

Proton-conducting composite membranes from graft copolymer electrolytes and phosphotungstic acid for fuel cells

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New organic-inorganic composite membranes based on poly(vinylidene fluoride-co-chlorotrifluoroethylene)-graft-poly(styrene sulfonic acid) [P(VDF-co-CTFE)-g-PSSA] with embedded phosphotungstic acid (PWA) were prepared. Fourier transform infrared spectra indicated the existence of a specific interaction between P(VDF-co-CTFE)-g-PSSA graft copolymer and PWA particles. PWA nanoparticles were well confined in the polymeric matrix up to 20 wt.%, above which they started to be extracted from the matrix, as revealed by scanning electron microscope analysis. Accordingly, Young's modulus of membranes also increased with PWA concentration up to 20 wt.%, above which it continuously decreased. Upon incorporation of PWA nanoparticles, the proton conductivity of composite membranes slightly decreased from 0.042 to 0.035 S/cm at room temperature up to 20 wt.%, presumably due to strong interaction between the sulfonic acids of graft copolymer and PWA nanoparticles.