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Proton conducting, high modulus polymer electrolyte membranes by polymerization-induced microphase separation SUJAY CHOPADE, MARC HILLMYER, TIMOTHY LODGE, Univ of Minn - Minneapolis — Robust solid-state polymer electrolyte membranes (PEMs) are vital for designing next-generation lithium-ion batteries and high-temperature fuel cells. However, the performance of diblock polymer electrolytes is generally limited by poor mechanical stability and network defects in the conducting pathways. We present the *in-situ* preparation of robust cross-linked PEMs via polymerization-induced microphase separation, and incorporation of protic ionic liquid (IL) into one of the microphase separated domains. The facile design strategy involves a delicate balance between the controlled growth of polystyrene from a poly(ethylene oxide) macro-chain transfer agent (PEO-CTA) and simultaneous chemical cross-linking by divinylbenzene in the presence of IL. Small angle X-ray scattering and transmission electron microscopy confirmed the formation of a disordered structure with bicontinuous morphology and a characteristic domain size of order 20 nm. The long-range continuity of the PEO/protic IL conducting nanochannels and cross-linked polystyrene domains imparts high thermal and mechanical stability to the PEMs, with elastic modulus approaching 10 MPa and a high ionic conductivity of 15 mS/cm at 180 C.

Sujay Chopade
Univ of Minn - Minneapolis

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