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Decoupling ion flux and mechanical strength in polymer battery membranes DERRICK SMITH, SHAN CHENG, Drexel University, TIMOTHY BUNNING, Wright-Patterson Air Force Base, CHRISTOPHER LI, Drexel University — While much research has demonstrated repeatable characteristics of electrolyte membranes, the fundamentals behind the interactions during ionic diffusion in solid polymer electrolyte membranes for battery applications are not well understood, specifically the role of nanostructures, which hold the key to improving performance of energy storage devices such as fuel cells and Lithium ion batteries. 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 (hPEM) volume gratings comprised of alternating layers of cross-linked polymer resin and ionic liquid were fabricated using holographic polymerization with an average d-spacing of 180 nm. 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. These membranes provide a platform in decoupling ion flux and bulk mechanical properties for future blend systems for battery applications. These volume gratings also offer an exciting route to fabricate multifunctional gratings for optic and sensing applications.

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