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Anion Exchange Nanocomposite Membrane Doped with ZnO-Nanoparticles for Direct Methanol Alkaline Fuel Cell

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Abstract : A series of quaternized poly (2.6 dimethyl – 1.4 phenylene oxide)/ polysulfone (QPPO/PSF) blend anion exchange membrane (AEM) were successfully fabricated and characterized for methanol alkaline fuel cell application. Zinc Oxide (ZnO) nanoparticles were introduced in the polymer matrix to enhance the intrinsic properties of the AEM. To confirm successful fabrication, FT-IR spectroscopy and nuclear magnetic resonance (^{1}H NMR and HMBC ^{15}N NMR) were used. The membrane properties were enhanced by the addition of ZnO nanoparticles. The addition of ZnO nanoparticles resulted to a higher ion exchange capacity (IEC) of 3.72 mmol.g^{-1}and a 30-fold ion conductivity (IC) increase of the nanocomposite due to no (zero (0)) methanol permeability at 30 °C and increased water uptake. The QPPO/PSF/2% ZnO composite retained over 80 % of its initial IC when evaluated for alkaline stability at room temperature. The maximum power output reached for the membrane electrode assembly (MEA) constructed with QPPO/PSF/2%ZnO is 69 mW.cm^{-2}, which is about three times more than the parent QPPO membrane. The above results indicate that QPPO/PSF-ZnO is a good candidate as an anion exchange membrane for fuel cell application.

Keywords : anion exchange membrane, fuel cell, zinc oxide, nanocomposite
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