Synthesis and Characterization of Crosslinked Triblock Copolymers

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A high proton conductivity of sulfonated polymer membranes is of pivotal importance in improving the efficiency of fuel cells. However, conventional sulfonated polymers exhibit "trade-off" behaviour between proton conductivity and mechanical properties. This trade-off behaviour can be effectively controlled to some degree by adjusting the crosslinking density of the prepared membranes, maintaining a proper sulfonation level and mechanical properties. In the study, we synthesized two types of ABC triblock copolymer, i.e. polystyrene-b-poly (hydroxyethyl acrylate)-b-poly(styrene sulfonic acid), (PS-b-PHEA-b-PSSA) and polystyrene-b-poly(hydroxyethyl acrylate)-b-poly(sulfopropyl methacrylate), (PS-b-PHEA-b-PSPMA) via atom transfer radical polymerization (ATRP) and used for the preparation of crosslinked polymer electrolyte membranes. The middle PHEA block was crosslinked by sulfosuccinic acid (SA) via the esterification reaction between -OH of PHEA and -COOH of SA. The resultant membranes were characterized in terms of ion exchange capacity (IEC), water uptake and proton conductivity.