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Holographic polymerization for highly conductive robust electrolyte membranes DERRICK SMITH, WENDA WANG, Drexel University, TIMOTHY BUNNING, Wright Patterson Air Force Base, CHRISTOPHER LI, Drexel University — The roles of nanostructure and confinement for ion mass transport in polymer electrochemical applications are key for improving the diffusion characteristics and mechanical robustness of solid electrolyte membranes. The challenges in fabricating highly controlled model systems are largely responsible for the interdependent ambiguities between nanostructures and the corresponding ion transport behavior. In this work, holographic polymer electrolyte membrane volume gratings comprised of alternating layers of robust cross-linked polymer resin and electrolyte, with an average d-spacing of 180 nm, were fabricated using holographic polymerization. These one-dimensional confinement structures were used to quantitatively study the anisotropic ionic conductivity properties and correlate this behavior to nano-confinement and phase mixing. Anisotropies greater than 5000 have been observed, and conductivities approaching 10^{-4} S/cm in robust freestanding films. In this case, the cross-linked resin serves as both load-bearing scaffold layers and as an electrolyte blending agent. These membranes serve as a platform in next generation nanostructured blend systems with enhanced mechanical properties for electrochemical applications.

Derrick Smith
Drexel University

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