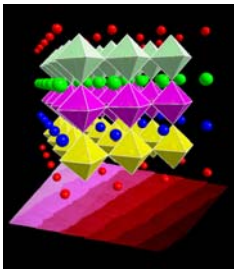
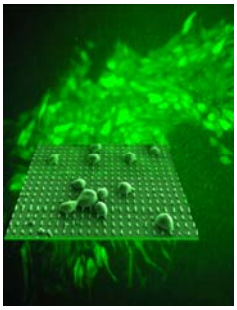
Center for Nanophase Materials Sciences (CNMS)

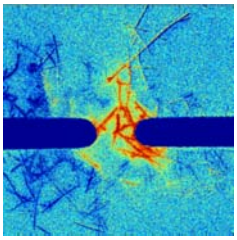
CNMS DISCOVERY SEMINAR SERIES

Joint Meeting with the

Chemical Sciences Division







Wednesday, November 1, 2006
2:00 pm
Weinberg Auditorium (4500N)

Refreshments will be served at 1:45 pm

"Neutron Scattering from Polymers and Nano-structured Composite Materials; Everything you ever wanted to know about SANS, but were afraid to ask"

George D. Wignall
Neutron Scattering Sciences Division
Oak Ridge National Laboratory

Abstract: The distinctive role of small angle neutron scattering (SANS) in polymer science arises from the difference in the coherent scattering length between deuterium (b_D = 0.66x10^{-12} cm) and hydrogen (b_H = -0.37x10^{-12}cm), which results in a marked scattering power (or contrast), between molecules synthesized from normal (H^1-lableled) and deuterated (D^2-labeled) units. Thus, deuterium labeling techniques may be used to "color" molecules and make them "visible" in the condensed state. In addition, polymers in solution may be examined by means of contrast variation methods, using mixtures of normal and D^2-labeled solvents.

This lecture will review the role SANS to provide structural information on polymers and other "soft" materials on length scales of 1-100 nm. Using a minimum of mathematics and concentrating on practical applications of the technique, it will be illustrated by examples of experiments on polymer blends (alloys), composite materials, fluids in porous matrices and micellar aggregates in various fluid media.

The combination of new steady-state and pulsed SANS instrumentation that will come on line at the HFIR and SNS in 2007 will expedite data collection from macromolecular systems, permit the study of smaller sample quantities, and facilitate kinetic (time-resolved) experiments. In addition, the synthetic capabilities provided by the *Center for Nanophase Materials Sciences* will provide opportunities for tailored synthesis and control over polymer morphology, and selective deuteration to "label" the appropriate parts of the system for scattering characterization. Particular attention will be given to various artifacts that can limit the effectiveness of the SANS technique, along with strategies to minimize these constraints.

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