Proton conducting membranes based on poly(vinyl chloride) graft copolymer electrolytes

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The direct preparation of proton conducting poly(vinyl chloride) (PVC) graft copolymer electrolyte membranes using atom transfer radical polymerization (ATRP) is demonstrated. Here, direct initiation of the secondary chlorines of PVC facilitates grafting of a sulfonated monomer. A series of proton conducting graft copolymer electrolyte membranes, i.e. poly (vinyl chloride)-g-poly(styrene sulfonic acid) (PVC-g-PSSA) were prepared by ATRP using direct initiation of the secondary chlorines of PVC. The successful syntheses of graft copolymers were confirmed by 1H-NMR and FT-IR spectroscopy. The images of transmission electron microscopy (TEM) presented the welldefined microphase-separated structure of the graft copolymer electrolyte membranes. All the properties of ion exchange capacity (IEC), water uptake, and proton conductivity for the membranes continuously increased with increasing PSSA contents. After crosslinking, water uptake significantly decreased from 207% to 84% and the tensile strength increased from 45.2 to 71.5MPa with a marginal change of proton conductivity from 0.093 to 0.083 S/cm^{-1}.