

An Amphiphilic Polysulfone-*graft*-Poly(ethylene) Glycol  
Random Copolymer for Alkaline Exchange Membrane  
Fuel Cell

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The corrosive acidic environment of Proton Exchange Membrane Fuel Cells (PEMFCs) necessitates the use of prohibitively expensive precious metal catalysts, strongly hindering commercial feasibility. The basic environment of an Alkaline Exchange Membrane Fuel Cell (AEMFC), however, provides the potential to use cheap, earth-abundant metal catalysts. Unfortunately, AEMFCs typically perform significantly worse than their PEMFC counterparts, due in large part to the poor ionic conductivities of the current alkaline exchange membranes.

Our goal is to develop a higher performance alkaline exchange polymer membrane by morphologically tuning the polymer towards more efficient ion transport. To this end, we have developed a novel amphiphilic polymer, quaternary ammonium-functionalized polysulfone-*graft*-poly(ethylene) glycol (QA PSf-*g*-PEG), with the rationale that the hydrophilic PEG grafts co-localize the ion-conducting quaternary ammonium groups, thereby inducing the formation of efficient ion transport domains. A fully hydrated QA PSf-*g*-PEG film exhibited an ionic conductivity of 35 mS/cm at room temperature, a notable increase over the 20 mS/cm of un-PEGylated films. This conductivity improvement consequently increased the peak power density of the fuel cell from 120 mW/cm<sup>2</sup> to 185 mW/cm<sup>2</sup> at 65°C.

We will discuss the synthesis and characterization of these anion exchange membranes. Moreover, we will present theoretically informed coarse-grained simulations of the copolymer melt in an effort to assess the influence of thermodynamic phase behavior on mesostructure and ion transport properties.