Preparation and characterization of radiation-grafted poly(ethylene-co-tetrafluoroethylene) films as electrolyte for alkaline fuel cells

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Anion Exchange membranes (AEMs) are a promising alternative to the development of more efficient electrolytes for alkaline fuel cells. In general, the AEMs are ionomeric membranes able to conduct hydroxide ions (OH^-) due to quaternary ammonium exchange groups, which confer to AEM high pH equivalent. The AEMs are based on crosslinked fluorinate/partially fluorinated polymer due to their outstanding chemical and thermal stability compared to hydrocarbon polymer-based matrix. The pre-irradiation method has been widely used for grafting (copolymerization) of monomers into polymer matrix due to a reduced formation of homopolymers and the possibility of grafting to be carried out at any time. The radicals produced during radiation process decay as a function of time and affect the grafting reaction, such as reduction of active centers, grafting yield and membranes properties. In order to optimize the irradiation parameters process and the membrane reproducibility, the stability of radicals styrene-grafted ETFE prepared by using electron beam irradiation by doses of 70 and 100 kGy as a function of storage time (up to 10 months) was evaluated by electron paramagnetic resonance (EPR), degree of grafting, ion exchange capacity (IEC), and electrochemical impedance spectroscopy. Results have shown that the radicals formed could be preserved by storage at low temperature (-70 °C), producing membranes with high homogeneity and satisfactory ionic conductivity. Such results have demonstrated that ETFE-based AEMs are promising electrolyte for alkaline fuel cell applications.

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