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Preparation and characterization of PVdF nanofiber ion exchange membrane for the PEMFC application

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ABSTRACT

This paper reports the preparation and characterization of polyvinylidene fluoride (PVdF) nanofiber ion exchange membrane for the application in polymer electrolyte membrane fuel cells (PEMFC). The composite membrane of PS/PVdF was prepared by using the electrospinning method with PVdF solution in a mixed solvent of DMAc and acetone by pore-filling with a mixture of styrene and PS using DVB as cross-linking reagent. Ion exchange mem-brane (SPS/PVdF) was then manufactured by introducing sulfonate ($-SO_3H$) groups using sul-furic acid on the prepared PS/PVdF membranes. The modified membranes were characterized by fourier transform infrared (FTIR), scanning electron microscopy (SEM), energy dispersive x-ray spectroscopy (EDS), water uptake, ion exchange capacity (IEC), electrical conductivity and membrane & electrode assembly (MEA). By controlling the content of PS, characteristics comparable to Nafion which has water uptake, IEC and electrical conductivity values suited for the application in PEMFC could be observed in modified membranes. In particular, not only water uptake values (90–550%) were much higher than that of Nafion 115, but also IEC values were more than double the values of Nafion 115. As of the results of electrical conductivity measurements and MEA tests, SPS/PVdF membranes showed the possibility of being an alternative membrane for Nafion 115 due to their improved properties.

Keywords: PEMFC; Nanofiber; PVdF; Pore-filling; PS; DVB; Electrospinning

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