Physics Seminar

Dr. Robert Wickham

Friday October 24, 2008
PSC 3046
4:00 pm

Macromolecular Self-Assembly in Confined Spaces

Self-assembly in macromolecular systems provides a convenient route to create structure at the nanoscale. These structures have potential applications as, for example, lithographic templates for nanowires, photonic crystals, and high-density magnetic storage media. Confinement effects, produced by boundaries, influence the self-assembly process and can generate novel nanostructures. The high degree of recent interest in confined self-assembly arises, therefore, from potential applications of these new structures, and also from the fundamental question of understanding the role that confinement plays in influencing the mechanism of self-assembly. The application of self-consistent field-theory to study diblock copolymers confined in cylindrical and spherical nanopores has enabled my group to perform accurate, extensive studies of the phase boundaries and stability regions for the various domain structures that form in these systems. Our study reveals an intricate phase diagram, with many phases (mixed phases, perforated layers, helical phases) that have no stable analogue in the bulk. Some simple explanations for the structure of the phase diagram under confinement will be given. Our results are consistent with experimental observations and Monte Carlo simulation and, taken together, these data suggest a certain universality to the sequence of structures formed.

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