Synthesis and Characterization of Poly {styrene-co-crylonitrile} for Application in Fuel Cells

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ABSTRACT

The growing demand for energy and concern about the high level of pollution caused by the emission of gases associated with fossil fuels has been significantly contributed to the development of alternative sources of power generation. Fuel cells have received considerable attention due to the direct conversion of chemical into electrical energy with high efficiency. In this context, Polymer Electrolyte Membrane Fuel Cells (PEMFCs) stand out due to their high performance, low emissions and low temperature operation, but these systems require hydration for use, which limits the operating temperature of the system. However, the development of polymer electrolytes to allow the use of temperatures higher than 130 ^{o}C, will open the type of catalyst used and hence reduce the degree of purity required for the fuel. Among the most commonly used membranes Nafion dominates the market for ionomer membranes, reaching the requirements of high proton conductivity below 100 º C. However, it has a high cost and is limited due to high permeability to methanol, for its use in direct methanol fuel cell. Alternatively, the proton conducting membranes of sulphonated aromatic based hydrocarbons, exhibit excellent thermal and chemical stability, reasonable mechanical strength and film-forming ability. In this work, the synthesis and characterization of membranes derived of poly{styrene-co-acrylonitrile} (SAN) is described. In order to enhance proton conductivity and thermal stability, sulfonation treatment and doping with nano metal particles (silver, gold and copper) were also carried out. Membranes were prepared by outside spin coating technique and evaluated for chemical structure, thermal stability, mechanical properties and proton conductivity. Results show doping increases thermal stability and ionic conductivity is similar to materials obtained commercially.

Keywords: Fuel cell, poly{styrene–co-acrylonitrile}, polymer electrolyte.


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