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Development and characterization of poly(arylene ether sulphone) based polymer electrolyte membranes for direct methanol fuel cell applications

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Abstract

Fuel cells represent a clean and environmentally friendly alternative to current technologies of power generation due to savings in fossil fuels, high efficiency of energy conversion and low pollution level. The most important component of a fuel cell is the polyelectrolyte membrane (PEM). In this study, new polymer electrolyte membranes (PEM) based on poly(arylene ether sulfone)s were prepared for direct methanol fuel cells (DMFC). Common requirements for a polyelectrolyte membrane in DMFC applications include high proton conductivity, high chemical and mechanical durability, low methanol permeability at operation conditions and low cost. In order to satisfy these requirements sulfonated poly(arylene ether sulfones) (PESS) were prepared. The sulfonate groups are introdoced to the poly(arylene ether sulfone) structure to increase the proton conductivity, however completely sulfonated polymers increase the methanol permeability, therefore to decrease the methanol permeability, partially sulfonated poly(arylene ther sulfone) copolymers were prepared via the solution condensation polymerization of 4-fluoro phenyl sulfone, hydroquinone 2-potassium sulfonate and an excess of Bisphenol A. These poly(arylenethersulfone) based polymers were also methacrylated via reaction with glycidyl methacrylate (PESSGMA), cross-linked and altered via radical polymerization with co-monomers such as styrene and vinyl-phosphonic acid. The chemical structures of the synthesized polymers were characterized via H^1-NMR and FT-IR spectroscopic techniques, the effects of cross-linking and the introduction of the co-monomers on the proton conductivity, thermomechanical and thermal properties of the polymers were investigated using impedance spectroscopy, DMA, TGA and DSC methods respectively.

Biography

Erde Can is an assistant professor in the Dept. of Chemical Engineering at Yeditepe University, Istanbul, Turkey. She recieved her MS degree in Chemistry from Boğaziçi University in 1999 and PhD degree in Materials Science and Engineering from University of Delaware in 2005 after which she held a post-doctoral fellowship in the Chemical and Bioengineering Dept. at Drexel University (2006-2007). Her current research areas are polymers from renewable resources, polymeric biomaterials and polymeric fuel cell membranes.