Nanocomposite Proton Conducting Membranes Based On Amphiphilic PVDF Graft Copolymer

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A novel comb-like amphiphilic graft copolymer of poly(vinylidene fluoride-co-chlorotrifluoroethylene)-graft-poly(4-styrene sulfonic acid-co-trimethoxysilyl propyl methacrylate), i.e. P(VDF-co-CTFE)-g-P(SSA-co-TMSPMA) was synthesized via atom transfer radical polymerization (ATRP) technique. Successful synthesis and a microphase-separated structure of the copolymer were confirmed by proton nuclear magnetic resonance (1H-NMR), FT-IR spectroscopy and transmission electron microscopy (TEM). This graft copolymer was combined with tetraethoxysilane (TEOS) in an acidic condition to produce organic-inorganic nanocomposite membranes through in-situ sol-gel reaction between TEOS and PTMSPMA, as characterized by X-ray diffraction (XRD) and TEM. Upon introduction of silica, the proton conductivity and the water uptake of membranes were slightly decreased but the thermal and mechanical properties of the membranes were significantly enhanced. The various morphologies of nanocomposite membranes were obtained upon controlling the TEOS concentration, which were correlated with thermal, mechanical and transport properties.