

研究论文

掺杂纳米SiO₂的PVDF-g-PSSA质子交换膜

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摘要 以聚偏氟乙烯(PVDF)为骨架, 采用溶液接枝苯乙烯磺酸, 合成了掺杂纳米SiO₂颗粒的复合质子交换膜

(PVDF/xSiO₂-g-PSSA). 利用红外光谱、热失重分析方法、扫描电镜, 对膜的结构、热稳定性、

表面及断面形态进行了表征. 考察了膜的吸水率、电导率、甲醇渗透性等性质. 结果表明, 纳米SiO₂

颗粒能提高膜的阻醇性能, 掺杂质量分数10%的适量SiO₂颗粒所得的复合膜的甲醇渗透系数达 $1.0 \times 10^{-7} \text{ cm}^2/\text{s}$,

低于聚偏氟乙烯接枝苯乙烯磺酸(PVDF-g-PSSA)膜的 $1.7 \times 10^{-7} \text{ cm}^2/\text{s}$, 仅为Nafion-117的渗透系数的二十分之一.

PVDF/10% SiO₂-g-PSSA复合膜具有较高的选择性, 在直接甲醇燃料电池中具有良好的应用前景.

关键词 [直接甲醇燃料电池](#) [质子交换膜](#) [聚偏氟乙烯接枝苯乙烯磺酸](#) [二氧化硅](#) [甲醇渗透率](#)

分类号

PVDF-g-PSSA and SiO₂ Composite Proton Exchange Membranes

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Abstract A novel kind of composite proton exchange membrane was prepared by doping the nano-SiO₂ into poly(vinylidene fluoride) grafted polystyrene sulfonated acid (PVDF/xSiO₂-g-PSSA). The structure and stability of the membranes were characterized with the IR spectra and thermal gravity analysis (TGA). The morphology of the surface and the dispersion of elements in the cross section of the membrane were observed by the scanning electron microscope (SEM). The water-uptake, proton conductivity and methanol permeability of the membranes were measured. The results showed that the nano-SiO₂ could slow the methanol permeation; the permeability coefficient of the composite membrane with SiO₂ ($w=10\%$) was up to $1.0 \times 10^{-7} \text{ cm}^2/\text{s}$, which is lower than that of PVDF-g-PSSA and just one twentieth of that of Nafion-117. This kind of composite membranes has high selectivity and shows a promising practical value in direct methanol fuel cells (DMFC).

Key words [direct methanol fuel cell \(DMFC\)](#) [proton exchange membrane](#) [poly\(vinylidene fluoride\) grafted styrene sulfonic acid](#) [SiO₂](#) [methanol permeability](#)

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