

Novel Sulfonated Poly(arylene ether ketone)s as Proton Exchange Membranes

Feng Wang,¹ Racial Hopp,² Yu Cheung Kim,¹
Michael Hickner,¹ Thomas Zawodzinski³ and
James McGrath¹

¹Virginia Polytechnic Institute and State University
Department of Chemistry and Material Institute
Blacksburg, VA 24061
USA

²University of Wisconsin
Department of Chemistry
Stevens Point, WI 54481
USA

³Los Alamos National Laboratory
MST-11
Los Alamos, NM 87545
USA

Disodium 3,3'-disulfonate-4,4'-difluorobenzophenone (SDFK) was synthesized by sulfonation of 4,4'-difluorobenzophenone (DFK) with fuming sulfuric acid and neutralization with sodium chloride and sodium hydroxide. A series of novel poly (arylene ether ketone)s containing pendant sodium sulfonate groups were prepared by aromatic nucleophilic substitution polycondensation of SDFK, DFK and hexafluoro bisphenol-A. (Co) polymerization proceeded quantitatively to high molecular weight at 175°C in presence of anhydrous potassium carbonate. The presence of sulfonate groups was confirmed by the FTIR spectra. The sulfonated polymers were soluble in dipolar aprotic solvents, such as N, N-dimethylacetamide and N-methyl-2-pyrrolidinone. Tough membranes with high sulfonate groups content cast from N, N-dimethylacetamide were obtained. The acid form membranes were successfully obtained by treating the sodium form of the membranes with dilute sulfuric acid solution. The proton conductivity is greatly influenced by ion exchange capacity, chemical compositions, temperature, and water activity. The new copolymers, which contain ion conductivity sites on the deactivated positions of the aryl backbone rings, are candidates as new polymeric electrolyte materials for proton exchange membrane (PEM) fuel cells.