



Contribution ID: 278

Type: **Invited Speaker**

Synchrotron SAXS/WAXS for nano structural investigation

Monday, November 28, 2016 2:30 PM (30 minutes)

BL1.3W: SAXS/WAXS (Small/Wide angle x-ray scattering) at SLRI is a dedicated beamline for nano-structural investigation of material that has electron density fluctuation on the length scale under 100 nm. High intensity x-ray is obtained by incorporating the synchrotron radiation from a wiggler insertion device and a double multi-layers monochromator. The beam is focused by a toroidal mirror while three four blades slit systems were used for collimation purpose. Rayonix SX165 CCD detector having the diameter of 165 mm was employed as the x-ray detector.

The beamline is equipped with sample holder where the temperature of 15-200 °C can be controlled. The sample situated in air environment can be powder, solid or liquid state. A temperature controlled tensile machine is also available for in-situ study of nano structure of material under tension. The sample to detector distance can be varied from 0.1 to 4.8 m to cover the q-range of wide and small angle x-ray scattering $0.08 < q < 35 \text{ nm}^{-1}$.

SAXS can be used to study several types of material. For nano particle in colloidal system, the size, size distribution, fractal dimension can be obtained. For protein solution, SAXS offer folding/unfolding, aggregation, shape and conformation. For polymer system, orientation and period of periodic domain in block copolymer, lamellar structure of semicrystalline polymer can be extracted. The setup for WAXS measurement is also possible for the study of crystal structure such as phase identification and calculation of crystallinity.

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Session Classification: Hornbill 2

Track Classification: Nano-electronics/systems