Morphology and Ion Transport in Block Copolymer Electrolytes

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The global energy crisis and an increase in environmental pollution in the recent years have drawn the attention of the scientific community to develop innovative ways to improve energy storage and find more efficient methods of transporting the energy. Polymers containing charged species have the potential to serve as electrolytes in next-generation energy systems and achieving high ionic conductivities from these electrolytes is the key to improving the device efficiency. Although the synthesis and characterization of a wide variety of polymer electrolytes have been extensively reported over the last decade, quantitative understanding of the factors governing the ion transport properties of these materials is in its infancy. In this seminar, I will present the underpinning of key factors affecting the thermodynamics, morphologies and ion transport in polymer electrolytes by focusing on the use of block copolymers and ionic liquids (ILs). Various strategies for accessing improved ionic conductivity and high cation transference number from IL-containing block copolymers are elucidated. The major accomplishment of obtaining well-defined nanoscale morphologies for these IL-containing block copolymers is particularly emphasized as a novel means of controlling the transport properties. The applications of IL-containing block copolymers in high temperature fuel cells, lithium batteries, and electro-active actuators are also enclosed.