Stevens Institute of Technology

Nanotechnology Graduate Program

Advanced Nanostructure Characterization by Synchrotron Scattering/Diffraction Techniques

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Burchard 118, 11 am

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The lecture focuses on the current status and future trends of advanced scattering/diffraction techniques to characterize the nanostructure in complex soft or hard matter. In particular, the recent simultaneous scattering and diffraction techniques and instrumentations developed at the Advanced Polymers (X27C) Beamline (http://www.bnl.gov/nsls/x27c/), National Synchrotron Light Source (NSLS), Brookhaven National Laboratory (BNL) will be described. This facility is dedicated to simultaneous small-angle X-ray scattering (SAXS) and wide-angle X-ray diffraction (WAXD) experiments. By nature, SAXS probes relatively large-scale structures, in contrast to WAXD that deals mainly with the atomic structure of crystals. SAXS includes not only the diffraction of large lattice spacing, of the order of tens, hundreds or even thousands of inter-atomic distances, but also the scattering by perturbed or non-periodic structures of amorphous and semi-crystalline materials. The state-of-the-art visualization technique for extraction of the superstructure information in reciprocal spacing from simple polymers to supramolecular systems will be described. The superstructure of materials organized on a nanoscopic length scale often determines the functionality of such systems. In this presentation, relationships between superstructure and function will be investigated for materials ranging from synthetic polymers and surfactants, both in bulk and in solution, over inorganic nanostructured materials to hierarchically organized biological systems. The biological composite material bone, consisting of inorganic mineral crystals reinforcing an organic nanofibrous matrix, will be considered in detail. In addition, several in-situ X-ray studies during polymer processing such as shearing of polymer melts, fiber spinning from gel and molten state as well as uniaxial fiber deformation will be discussed.

Benjamin S. Hsiao was born in Taipei, Taiwan. He received his B.S. degree from Chemical Engineering Department, National Taiwan University in 1980 and his Ph.D. degree from Institute of Materials Science, University of Connecticut in 1987. He carried out his postdoctoral training at University of Massachusetts from 1987-1989 before his tenure at DuPont Fibers and then Central Research and Development for eight years. Currently, he is a Professor and Chair in the Chemistry Department and an affiliated member in the Biomedical Engineering Department at Stony Brook. He is also the spokesperson for Advanced Polymer PRT (X27C) Beamline at the National Synchrotron Light Source, Brookhaven National Laboratory. He became a Fellow of the American Physical Society in 2002. He is on the editorial advisory boards of Polymer; Journal of Macromolecular Science – Physics; Journal of Polymer Research; High Performance Polymers; and Chinese Journal of Applied Chemistry. His current research interests include polymer physics (structure, morphology, property and processing) with an emphasis of nanostructured materials, and bioabsorbable polymers for biomedical and environmental applications. His research activities are currently supported by NSF, NIH, NIST, DoE, DoD and several industrial companies. He has authored and coauthored over 330 reviewed scientific papers, book chapters and reviews, 2 edited books, 9 patents, 12 patent applications and 190 conference proceedings.

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