Fall 2016 Lecture Series
Chemical & Biomolecular Engineering

Ionic Liquid/Block Polymer Nanocomposites: Remarkably Versatile, Functional Materials

Ionic liquids are an emerging class of solvents with an appealing set of physical attributes. These include negligible vapor pressure, impressive chemical and thermal stability, tunable solvation properties, high ionic conductivity, and wide electrochemical windows. In particular, the non-volatility renders ionic liquids practical components of devices, but they require structure-directing agents to become functional materials. Block polymers provide a convenient platform for achieving desirable nanostructures by self-assembly, with lengthscales varying from a few nanometers up to several hundred nanometers. Furthermore, ionic liquids and polymer blocks can be selected to impart exquisitely tunable thermosensitivity, by exploiting either upper or lower critical solution transitions (UCSTs and LCSTs). In selected cases, it is also possible to prepare photoreversible and photopatternable systems. Overall, by combining designed block polymers and ionic liquids we have demonstrated materials with superior performance for a remarkably diverse set of applications. These include micelles for extraction, nanoreactors for catalysis, gate dielectrics in organic transistors, electrochromic and electroluminescent gels, and membranes for gas separation, ion batteries, and fuel cells.

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