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www.elsevier.com/locate/memsci

PII: S0376-7388(16)31282-0
DOI: http://dx.doi.org/10.1016/j.memsci.2016.12.065
Reference: MEMSCI14995

To appear in: *Journal of Membrane Science*

Received date: 12 August 2016
Revised date: 20 December 2016
Accepted date: 26 December 2016

Cite this article as: Chen Li, Lei Wang, Xudong Wang, Mengxiao Kong, Quar Zhang and Guangyuan Li, Synthesis of PVDF-g-PSSA proton exchang membrane by ozone-induced graft copolymerization and its application i microbial fuel cells, *Journal of Membrane Science* http://dx.doi.org/10.1016/j.memsci.2016.12.065

Synthesis of PVDF-g-PSSA proton exchange membrane by ozone-induced graft copolymerization and its application in microbial fuel cells

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Abstract

Thermally induced graft copolymerization of sodium styrene sulfonate (SSS) with ozone-preactivated poly(vinylidene fluoride) (PVDF) produced a PVDF-g-PSSS copolymer. Sulfonic acid proton exchange membranes (PVDF-g-PSSA) were then prepared using the solvent evaporation method. They were investigated with a Fourier transform infrared spectrometer and an X-ray diffractometer. The results indicate that the proton conductivity of the prepared membranes reached 0.046 s/cm when the degree of grafting was 50.52%. Results from a quartz crystal microbalance with dissipation monitoring indicated that the PVDF-g-PSSA membrane showed superior antifouling performance to that of a Nafion membrane. The performance of the prepared membrane in dual-chamber microbial fuel cells was also evaluated and compared with that of Nafion 117. Although the microbial fuel cell with the prepared membrane generated lower maximum power density (106.7 mW/m^2) than that with Nafion 117 (132.0 mW/m^2), it was more cost-effective because of its lower price and more simplified preparation process. In addition, its chemical oxygen demand (COD) removal (85%) was much higher than that of Nafion 117 (74%).

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