



## PSSA pore-filled PVDF membranes by simultaneous electron beam irradiation: Preparation and transport characteristics of protons and methanol

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### Abstract

Polystyrene sulfonic acid (PSSA) pore-filled poly(vinylidene fluoride) (PVDF) membranes have been prepared using simultaneous electron irradiation method. Porous PVDF films were grafted by pre-swelling in styrene solution and subsequent irradiation with an electron beam (EB) under nitrogen atmosphere and at ambient temperature. The grafted films i.e. polystyrene (PS) pore-filled PVDF were subsequently sulfonated with a diluted mixture of chlorosulfonic acid. The effects of the reaction parameters on the content of PS grafted in the pores of PVDF films were investigated. The chemical and morphological properties of the membranes in comparison with their un-grafted and grafted counterparts were studied by Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). The transport properties of these membranes such as ionic conductivity and methanol permeability were evaluated and correlated with the content of PS grafted in the pores of the PVDF films. The PSSA pore-filled PVDF membranes with PS content in the pores of 40% and above showed superior performance characteristics compared to Nafion 117 membrane and therefore can be potential alternatives to improve the performance of direct methanol fuel cell (DMFC).

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**Keywords:** Radiation grafted pore-filled membranes; Simultaneous electron irradiation; Methanol transport; DMFC

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