PEBAX-실리카 하이브리드막의 기체투과특성

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Gas Permeation Properties of Poly(amide-6-b-ethylene oxide)-Silica Hybrid Membranes

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1. Introduction

Recently, a number of groups have reported organic-inorganic hybrids as one of candidates to improve the permeation characteristics [1,2]. At least, two effects of inorganic particles in polymer matrix on permeation properties can be described. First, the strong interaction between polymer and inorganic particle reduces segmental and subsegmental mobility and inhibits segmental packing of polymer. A change in polymer structures contributes to increase diffusivity (by disrupting interchain packing) and diffusivity selectivity (by increasing polymer backbone stiffness), which plays more important role than solubility in determining the productivity of given polymers [1,3]. Second, the interaction between the residual OH groups on the inorganic component and polar gases (such as CO_2 and SO_2) and the morphological changes can give rise to the increase of solubility associated with an increase of the Henrys contribution [4,5].

In the present study, we explore gas transport properties of PEBAX®-silica hybrids. These composites have been prepared via *in situ* polymerization of tetraethoxysilane (TEOS) using the sol-gel process. The permeability and permselectivity at various temperatures

were obtained for He, CO_2, O_2 and N_2. It is our intention to investigate and discuss the effect of silica incorporation into PEBAX® on the structural changes and corresponding permeation characteristics.

2. Experimental

For the preparation of PEBAX®-silica hybrids, the measured amount of TEOS (previously diluted in propanol) was carefully added to a 3wt% PEBAX® solution. A 0.15M HCl solution, also diluted with propanol, dropped into the PEBAX®-TEOS solution mixture at 80iÉ under reflux with fast agitation, keeping 4:1 water to TEOS hydrolysis ratio. After 30hr reaction, the homogeneous solution was poured into a covered Teflon-coated Petri dish. After 2 weeks at room temperature, the cover was removed and the solvent was evaporated for at least another 48hr. To remove any residual solvent, the film was further dried under vacuum for 24hr.

3. Results and discussion

The hybrid membranes exhibited higher gas permeability coefficients and permselectivities than those of PEBAX®, particularly at an elevated temperature: α_{CO_2/N_2}=72 at 25℃ with P_{CO_2}= 205 and α_{CO_2/N_2}=44 at 85℃ with P_{CO_2}=507 Barrer for P8S2 obtained. The high permeability and permselectivity of the hybrid membranes are attributed to the strong interaction between CO_2 molecules and SiO_2 domains, additional sorption sites in PA block of PEBAX® and the organic/inorganic interphase.

4. References

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