

Anhydrous Polymer Electrolyte Membranes Based on Polystyrene-*b*-Poly (hydroxyl ethyl methacrylate) Block Copolymer

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A block copolymer of polystyrene-*b*-poly (hydroxyl ethyl methacrylate), PS-*b*-PHEMA, was synthesized via atom transfer radical polymerization (ATRP) and crosslinked with 4,5-imidazole dicarboxylic acid (IDA) via esterification of the -OH groups of PHEMA in the block copolymer and the -COOH groups of IDA at 130°C. As forming imidazole-H₃PO₄ complexes with doping of H₃PO₄, the proton conductivity of the membranes continuously increased as the content of H₃PO₄ increased. In addition, both the elongation at break and the tensile strength increased with IDA content. A proton conductivity of 0.01 S/cm at 100°C was obtained for the PS-*b*-PHEMA/IDA/H₃PO₄ membrane with [HEMA]:[IDA]:[H₃PO₄] = 3:4:4 under anhydrous conditions. All of the PS-*b*-PHEMA/IDA/H₃PO₄ membranes were thermally stable up to 350°C.