

Preparation and characterization of nanocomposite membranes assisted by ATRP and sol-gel process for polymer electrolyte membrane fuel cells

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Proton conducting nanocomposite membranes consisting of poly(vinylidene fluoride-co-chlorotrifluoroethylene)-graft-poly(styrene sulfonic acid), i.e., P(VDF-coCTFE)-g-PSSA graft copolymer and functionalized silica by sulfonated group. These were prepared through a sol-gel reaction and subsequent oxidation of a silica precursor, i.e., (3-mercaptopropyl) trimethoxysilane (MPTMS). The functionality of nanocomposite membranes was investigated by the FT-IR to confirm the each based material function group. The amorphous character was checked via the XRD. Furthermore, the well dispersed 5-10nm sized silica particles in nanocomposite membrane with 5 wt% MPTMS was observed in transmission electron microscopy and small-angle X-ray scattering analysis. Upon higher concentration of MPTMS in the composite, the silica sized grew too high to disrupt the micro-separated structure of the graft copolymer. As a result, the maximum values at 5wt% MPTMS were recorded that proton conductivity was 0.12 S/cm at 25 °C and single cell performance was 1.0 W/cm² at 75 °C.