Soft X-ray Scattering for Soft Materials at ALS

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Lawrence Berkeley National Laboratory — The function and properties of organic
and biological soft-condensed matter systems are largely determined by their nano-
and mesoscopic chemical morphology. The understanding and rational use of such
systems thus require that this structure be known. Using x-ray energies close to
the absorption edge of constituent atoms, soft x-ray scattering is a combination of
conventional x-ray scattering with x-ray absorption spectroscopy that yields both
elemental and chemical sensitivity. The strong resonance enhancement of the scat-
ering contrast offers large scattering signal for thin organic films with only tens
of nanometers thick. The enhanced scattering and tunable sensitivity for organic
materials can be achieved without any chemical modifications. Various scattering
geometries including specular reflectivity, transmission, and grazing incidence with
soft x-ray scattering make it a great complimentary tool for the study of soft material
thin films. By taking advantage the unique features including elemental/chemical
sensitivity, mesoscale probing size, large coherence length, and molecular orientation
sensitivity with the polarization of the beam of photons, an inherent characteristic
of synchrotron sources, soft x-ray scattering provides yet another key to unlock
structure-property relationships that will lead to better materials. A dedicated soft
x-rays scattering instrument optimized for soft materials has been constructed at
Beamline 11.0.1.2 at the ALS. Some recent results on organic PV, block copolymer
thin films will be presented.

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