Proton Conducting Grafted/Crosslinked Membranes Prepared From Poly(vinylidene fluoride-co-chlorotrifluoroethylene) Copolymer

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Poly(vinylidene fluoride-co-chlorotrifluoroethylene), P(VDF-co-CTFE) backbone was grafted with crosslinkable chains of poly(hydroxyl ethyl acrylate) (PHEA) and proton conducting chains of poly(styrene sulfonic acid) (PSSA) to produce amphiphilic P(VDF-co-CTFE)-g-P(HEA-co-SSA) graft copolymer via atom transfer radical polymerization (ATRP). Successful synthesis and microphase-separated structure of the copolymer were confirmed by 1H NMR, FT-IR spectroscopy, and TEM analysis. Furthermore, this copolymer was thermally crosslinked with sulfosuccinic acid (SA) to produce grafted/crosslinked membranes. Ion exchange capacity (IEC) continuously increased with increasing SA contents but the water uptake increased up to 6 wt% of SA concentration above which it decreased monotonically. The membrane also exhibited a maximum proton conductivity of 0.062 S/cm at 6 wt% of SA concentration, resulting from competitive effect between the increase of ionic groups and the degree of crosslinking. XRD patterns also revealed that the crystalline structures of P(VDF-co-CTFE) disrupted upon graft polymerization and crosslinking.