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Polyelectrolyte nanocomposite membranes using imidazole-functionalized nanosilica for fuel cell applications

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The preparation and characterization of a new type of nanocomposite polyelectrolyte membrane TM® (PEM), based on DuPont nafion/imidazole modified nanosilica (Im-Si), for direct methanol fuel cell (DMFC) applications is described. Related to the interactions between the protonated imidazole groups, grafted on the surface of nanosilica and negatively charged sulfonic acid groups of nafion, new electrostatic interactions can be formed in the interface of nafion and Im-Si which result in both lower methanol permeability and also higher proton conductivity. Physical characteristics of these manufactured nanocomposite membranes were investigated by scanning electron microscopy (SEM), thermogravimetry analysis (TGA), differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FTIR), water uptake, methanol permeability and ion exchange capacity, as well as proton conductivity. The nafion/Im-Si membranes showed higher proton conductivity, lower methanol permeability and as a consequence, higher selectivity parameter in comparison to the neat nafion or nafion/silica membranes. The obtained results indicated that the nafion/Im-Si membranes could be utilized as promising polyelectrolyte membranes for direct methanol fuel cell applications.

Biography

Elham Jafarnia has received Chemical Engineering degree and MSc in Nanoscience and Nanotechnology, both from Sharif University of Technology, Iran. She is presently working on environmental friendly procedure to recycle polymer wastes and nanocomposite membranes.

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