Composite Polymer Electrolyte Membranes Comprising Triblock Copolymer and Heteropolyacid for Fuel Cell Applications

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The hybrid organic/inorganic composite polymer electrolyte membranes consisting of triblock copolymer (tBC) and heteropolyacid (HPA) with different HPA contents were prepared and investigated. ABC triblock copolymer, i.e. polystyrene-b-poly(hydroxyethyl acrylate)-b-poly (styrene sulfonic acid), PS-b-PHEA-b-PSSA at 28:21:52 wt% was synthesized via atom transfer radical polymerization (ATRP) and solution-blended with a commercial HPA. Upon the incorporation of HPA to tBC, both the symmetric stretching bands of SO3- at 1187 cm−1 and the -OH groups at 3440 cm−1 in pristine tBC shifted to lower wavenumbers at 1158 and 3370 cm−1, respectively. These FT-IR band shifts suggest that the HPA particles strongly interact with both the sulfonic acid groups and the hydroxyl groups in PSSA and PHEA domains of the copolymer, respectively. The proton conductivity of the composite membranes increased from 0.048 to 0.065 S/cm at room temperature up to 0.2 weight fraction of HPA, presumably due to both the intrinsic conductivity of the HPA particles and the enhanced acidity of the sulfonic acid of the tBC.