졸-겔법과 모노머 흡습법을 이용하여 제조된 실리콘을 함유한 수소이온교환막의 특성분석

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Characterization of a Si-containing proton exchange membrane prepared by the sol-gel method and monomer sorption

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Fuel cell technology is one of the key technologies of the 21st century for stationary applications and transportation applications. The proton exchange membrane (PEM) is a key component in polymer electrolyte membrane fuel cells. The current state-of-the-art PEM is Nafion®. The major limitations of perfluorosulfonic polymers such as Nafion® are high cost, high methanol permeability, and loss of membrane performance at elevated temperature. There is much interest in the study and development of alternative PEMs [1-3].

Nano-ordered composite materials consisting of organic polymers and inorganic components have been attracting attention for their use in new high performance materials for PEM. The inorganic component can enhance the thermal stability and mechanical strength of organic polymers. Moreover, the inorganic phase can improve chemical stability and proton conductivity at high temperature by the increase of water retention up to higher temperatures [4].

The objectives of this study are: (1) to prepare low cost silicon-containing non fluorinated PEMs by the use of sol gel condensation and monomer sorption method (Fig. 1) and (2) to evaluate and compare their properties. The prepared membranes were characterized in terms of physical and electrochemical properties such as ion exchange capacity, water uptake, and proton conductivity. The prepared membranes had proton conductivities of

more than 0.1 S cm^{-1} at room temperature under full hydration condition. Also, the chemical structure and morphology of the prepared membranes were investigated using microscopic Fourier transform infrared spectroscopy mapping method, field emission scanning electron microscopy (FESEM), and transmission electron microscopy (TEM).

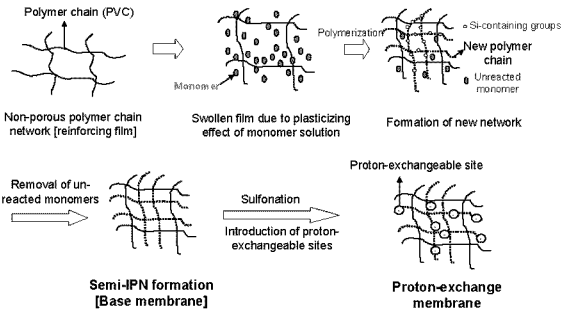

Fig. 1. Preparation scheme for proton exchange membrane.

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