

## UV조사 폴리이미드실록산막의 기체 투과특성

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### Gas Permeation Properties of UV-irradiated Poly(imide siloxane) Membrane

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Some of the most interesting and unique features of siloxane containing copolymers are associated with their surface morphology and the resultant surface properties, which distinguish them from other polymeric systems. Due to their very large molar volumes jointed with the very low intramolecular interactions and high flexibilités, polydimethylsiloxane (PDMS) have very low surface tension and surface energies. As a result, the air-polymer interfaces of siloxane containing copolymers such as poly(imide siloxane) and poly(amideimide siloxane), as well as their blends with other polymers are substantially enriched in the lower surface energy siloxane. The thermodynamic driving force behind this process is the minimization of the interfacial and/or surface energy. It is well known that the surface energy interfacial tensions vary with both temperature and molecular weight of the active component and probably to some extent with the copolymer architecture.

Siloxanes are also very well known for their high gas permeabilities. However, siloxane homopolymers are mechanically weak and also do not show high selectivities towards different gases. Siloxane copolymers on the other hand, usually possess good mechanical strength. Through careful selection and design of the

organic backbone structures, it is also possible to improve the gas selectivity of these polymers.

Whereas  $\text{SiO}_x$  films are versatile materials offering a myriad of applications due to their interesting properties. Their high resistance to oxygen and water, and high gas selectivity lead to their use as moisture barriers, protective layers, and gas separation membranes. Usually, techniques used to produce  $\text{SiO}_2$  thin films involve restrictive atmospheric conditions. Pyrolytic degradation of polydimethylsiloxane (PDMS) can result in high-quality silicon oxide films at temperatures above  $400^\circ\text{C}$ . In addition, PDMS can be converted to  $\text{SiO}_x$  by exposure to UV light in the presence of atmospheric oxygen at ambient conditions. Simultaneously, ozone, an active oxidizing agent, is generated in situ from atmospheric oxygen by exposure to UV light.

In this study, we focused on the change of PDMS phase in the poly(imide siloxane) by UV irradiation. Fig. 1 showed  $\text{Si}_{2p}$  XPS spectra for the poly(imide siloxane) films before and after exposure to UV for 1 hr. After exposure to UV, the  $\text{Si}_{2p}$  binding energy shifts toward that of amorphous  $\text{SiO}_2$  or to a value corresponding to tetrahedral coordination

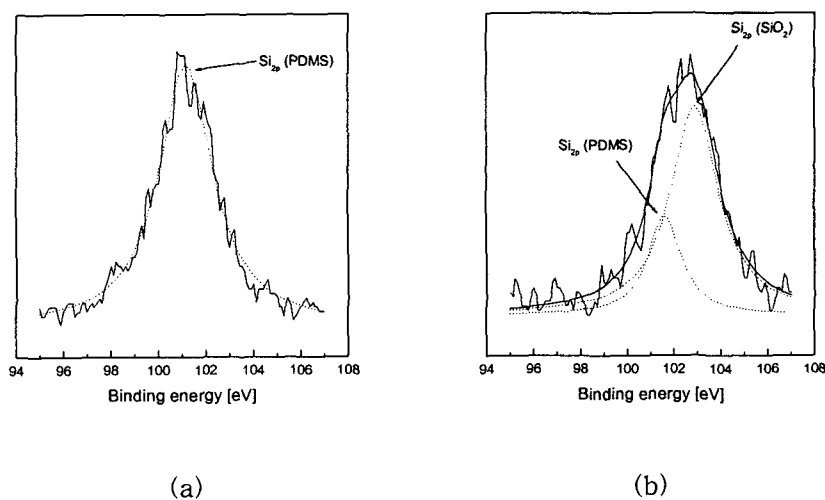


Fig. 1.  $\text{Si}_{2p}$  XPS spectra for the poly(imide siloxane) films before (a) and after (b) exposure to UV for 60min.

of each silicon atom to four oxygen. Consequently, UV irradiation of poly(imide siloxane) can lead to an organic-inorganic composite membrane composed of imide domain and converted SiO<sub>2</sub> domain. Particularly, in present work, it would be intensively investigated whether the converted SiO<sub>2</sub> phase in the poly(imide siloxane) film would affect the gas permeation properties through the membrane or not.

### Reference

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