일반강연 A-6

직접메탄올연료전지용 술폰화 고분자막의 수소이온전도도 및 메탄올 투과특성

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Proton Conductivity and Methanol Permeability of Sulfonated Polymer Membranes For Direct Methanol Fuel Cell

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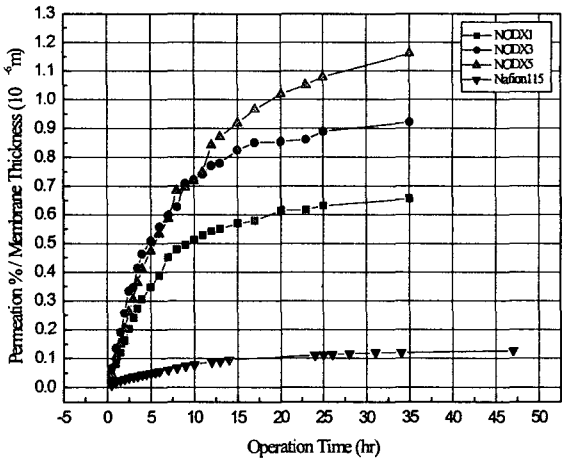
Perfluorinated ionomer, such as Nafion™, are usually used as potential polymer electrolyte in DMFC for its good proton conductivity and chemical/ hydrolytic stability, while it has high cost and methanol permeability ($2.3*10^{-6} cm^2/s$ for Nafion 117) through the membranes causing methanol crossover. Methanol crossover is a main barrier to its commercial application, which introduced methanol as fuel at the anode transports to the cathode through the membrane and react at cathode without generation of electricity. This not only lowers fuel utilization, but also adversely effects the performance in cathode side.

From the standpoint of high methanol crossover and its high cost, alternative polymer electrolyte membranes are eagerly desired, and major research objective in recent would be to identify and to achieve novel, high performance, effective proton conductive electrolyte with low

methanol crossover and low cost. Potential thermoplastic polymers such as polysulfones(PSf), polyethersulfones(PES), polyetherketones(PEEK), polyimides(PI), polyoxadiazole, polyphosphazene and polybenzimidazol (PBI) have been suggested. However, the direct sulfonation to these polymers has caused the formation of water-soluble polymers with low sulfonation, side reaction including crosslinking, cleavage of polymer chain, and low realibility.

In addition, another way to prepare sulfonated polymers is based on chemical modification of polymer or monomer sulfonation and subsequent polymerization. Among many methods, the synthesis of sulfonated polymer using sulfonated monomer is the most favorable owing to easily controlling sulfonation degree and preventing the polymer decomposition.

In this study, novel high performance proton exchange membranes having proton conductivity close to that of Nafion™ while having modified lower methanol permeability were prepared by introducing sulfonated monomer by fuming sulfuric acid and pendant group in aromatic polymer backbone. Additionally, necessary requirements as proton exchange membrane such as thermo-oxidative stability, water vapor sorption, degree of swelling, hydrolytic stability, chemical stability including peroxide radical stability, and ion exchange capacity were observed and investigated in relation to the effect of structural change.



References

[1] C. Genies, R. Mercier, B. Sillion, N. Cornet, G. Gebel, M. Pineri, Polymer 42 (2001) 359-373

[2] D.S. Faure, N. Cornet, G. Gebel, R. Mercier, M. Pineri, B. Sillon, in : O. Savadogo (Ed.), Proc. of the second Int. Symp. on New. Mat. for Fuel Cell and Battery. Montreal, Canada, 1997, pp. 818-827

[3] R. Kovar, D. Ofer, B. Nair, R. Formato, P. Osenar, N. Landrau. J. E. McGrath, A. Laconti, J. Kosek, M. Hamdan, ACS. Fuel Chemistry Division Preprint 2001, 46 (2), 445

[4] C. Genies. R. Mercier, B. Sillion, R. Petiaud, N.Cornet, G. Gebel, M. Pineri, Polymer 42 (2001) 5097-5105

[5] Rusanov AL. Adv Polym Sci 1994 ; 111 : 115-175