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Using Tapered Block Copolymers to Create Conducting Nanomaterials[1]

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Soft materials, such as polymers, colloids, surfactants, and liquid crystals, are a technologically important class of matter employed in a variety of applications. One sub-class of soft material, **block copolymers**, provides the opportunity to design materials with attractive chemical and mechanical properties based on the ability to assemble into periodic structures with nanoscale domain spacings. Several applications for block copolymers currently under investigation in my group include battery and fuel cell membranes, analytical separations membranes, nano-tool templates, precursors to electronic arrays, and drug delivery vehicles. One area of recent progress in the group focuses on the behavior of conventional block copolymer and tapered block copolymer systems for lithium battery membrane applications. We find that we can tune poly(styrene-*b*-ethylene oxide) diblock copolymer nanostructures by adjusting the lithium counterion and lithium salt concentration, as well as the taper volume fraction and composition. Additionally, we can estimate the effective interaction parameters (χ_{eff}) for the salt-doped copolymers to determine the overall influence of tapering on the energetics of copolymer assembly. These tapered materials allow us to design nanostructured membrane systems with increased conductivity and improved mechanical properties in ion transport devices.

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