Special Physical Chemistry Seminar

Wednesday, May 6, 2009 | **1:00 p.m.** | **Room 8335 Chemistry Building**

Crystallization at the Nanoscale: Regulating Polymophism and Other Curiosities

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Mature crystals grow from crystal nanometer-scale nuclei, which are generally accepted to have structures that resemble their mature crystalline forms. The evolution of nuclei into mature crystals becomes favorable when they achieve critical size, at which the energetically favorable volume free energy begins to outweigh the energetically unfavorable surface energy. These nuclei are thought to determine crystal properties ranging from crystal habit to polymorphism, suggesting that intervention at the nanoscale can provide new routes to regulating crystallization outcomes. Little is known, however, of the properties of organic crystals at the nanoscale or the role of size on polymorphism. This presentation will describe recent investigations of crystallization at the nanoscale, wherein organic compounds are embedded in crystalline form within polymer monoliths with nanoscale cylindrical pores and nanoporous glass matrices. Nanoscale confinement exerts dramatic effects on thermotropic properties, phase behavior, and polymorphism, often with the least stable phase in the bulk becoming favored at the nanoscale. X-ray diffraction reveals that crystal growth in nanoscale cylindrical pores proceeds with the fast growth axis parallel to the pore direction, and the addition of stereochemical auxiliaries that selectively bind to specific crystal faces can alter growth orientation. Collectively, these studies are providing insight into crystallization of complex materials at a length scale that otherwise can be difficult to probe.