Nafion nanocomposite membranes containing silica nanoparticles with different surface characteristics to affect membrane properties for fuel cell applications

물미수레스, 김홍건, 박치훈, 이창현, 이영무*
한양대학교 화학공학과
(ymlee@hanyang.ac.kr*)

Nafion, a representative perfluorinated sulfonic acid ionomer, has been used as a proton exchange membrane for fuel cell system owing to high proton conductivity and excellent membrane stability. However, Nafion exhibits a rapid reduction of proton conductivity and excessive swelling in water-methanol solution mixture leading to high methanol crossover when the membrane was exposed at the high temperatures over 80 °C and under direct methanol fuel cell condition, respectively. In this study, Nafion-based nanocomposite membranes were fabricated *via* direct incorporation of silica nanoparticles into Nafion solution together with fluorosurfactants as dispersants to induce uniform distribution of the nanoparticles within the polymer matrix. The Nafion nanocomposite membranes showed improved proton conduction properties even at the temperature higher than 90 °C and reduced methanol barrier properties through the membranes at the same time. In particular, membrane properties were significantly dependent on the surface properties of silica nanoparticles as well as ionic properties of fluorosurfactants.