

Abstract Submitted
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Conductivity Scaling Relationships of Nanostructured Membranes based on Hydrated Protic Polymerized Ionic Liquids: Effect of Domain Spacing GABRIEL SANOJA, University of California, Berkeley, BHOOSHAN POPERE, University of California, Santa Barbara, BRYAN BECKINGHAM, Joint Center for Artificial Photosynthesis, CHRISTOPHER EVANS, University of California, Santa Barbara, NATHANIEL LYND, University of Texas, Austin, RACHEL SEGALMAN, University of California, Santa Barbara — Elucidating the relationship between chemical structure, morphology, and ionic conductivity is essential for designing novel materials for electrochemical applications. In this work, the effect of lamellar domain spacing (d) on ionic conductivity (σ) is investigated for a model system of hydrated block copolymer based on a protic polymerized ionic liquid. We present a strategy that allows for the synthesis of a well-defined series of narrowly dispersed PS-*b*-PIL with constant volume fraction of ionic liquid moieties ($f_{IL} \approx 0.39$). These materials self-assemble into ordered lamellar morphologies with variable domain spacing (23-59 nm) as demonstrated by SAXS. PS-*b*-PIL membranes exhibit ionic conductivities above 10^{-4} S/cm at room temperature, which are independent of domain spacing. The conductivity scaling relationship demonstrated in this work suggests that a mechanically robust membrane can be designed without compromising its ability to transport ions. In addition, PIL-based membranes exhibit lower water uptake ($\lambda = 10$) in comparison with many proton-conducting systems reported elsewhere. The low water content of these materials makes them promising candidates for solar-fuels electrochemical devices.

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