332a Electro-Active and Redox-Active Block Copolymer Nanostructures

Nitash P. Balsara

We describe the properties of nanostructured block copolymers wherein one of the blocks is compatible with ionic moieties. Examples include block copolymers with poly(ferrocenyldimethylsilane) or poly(ethylene oxide) blocks. The self-assembly of ferrocene-containing block copolymers can be controlled by altering the redox state of the ferrocene moieties. Oxidizing only 8% of the ferrocene units in our block copolymer results in a 40 K decrease in the order-disorder transition temperature. This result provides the basis for electrochemical self-assembly because oxidation state of ferrocene can be altered reversibly by the application of electric fields of the order of 1 V/cm. Ferrocene is catalytically active in the oxidized state. One can thus obtain catalysts from ferrocene-containing block copolymers wherein both the support and the active sites are formed by self-assembly. In a separate study, percolating ion-conducting channels of poly(ethylene oxide) dispersed in an insulating polystyrene matrix were obtained by self-assembly. This structure enables independent control over mechanical and electrical properties of the block copolymer. The possibility of using these composite systems in high power batteries is currently being examined. The overall goal of this research program is create a new class of responsive soft materials that are based on electro-active and redox-active block copolymers.

Coauthors: Hany Eitouni, David Durkee, Lola Odusanya, Mohit Singh, Alex Bell.

Financial support: NSF and DOE