

W0298

Fluctuation X-ray Microscopy – a Novel Approach for Characterization of Medium-Range Order in Noncrystalline Systems. L. Fan¹, D.J. Paterson², I. McNulty¹, M.M.J. Treacy³, D. Kumar³, P. Du⁴, U. Wiesner⁴, J.M. Gibson¹, ¹Advanced Photon Source, Argonne National Laboratory, Argonne, IL 60439, ²Australian Synchrotron, Clayton, Victoria 3068, Australia, ³Dept. of Physics and Astronomy, Arizona State Univ., Tempe, AZ 85287, ⁴Materials Science & Engineering, Cornell Univ., Ithaca, NY 14853.

The characterization of medium-range order (MRO) is a challenging problem. At present no x-ray technique effectively probes MRO. We have developed fluctuation X-ray microscopy (FXM) which offers quantitative insight into MRO in materials at nanometre- and larger-length scales. FXM examines spatially resolved fluctuations of X-ray speckle patterns. Systematically measuring the speckle variance as a function of the scattering vector and the X-ray spot-size produces information about the degree of MRO and the correlation length. To demonstrate this new technique we have studied a model system comprised of polystyrene spheres. Using nanofocusing optics, we have further developed fluctuation X-ray microscopy for the study of nanomaterials. The MROs in polymer-inorganic hybrids are quantitatively determined by FXM.

Use of the Advanced Photon Source was supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. W-31-109-ENG-38.