일반강연 A-1

이온교환막의 분포가 이온교환막의 물성에 미치는 영향

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Effect of a marcroscopic fixed charge distribution on the properties of ion-exchange membrane

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The performance of ion-exchange membrane depends on its chemical nature and the conditions of the surrounding liquid medium. The former includes the type of a membrane (cationic or anionic), the amount of fixed charges and its distribution. The latter includes the operating condition and the flow field near the liquid membrane interface. Increasing fixed charge in a membrane can improve the performance of an ion-exchange membrane [1]. A particular distribution of fixed charge groups inside the membrane plays a significant role. Many researchers have studied the effect of fixed charge distribution on the performance of ion-exchange membrane [2-11]. However, since preparation of ion-exchange membrane with nonuniform or uniform fixed charge distribution (Fig. 1) is difficult, most of the studies have been carried out only theoretically without experimental investigation.

Plasma-induced graft polymerization (PIGP) is a well-known method to modify a polymer surface since the outer surface of a polymer is activated without a change of the bulk properties. PIGP consists of two steps: the first step is a plasma treatment to generate polymer radicals on the substrate; the second step is a grafting and polymerization of the monomer with the radicals. When a porous membrane is utilized as a substrate, PIGP occurs both on the outer surface of the membrane and on the surface of the internal pores in the membrane [13].

In this study, we prepared ion-exchange membranes with uniformly and non-uniformly fixed charge distribution using the control of the reaction temperature of plasma-induced graft polymerization and investigated the effect of the fixed charge distribution on the properties of the ion-exchange membrane using sulfonated glycidyl methacryalted(GMA)-g-polypropylene(PP) membrane (Fig. 2). The prepared membranes with various fixed charge distribution were characterized in terms of physical and electrochemical properties such as transport number, ion exchange capacity, water content, membrane electric resistance, I-V relation and chronopoteniometric reponses. Also, the chemical structure and morphology of the prepared membrane were investigated using microscopic Fourier transform infrared spectroscopy mapping method, field emission scanning electron microscopy (FESEM).

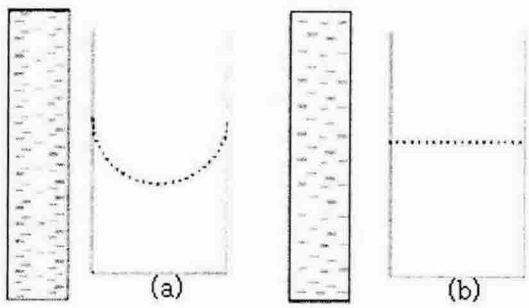

Fig 1. Nonuniformly charged membrane(a) and uniformly charged membrane (b)

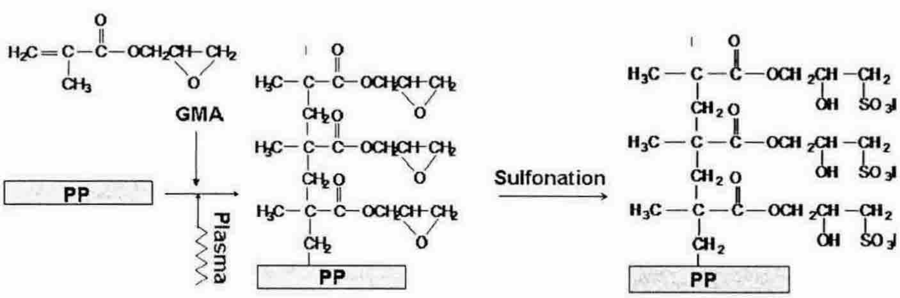

Fig. 2. Preparation scheme for cation-exchange membrane

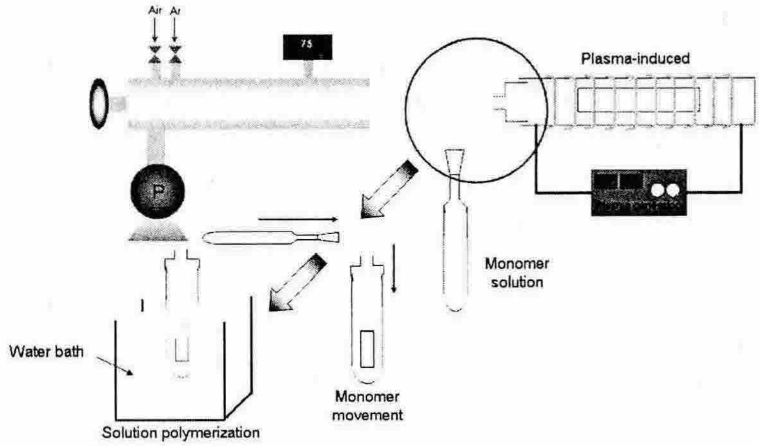

Fig. 3. Apparatus for plasma graft polymerization

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