Wirote Tangsaittkiat 2007: Synthesis and Characterization of Composite Copolymer Membrane for PEMFC. Master of Engineering(Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Assistant Professor Nanthiya Hansupaluk, Ph.D. 65 pages.

The work focused on sulfonation of poly(arylene ether sulfone) based biphenol and characterization using FTIR, NMR, and SEM, including ion-exchange capacity, water uptake, and proton conductivity. In addition, effect of ZSM-5 in the composite membranes aged for 3 hours at 4 different temperatures (room temperature, 80, 100, and 120°C) and a constant relative humidity of 100 percent on mechanical strength was also investigated. It was found that sulfonated polymers did not deform or dissolve in water or when in contact with steam. Good distribution of ZSM-5 in the composite membranes could be obtained when there was less than 15% ZSM-5 in the membranes. Water uptake, proton conductivity, and ion-exchange capacity were proportional to the amount of sulfonated polymers in the membrane. The Proton conductivities of the composite membranes containing 0 – 25 % ZSM-5 were in the range of 0.0071-0.1175 S/cm which was lower than nafion-117 Nafion. As the acceptable value of the conductivity for regular proton-exchange membranes is about 0.01 S/cm, our composite membanes may have potential of being used in the proton-exchange membrane fuel cell. For aged membranes at all four different temperatures at a fixed relative humidity of 100%, increasing ZSM-5 reduced their tensile strength, and enhanced Young's moduli. Furthermore, sulfonated polymers had lower tensile strengths. However, the temperature-aging could improved the property.

Student's signature

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25 / 05 / 2550