Effect of Confinement on Proton Transport in Nanos-structured Block Copolymer/Ionic Liquid Membranes

MEGAN L. HOARFROST, University of California, Berkeley, MADHU S. TYAGI, NIST Center for Neutron Research, RACHEL A. SEGALMAN, JEFFREY A. REIMER, University of California, Berkeley — Nanos-structured membranes containing structural and proton-conducting do-

mains are of great interest for a wide range of applications requiring high conductivity coupled with high thermal stability. Understanding the effect of nanodomain confinement on proton-conducting properties in such materials is essential for designing new, improved membranes. This relationship has been investigated for a lamellae-forming mixture of poly(styrene-b-2-vinylpyridine) (PS-b-P2VP) with ionic liquid composed of imidazole and bis(trifluoromethane)sulfonimide (HTFSI), where the ionic liquid selectively resides in the P2VP domains of the block copoly-

mer. Quasi-elastic neutron scattering and NMR diffusion measurements reveal high levels of a fast proton hopping transport mechanism, which we hypothesize is due to changes in the hydrogen bond structure of the ionic liquid under confinement. This, in combination with unique ion ag-
gregation behavior, leads to a lower activation energy for macroscopic ion transport compared to that in a mixture of ionic liquid with P2VP homopolymer. These results portend the rational design of nanostructured membranes having improved mechanical properties and conductivity.

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