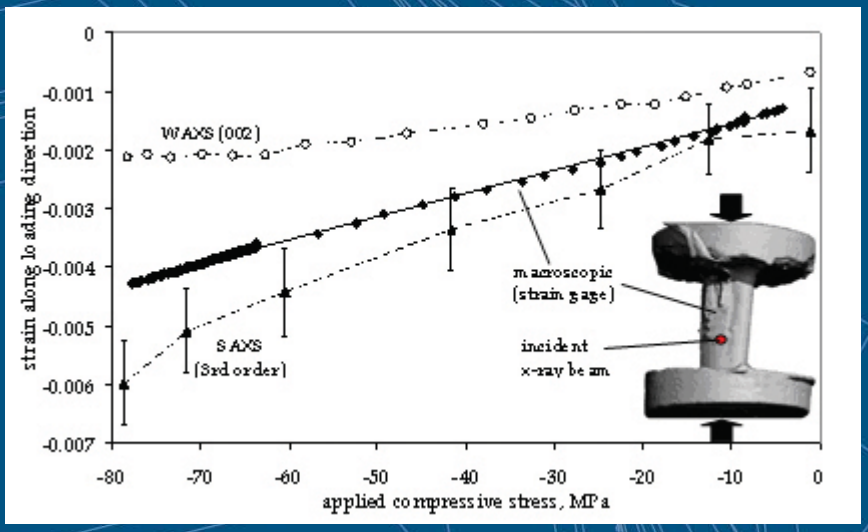
ADVANCED PHOTON SOURCE

Dedicated High-energy X-ray Scattering at the Advanced Photon Source

High-energy x-ray scattering has emerged as a major tool for the study of the mechanical properties of materials. The Advanced Photon Source (APS) produces a very high intensity of photons from 50–120 keV, and has three beamlines (X-ray Operations and Research beamlines 1-ID, 11-ID-B, and 11-ID-C) dedicated to experiments using x-rays of this energy range. The combination of high flux, considerable penetration power, and largely forward scattering make high-energy x-rays an excellent choice for the study of composition, strain, and texture in both simple and complex materials. Knowledge of these properties is essential for the improvement of many economically and scientifically important materials.

High-energy x-ray scattering at the APS has been employed for the study of many of the traditional structural materials (e.g., steel and many other metallic alloys, composites, cement, coatings). In particular, the high flux of the APS high-energy x-ray beam allows these materials to be studied *in situ* during, for example, processing or dynamical loading. Often, high-energy x-ray experiments at the APS use a beam size just a few microns in diameter, allowing the sampling of separate components in a heterogeneous environment.

Recently, this tool has been used to study natural structural materials, such as the example shown here of the response of various components of canine bone to loading. Experiments such as this one are gathering data that provide unique information that can be used to develop or verify models of deformation behavior.



Internal and macroscopic strain measured during in situ *compression of a canine fibula. The wide-angle x-ray scattering (WAXS, circle), small-angle x-ray scattering (SAXS, filled triangle) and macroscopic data (filled diamond) represent, respectively, the crystalline apatite phase, collagen phase, and composite responses to applied stress. As seen in the inset, the fibula section was potted in epoxy; the incident location of the transmitted 80.7-keV x-ray beam is indicated.*

See: J. Almer and S. Stock, "Internal strains and stresses measured in cortical bone via high-energy X-ray diffraction," J. Struct. Biol. **152**, 14 (2005).

CALL FOR PROPOSALS

At the Advanced Photon Source, our door is open to experimenters from all scientific disciplines whose research requires the highest brilliance hard x-ray beams in the Western Hemisphere.
General-user proposals for beam time during Run 2007-2 are due by March 9, 2007.
Information on access to beam time at the APS is at http://www.aps.anl.gov/user/beamtime/get_beam.html or contact Dr. Dennis Mills, DMM@aps.anl.gov, 630/252-5680.

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