TOP GLOBAL UNIVERSITY JAPAN

JGP Seminar

Professor Timothy P. Lodge

Department of Chemistry and
Department of Chemical Engineering & Materials Science
University of Minnesota, U. S. A.

Chem&ChemEn

"Dynamics of Chain Exchange in Block Copolymer Micelles"

Block copolymers provide a remarkably versatile platform for achieving desired nanostructures by self-assembly, with lengthscales ranging from a few nanometers up to several hundred nanometers. In particular, block copolymer micelles in selective solvents are of great interest across a range of technologies, including drug delivery, imaging, catalysis, lubrication, and extraction. While block copolymers generally adopt the morphologies familiar in small molecule surfactants and lipids (*i.e.*, spherical micelles, worm-like micelles, and vesicles), one key difference is that polymeric micelles are very rarely at equilibrium. The primary reason for this is the large number of repeat units in the insoluble block, N_{core}, which makes the thermodynamic penalty for extracting a single chain ("unimer exchange") substantial. As a consequence, the critical micelle concentration (CMC) is rarely accessed experimentally; however, in the proximity of a critical micelle temperature (CMT), equilibration is possible. We have been using time-resolved small angle neutron scattering (TR-SANS) to obtain a detailed picture of the mechanisms and time scales for chain exchange, at or near equilibrium. The model system is poly(styrene-*b*-(ethylene-*alt*-propylene)) (PS-PEP), in the PEP-selective solvent squalane ($C_{30}H_{62}$). Equivalent micelles with either normal (hPS) or perdeuterated (dPS) cores are initially mixed in a blend of isotopically substituted squalane, designed to contrast-match a 50:50 hPS:dPS core. Samples are then annealed at a target temperature, and chain exchange is revealed quantitatively by the temporal decay in scattered intensity. The rate of exchange as function of concentration, temperature, N_{core}, added PEP homopolymer concentration, and chain architecture (diblock versus triblock) will be discussed.

Date/Time: Oct. 23 (Fri.), 2015, 2:00pm – 4:00pm

Place: A2-306, Katsura Campus

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