Crosslinked sulfonated poly(arylene ether sulfone) membranes for high temperature PEMFC

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Sulfonated poly(arylene ether sulfone) copolymers containing carboxyl groups are prepared by an aromatic substitution polymerization reaction using phenolphthalin, 3,3'-disulfonated-4,4'-dichlorodiphenyl sulfone, 4,4'-dichlorodiphenyl sulfone and 4,4'-bisphenol A as polymer electrolyte membranes for the development of high temperature polymer electrolyte membrane fuel cells. Thin, ductile films are fabricated by the solution casting method, which resulted in membranes with a thickness of approximately 50 μm. Hydroquinone is used to crosslink the prepared copolymer in the presence of the catalyst, sodium hypophosphite. The water uptake and proton conductivity of the membranes are decreased with increasing the degree of crosslinking which is determined by phenolphthalin content in the copolymer. The prepared membranes are tested in a 9 cm^2 commercial single cell at 80 °C and 120 °C in humidified H_2/air under different relative humidity conditions. The uncrosslinked membrane is found to perform better than the crosslinked membranes at 80 °C; however, the crosslinked membranes perform better at 120 °C.