CENTER FOR RESEARCH IN SOFT MATTER & POLYMERS

CRiSP SEMINAR

Monday, May 6, 2019

10:00 a.m.

366 Colburn Lab

"Combining Theory, Experiment, and Simulation to Describe the Thermodynamics that Drive Self-Assembly in Block Copolymer Systems"

Among the next generation of technologies, we expect medical diagnostic devices that are more accurate and portable; electronic devices that are faster, smaller, and capable of storing more information; and energy sources that are cleaner without sacrificing capacity or power. Self-assembling block copolymer systems with tunable nano- and micro-structured morphologies can address these challenges. With this motivation in mind, I will present my group's work in three areas of block copolymer self-assembly. In the first part of the talk, I will discuss simulations and experiments in which a block copolymer is blended with homopolymers corresponding to the blocks of the parent copolymer; these blends allow us to increase nanostructure size. The simulations are validated against experiment and provide insight into the molecular-level chain packing within the nanostructures that are formed. Additional thin film experiments demonstrate how surface interactions lead to different phase behavior from the bulk due segregation of one of the homopolymer components to the substrate and free air interfaces. In the second part of the talk, I will discuss simulations and experiments on cyclic block copolymers, which exhibit nanostructure domain sizes 20-50% smaller than linear counterparts, to decrease domain size. Finally, I will show how equilibrium thermodynamics theory can be used to guide solvent selection for solvent vapor annealing of block copolymer thin films, a technique that is employed to control nanostructure orientation in these systems. Simulation work is performed in collaboration with Dr. Hank Ashbaugh (Tulane Chemical Engineering).

https://sites.udel.edu/udcrisp

Prof. Julie Albert

Tulane University

Dr. Albert received her B.S. in Chemical Engineering from the University of Florida in 2005 and her Ph.D. in Chemical Engineering from the University of Delaware in 2012. Subsequently, she pursued postdoctoral research studies at North Carolina State University. Albert's primary research interests are centered on engineering nano- and micro-structured block copolymer and semi-crystalline polymeric materials for applications related to technology development in the energy, health, and environmental sectors. During her doctoral studies, Albert received an NSF Graduate Research Fellowship and a Teaching Fellowship, and during her postdoctoral studies, she received the AIChE Women's Initiative Committee Travel Award in 2012. As a faculty member, in 2015, she was selected for a prestigious Early-Career Research Fellowship by the National Academy of Sciences Gulf Research Program to develop nanoporous membranes for enhanced oil recovery from spills. In 2016 she was awarded a National Science Foundation Early-Career Development Program Grant (NSF-CAREER) to study the effects of solvent vapor processing on polymer thin film morphology. In addition to her research-related activities at Tulane, Julie also serves as the faculty advisor for the undergraduate Society of Women Engineers (SWE) and the graduate Women+ in Science and Engineering student organizations on campus. In 2017, she was selected for the Academic Leadership for Women in Engineering (ALWE) Program and an ASSIST Travel Grant to attend the workshop held during the SWE National Conference.

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