

# Nanomaterials and Neutrons

## *Research Forum*

Friday, September 12, 2014 • 11:00 am  
Iran Thomas Auditorium

### Structure, Dynamics, and Properties of Block Polymer Dispersions

**Frank S. Bates**  
University of Minnesota

Block copolymers belong to a broad class of amphiphilic compounds that includes soaps, lipids and nonionic surfactants. These macromolecules assemble into micelles with molecular dimensions on the order of 5 to 50 nm in size when mixed with excess solvent that preferentially solvates one block type. This presentation will explore the fundamental thermodynamic and kinetic factors that control micelle shape and dynamics based on small-angle x-ray and neutron scattering (SAXS and SANS) experiments and cryogenic transmission and scanning electron microscopy results. Although the structural features displayed by amphiphilic block copolymers resemble those associated with the self-assembly of lipids and simple surfactants (e.g., spherical and cylindrical micelles and vesicles) a macromolecular architecture leads to unanticipated structures and remarkably different dynamic properties, linked to a vanishingly small critical micelle concentration. As a consequence, molecular exchange is rapidly extinguished with increasing molecular weight resulting in non-ergodic behavior. Experiments conducted with model diblock copolymers dispersed in water and organic solvent will be described.



Frank S. Bates is a Regents Professor and a member of the Chemical Engineering and Materials Science department at the University of Minnesota. He received a B.S. in Mathematics from SUNY Albany in 1976, and M.S. and Sc.D. degrees in Chemical Engineering from MIT in 1979 and 1982. Between 1982 and 1989 Bates was a member of the technical staff at AT&T Bell Laboratories then joined the University of Minnesota as an Associate Professor. He was promoted to Professor in 1991, named a Distinguished McKnight University Professor in 1996, department Head from 1999 to 2014, and became a Regents Professor in 2007. Professor Bates conducts research on a range of topics related to polymers, with a particular focus on the thermodynamics and dynamics of block polymers and blends. In 1988 Bates was named a Distinguished Member of the Technical Staff at Bell Labs, in 1989 he received the John H. Dillon Medal and in 1997 the Polymer Physics Prize, both from the American Physical Society where he is a Fellow. He received the 2004 David Turnbull Lectureship Award from the Materials Research Society, shared the ACS Cooperative Research Award in 2008, was awarded the 2008 Sustained Research Prize by the Neutron Scattering Society of America and he was the 2012 Institute Lecturer of the American Institute of Chemical Engineers. Bates was elected to the US National Academy of Engineering in 2002. In 2005 he was named a fellow of the American Association for the Advancement of Science and in 2010 was elected to the American Academy of Arts and Science.

- Location:

Iran Thomas Auditorium  
Spallation Neutron Source, Bldg. 8600

- For more information:

Laura Morris Edwards, NSCD, [edwardslm@ornl.gov](mailto:edwardslm@ornl.gov)  
Chris Rouleau, CNMS, [rouleaucm@ornl.gov](mailto:rouleaucm@ornl.gov)

[http://www.cnms.ornl.gov/upcoming\\_events/Bates\\_091214.pdf](http://www.cnms.ornl.gov/upcoming_events/Bates_091214.pdf)  
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