

Proton exchange membranes based on sulfonated poly(fluorenyl ether nitrile oxynaphthalate)
for high performance direct methanol fuel cells

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With the goal of developing the cost-effective proton exchange membranes with high ionic conductivity and low methanol permeability, a novel series of sulfonated poly(fluorenyl ether nitrile oxynaphthalate) (SPFENO) are synthesized by the nucleophilic substitution polycondensation of various amounts of 2,7-dihydroxynaphthalene-3,6-disulfonic acid disodium salt and 9,9-bis(4-hydroxyphenyl) fluorene with 2,6-difluoro benzonitrile. Degree of sulfonation or ion exchange capacity in these polymer materials are controlled by adjusting the molar ratio of reactants. Proton conductivities, thermal stabilities, water uptake, swelling behavior, mechanical strength and methanol permeabilities of the SPFENO-based membranes are investigated and compared with those of Nafion 117 membrane. Finally, the electrochemical performance of the single DMFC cell assembled with the optimized proton exchange membrane is evaluated and compared with that using Nafion 117 under the same operation conditions.