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Physico-chemical study of sulfonated polystyrene pore-filled electrolyte membranes by electrons induced grafting

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Abstract

Pore-filled polymer electrolyte membranes have been prepared as a potential proton exchange membrane by radiation induced grafting using simultaneous technique. The porous substrate films were grafted in a subsequent step after flooding the membranes pores with styrene monomer. The grafted films were then sulfonated in a post-grafting reactions. The influence of grafting conditions, i.e. irradiation dose and monomer concentration in correlation with the grafting yield (Y) have been investigated. The results showed that the grafting yield is increased for both conditions. The resulting membranes were then characterized by evaluating their physico-chemical properties such as ion exchange capacity, water uptake and proton conductivity as a function of grafting yield. The overall results showed that polystyrene grafts is successfully anchored within the pores of PTFE films during grafting and subsequently transformed into hygroscopic proton exchange regions after being sulfonated. The measured conductivity of the sulfonated polystyrene pore-filled electrolyte PTFE membranes achieved were approximately within the magnitude of 10^{-3} and 10^{-2} S cm^{-1} at room temperature and at higher operating temperature, respectively.

Keywords: Pore-filled membranes; Proton exchange membrane; Electron beam radiation; Physical and chemical properties

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