연료전지막을 위한 PPO/PS-b-PSSA 블랜드의 제조와 분석

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Preparation and Characterization of PPO/PS-b-PSSA Blend for Fuel Cell

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1. Introduction

Generally, The protone exchange membrane (PEM) contains cationic exchange groups such as $SO3^-$ group. The poly(styrene sulfonic acid) (PSSA) and its copolymers are widely studied because of easily synthetic method and higher conductivities. However, PSSA is not used individually because of poor physical properties such as brittleness and relatively lower Tg. So some researchers are concerned engineering plastics (EP) such as polyimides, polysulfone, polyketones, and poly(2,6-dimethyl-1,4-phenylene oxide) (MPPO) etc. And many studies of fuel cell membrane utilized random copolymer, block or graft copolymers. Blends of these polymers were rarely studied because of some dilemmas between conductivity and stability in fuel cell operation. The higher sulfonic group content donate the higher conductivity but also lower chemical stability. In this work, we concern the MPPO because of its good mechanical, chemical, thermal properties. Many papers showed fully miscible blend with MPPO and PS.

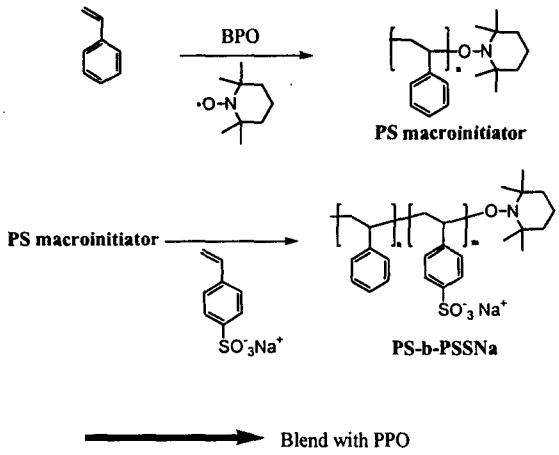
2. Experimental

polystyrene-*b*-poly(styrene sulfonic acid) sodium salt (PS-*b*-PSSNa) was synthesized via stable free radical polymerization (SFRP) using TEMPO. SFRP is a kind of living radical polymerization. So, it is possible to control of polymer architecture. The controlled PS block donate miscibility with MPPO and interfacial adhesion between PPO and PSSNa through anchoring of PS chain in MPPO matrix. The tuned PSSNa block donate controlled phase size of PSSNa and protone conductivity. Scheme 1 shows the preparation of the synthesis and blend of PS-*b*-PSSNa.

3. Results

The PS macroinitiator and block copolymers was characterized by GPC and 1H-NMR. The molecular weight of PS-*b*-PSSNa was characterized by FT-IR spectra (Figure 1). And the block

copolymer was examined morphologically by atomic force microscopy (AFM). Direct Applicability for fuel cell membrane was characterized by ion conductivity , water uptake and MeOH permeability etc. Other characters for fuel cell membrane such as phase separation behavior and conductivity etc. will be discussed.



Scheme 1. Preparation of blended membrane and synthesis of PS-*b*-PSSNa.

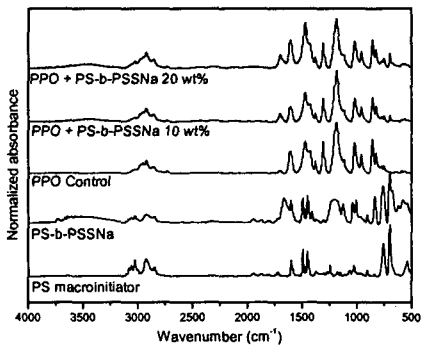


Figure 1. FT-IR spectra of blends and synthesized copolymers

4. References

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2. J. Ding, C. Chuy, S Holdcroft, Macromolecules, 35(2003), 1348.