

Physical Chemistry Seminar

Tuesday,
October 14, 2014

11:00 am

Room 1315
Chemistry Building

Confined Glassy Properties and Constrained Volume Processing of Polymer Nanoparticles



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Host: Professor Mark Ediger

In this talk, we discuss two important themes in contemporary polymer science: nanoscale confinement effects on polymer properties and new routes of processing nanomaterials, i.e., nanoparticles. Concerning the former, significant effort has been devoted to pursuing an understanding of the glass transition temperature of polymers confined to the nanoscale. Much of our understanding has been obtained via studies on thin polymer films. Here, we show the glass transition temperature of polymer nanoparticles can deviate significantly from the bulk value. Our work suggests a common origin of size effects of the glassy properties of confined polymers, irrespective of geometry, that is, interfacial effects. We also discuss the influence of surfactants and the dispersing media on the glass transition temperature and fragility of polymer nanoparticles as well as make a connection between size effects on fragility and a characteristic lengthscale. With regards to the later theme, we will demonstrate a strategy for the self-assembly of multi-faced nanoparticles through the precipitation-induced, rapid spinodal-decomposition of polymer phases within a confined solution volume. Using a two-faced Janus particle assembled from two simple homopolymers as a model system, we demonstrate the ability of the method to provide simultaneous control over particle size, surface functionality, and compositional anisotropy as the assembly process is scaled. Furthermore, we illustrate that tuning the molecular weight of the homopolymers and increasing the number of polymer components in the system can facilitate the formation of multi-faced and protruded nanoparticles, respectively. Our results demonstrate that incompatible polymers with different properties can be self-assembled into nanoparticles with controllable surface topology by simultaneously reducing the timescale and solution volume over which they undergo self-assembly.

Refreshments will be available prior to the seminar at 10:45 a.m. outside room 1315

Graduate Students may meet with the speaker at 1:00 p.m. in Room 8305F