

Preparation of PVdF/polystyrene composite membranes using supercritical CO₂ impregnation for DMFCs

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Grafting of styrene onto poly(vinylidene fluoride)(PVdF) membranes was carried out by impregnation and radical polymerization using supercritical carbon dioxide(scCO₂). First, PVdF membranes were cast on a glass plate with various thickness. Styrene monomer, the initiator 2,2'-azoisobutyronitrile(AIBN) and the crosslinking agent divinylbenzene(DVB) were impregnated into PVdF membranes using scCO₂ at 40°C and 15 MPa for 4 hours. After releasing CO₂, the polymerization was carried out at 80°C and 10 MPa for 4 hours. PVdF-grafted-polystyrene(PVdF-g-ps) was sulfonated in concentrated sulfuric acid(98%H₂SO₄) at 95°C. The sulfonated PVdF-g-ps membranes(PVdF-g-pssa) were characterized by measuring their permeability, ion conductivity, ion exchange capacity and performance. The results were compared with those of Nafion. EDS analysis shows that SO₃⁻ are uniformly distributed in cross-section area of PVdF-g-pssa membrane.