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Development of High Performance Polymeric Materials Having High Conductivity and Excellent Physical Properties for Fuel Cell Membrane

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Direct-methanol fuel cells (DMFCs) have attracted considerable attention for certain mobile and portable applications, because of their high specific energy density, low poison emissions, easy fuel handling, and miniaturization[1,2]. However, the high methanol permeation through electrolyte membranes in DMFCs still is one of the critical problems hindering the commercialization. Nafion® membrane, a perfluorosulfonate ionomer, is the major membrane used in polymer electrolyte membrane fuel cells (PEMFCs) presently. However, Nafion® membrane has a poor barrier property to methanol crossover. Therefore, the effective methods for reducing methanol crossover are to decrease the average diameter of ion-rich hydrophilic domains and increase the hydrophobicity of membrane surface. In this study, well-defined poly(2,6-dimethyl-4,4'-phenylene oxide)-*g*-poly (styrenesulfonic acid) (MPPO-*g*-PSSA) graft copolymer was synthesized *via* the bromination of MPPO and ATRP with SSNa (styrenesulfonic acid sodium salt), and the branching numbers and branching length of MPPO-*g*-PSSA graft copolymer were controlled. Then, the resulting graft copolymer was cast into membrane in order to prepare proton exchange membranes for DMFC application. The performance of MPPO-g-PSSA membranes was measured in terms of proton conductivity, methanol permeability, and thermal stability.

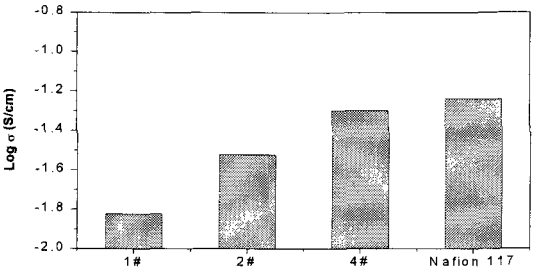

Figure 1. The proton conductivity of membrane

1. A.Aramata,I.Toyoshima,M.Enyo,Electrochim.Acta,37,1317(1992).
2. J.Wang,s.Wasmus,R.F.Savinell,J.Electrochem.Soc.,142,4218(1995).