学位論文概要

題 目　Synthesis of polysilsesquioxanes for water desalination and functionalized polydimethylsiloxanes

（海水淡水化用ポリシルセスキオキサンと官能基化ポリジメチルシロキサンの合成）

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In Part 1, “Development of organosilica reverse osmosis (RO) membranes for water desalination” is composed of three chapters. In chapter 1, the issue of water shortage in the world and the reverse osmosis technology to solve the problem is introduced. Commercially used RO membranes including polymeric membranes such as cellulose acetate (CA) and polyamide (PA) membranes and some novel RO membranes are introduced with respect to their fabrication and advantages and disadvantages for the use are introduced. In Chapter 2, the effort to improve the RO performance of the membranes, especially to improve the water permeability is described. In Chapter 3, membrane formation by interfacial polymerization is described. In Chapter 2, the introduction of more polar ethenylene units in **BT2-HM** membranes improved the RO performance from 3.4×10^{-13} $m^3/m^2 \cdot s$ Pa of the previously reported **BT1-HM** membrane to 1.1×10^{-12} $m^3/m^2 \cdot s$ Pa, though the salt rejection was a litter decreased to 89%. In the Chapter 3, a new method namely interfacial polymerization was firstly employed for the preparation of organosilica membranes for RO to replace the commonly used so-gel process. Though the interfacial polymerization method can only be used to some certain precursors with polar bridged units, such as bis[3-(triethoxysilyl)propyl]amine (**BTESPA**), the RO performance is similar to the membrane prepared by sol-gel process. More importantly, the interfacial polymerization is a much more convenient and time-saving method.

In Part 2, “Synthesis of polydimethylsiloxanes with functional end groups and their applications”, three chapters are involved. In Chapter 1, the properties and application of PDMS are introduced. The anionic ring-opening polymerization to synthesize the PDMS and the problems in the reaction is introduced. In Chapter 2, the preparation of amino-polydimethylsiloxanes is described. In Chapter 3, the ring-opining reaction of cyclic ethers with hydrosilyl PDMS to synthesize haloalkoxy and haloalkanoyloxy PDMS is described. In both the Chapters, PDMS with Si-H bond at one end were employed as the reactive polymers. In Chapter 2, The Si-H bond underwent dehydrogenative substitution reactions with diamines (R_2NH) in the presence of a catalytic amount of Pd/C to afford the amino-PDMS. Treatment of glass surface with the amino-PDMS improved the hydrophobicity of the glass surface, indicating the potential application of the diamino-polydimethylsiloxanes as hydrophobic glass surface modifier. In Chapter 3, the Si-H bonds of hydrosiyly PDMS reacted with cyclic ethers or a lactone, and MeI or allylBr in the presence of a catalyst $PdCl_2$ to produce haloalkoxy or haloalkanoyloxy PDMS is described.