Synthesis and characterization of sulfonated-fluorinated poly(fluorene-co-sulfone) ether membranes for fuel cell applications

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A new class of sulfonated poly(fluorene-co-sulfone)ether membranes containing perfluorocyclobutane (PFCB) groups were synthesized and characterized in terms of their electrochemical properties as proton exchange membranes for fuel cells. Two monomers, 9,9-bis(4-trifluorovinyloxyphenyl) fluorene and 4,4'-sulfonyl-bis(trifluorovinyloxy)biphenyl were synthesized and statistically copolymerized by thermal [2π+ 2π] cycloaddition to yield a series of polymers containing 0-60 mol% of fluorenyl content (PFS-X). The copolymers were then sulfonated using chlorosulfonic acid to afford 5 kinds of ionomers with different sulfonation levels (SPFS-X), which were cast into membranes and analyzed in terms of electrochemical properties. It was found the ion exchange capacity (IEC), water uptake, proton conductivity and methanol permeability values of SPFS-X increased with the increment of the sulfonated fluorenyl content. The proton conductivities of SPFS-50 and -60 with high IECs and water uptake values were higher than those of Nafion-115 between 25~80 C. The methanol permeability of SPFS-X was considerably lower than that of Nafion-115.