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**Cation-containing Polymers with Co-continuous Microphase-Separated Morphologies for Rapid Transport Membranes** FREDERICK BEYER, SAMUEL PRICE, ALICE SAVAGE, XIAOMING REN, U.S. Army Research Laboratory, NATALIE POMERANTZ, WALTER ZUKAS, Natick Soldier Research, Development, & Engineering Center — Cation-containing polymer membranes are the subject of renewed research for their potential to enable the use of alkaline fuel cells, and are also of interest for their water vapor transport properties. Charge and water vapor transport are both heavily dependent on membrane morphology and the development of hydrophilic channels throughout the material. Reaction induced phase separation has been shown to create such morphologies when used with uncharged copolymers and crosslinking monomers. Here we have applied this same technique but used ion-containing block copolymers of 4-vinylbenzyltrimethylammonium chloride and styrene to create a cation-containing polymer membrane having a microphase-separated, co-continuous morphology, as characterized by small-angle X-ray scattering (SAXS) and high-angle annular dark field scanning transmission electron microscopy (HAADF STEM). These materials show excellent charge transport behavior and water vapor transport properties, surpassing commercially available materials. These results and efforts to improve other important physical characteristics for membrane applications will be presented.

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