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Quantifying lithium salt distributions in nanostructured ion-conducting polymer domains: a neutron reflectivity study CAMERON SHELTON, University of Delaware, JOSEPH DURA, National Institute of Standards and Technology, THOMAS EPPS, University of Delaware — Measuring the distribution of lithium salts in block polymer (BP) electrolyte thin films with high resolution and limited film damage is key to understanding ion-transport kinetics and improving the efficiency of lithium battery membranes. In this work, we quantified the distributions of three common lithium salts within the ion-conducting poly(oligo(oxyethylene)methacrylate) (POEM) block of a lamella-forming polystyrene-POEM (PS-POEM) thin film by exploiting the polymer-polymer and polymer-salt contrast gained from nondestructive neutron reflectivity (NR). As the salt-doping ratio in the POEM domains increased, multilayer Bragg peaks in the NR profiles disappeared gradually due to decreasing NR contrast between the PS and POEM/salt domains; this behavior was indicative of an even lithium salt distribution in the POEM domains. Furthermore, fitting the NR profiles to lamellae models produced through-film salt distribution profiles that denoted a diminishing concentration of salt from the substrate to free surface. Overall, the high-resolution, non-destructive benefits of using NR to investigate BP electrolyte thin films provided conclusive details related to the distribution of lithium salts, which directly affects their material properties and performance.

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