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**Polymer Electrolyte Membrane with Heterocyclic Terminated Poly(ethylene glycol) Brushes: An Approach to Decorate Proton Conductive Species on Membrane Surface**

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**Abstract**

The incorporation of proton transfer species into the polymer electrolyte membranes (PEM) of the proton exchange membrane fuel cell (PEMFC), in most cases, rely on the chemical modification in solution state before casting the membrane, and therefore, the function of proton transfer species is depending on the membrane physicochemical properties. The present work proposes a simple grafting poly(ethylene glycol) (PEG) onto membrane surface to incorporate PEG hydrophilic chains for the function of water and acid molecules absorption. At the same time, the PEG terminated with benzimidazole provides the proton hopping. Sulfonated poly(ether ether ketone) (SPEEK) is cast to obtain a membrane and its surface is further grafted with polymer brushes of PEG containing benzimidazole terminals. The membrane obtained is stable up to 250 °C without degradation indicating the feasibility for high temperature PEMFC. The proton transfer is under the vehicle mechanism in non-humidified condition where the conductivity and water uptake of the membranes are increased when increasing of PEG chain length in combination with the benzimidazole units. The direct surface modification of PEM with polymer

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