PVDF based new proton conducting membrane for direct methanol fuel cells

Juhee Cho and Myung D. Cho
Samsung Advanced Institute of Technology
P.O. Box 111, Suwon, 440-600, Korea

The electrochemical and physical characterizations of proton-conducting membranes were investigated. The polymer electrolyte membrane is a vital part of the cell and need to have high ionic conductivity (>0.1Scm-1) at 25°C, good mechanical, chemical and thermal properties. For the fuel cell application, several additional specifications are required such as low cost and low methanol crossover [1, 2]. Methanol crossover and high ionic conductivity are the key factors for development of polymer electrolyte membrane (PEM) for the DMFC. There are two major considerations to preparing of proton exchange membranes for use of DMFC [3]:

· poisoning of the cathode catalyst by methanol crossover which formation of a mixed potential;

· lower ionic conductivity and conductance which will suppress the overall fuel cell efficiency due to lowering proton mobile species.

In this work the proton exchange membrane were prepared by simple blend of poly(vinylidene fluoride)-co-hexafluoro propylene (PVDF-HFP) with various type of ion exchange resin. PVDF-HFP was chose as based polymer matrix as it has thermally and mechanically strong, readily available, low cost and easy to process to preparation of membrane film.
Physical and electrochemical properties of the membranes were investigated. The conductivity of PVDF based electrolyte membranes at 25°C is 0.047 Scm^{-1} with an overall cell resistance of ~8.0 ohm cm^{-2} under fuel cell condition. The prepared PVDF-HFP membrane conductivity relatively lower then Nafion 115 (DuPont) but the methanol crossover significantly reduced due to no formation of micro channels as Nafion 115.

References;

1. X. Ren, T.E. Springer, S. Gottesfeld, J. Electrochem. Soc. 147 (2000) 92
2. E. Skou, P. Kauranen, J. Hentschel, Solid State Ionics 97 (1997) 333
3. M.P. Hogarth, G.A. Hards, Platium Met. Rev. 40 (1996) 150