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Abstract

Crosslinked ionomers containing clusters of alkyl ammonium group at side chain was synthesized by attaching an unique (tris[2-(dimethylamino)ethyl]amine on poly(2,6-dimethyl-1,4-phenylene oxide) (PPO) polymer backbone. These molecular structures show a dramatic enhancement in water resistance (low water uptake (9-13 %) and dimensional swelling (4-6%) in water at room temperature) compared with non-cluster-shaped PPOs. Moreover, the temperature had less of an influence on the water uptake and swelling ratio of the membranes. The resulting anion exchange membranes exhibit good ionic (OH^-) conductivities in water (up to 25.4 mS cm^{-1} at 25°C) and represent a new class of anion exchange membranes. A test of the alkaline stability of membranes (in 1M KOH at 60°C for 480h) showed hydroxide conductivity about 51% of the original conductivity and indicated that these membranes are good candidates for application in AFCs. Membrane electrode assembly made from the as-fabricated membrane showed moderate fuel cell performance reaching peak power density 77 mW cm^{-2} at 60°C in a H_2/O_2 alkaline fuel cell. This simplistic synthetic tactic enables the preparation of densely functionalized materials with the potential to meet the demands of AFCs.

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