Probing the Molecular-Level Physics of Block Copolymer Electrolytes for Next-Generation Rechargeable Lithium Batteries

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Abstract: Solid polymer electrolytes can help enable beyond Li-ion battery technologies with improved energy density and safety. Of particular interest are microphase separated diblock copolymers that can preferentially segregate salt to create distinct ion conducting and mechanically reinforcing microdomains. The addition of salt allows block copolymers to conduct ions but alters their physical properties, through new interactions between the polymer chains and ions. In this seminar, I will shed light on the molecular-level physics of a model block copolymer electrolyte system, polystyrene-

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block-poly(ethylene oxide) (SEO) mixed with lithium bis(trifluoromethanesulfonyl) imide (LiTFSI) salt (SEO/LiTFSI) wherein the Li salt preferentially segregates into the poly(ethylene oxide) domains. A variety of X-ray- and neutron-based scattering and spectroscopy techniques were used to uncover the effect of salt concentration on the thermodynamics and chain dynamics of SEO/LiTFSI. These results provide an important experimental dataset to allow for discrimination between new theories describing the thermodynamics of polymer salt mixtures as well as new insights into how polymer dynamics in the presence of salt are relevant to the operation of batteries at high currents.