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Development of Organic-Inorganic Hybrid Membranes for Seawater Desalination

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Summary

Hybrid organically bridged silica membranes have attracted considerable attention because of their high performances in a variety of applications. Development of robust reverse osmosis (RO) membranes to withstand aggressive operating conditions is still a major challenge. In this study, two types of new microporous membranes have been developed and applied in reverse osmosis. The first type of RO membranes were prepared by using titania, which show an excellent stability to both acid and alkali solutions. Pure TiO_2 and TiO_2 mixed with zeolites were investigated in an attempt to develop RO performance. However, The average pores sizes were approximately 1nm, and show rather low rejection (approximately 10%) to NaCl. Another strategy is the use of organosilica membranes. Sol-gel derived organosilica RO membranes reject isopropanol with rejection higher than 95%, demonstrating superior molecular sieving ability for neutral solutes of low molecular weight. Due to the introduction of an inherently stable hybrid network structure, the membrane withstands higher temperatures in comparison with commercial polyamide RO membranes, and is resistant to water to at least 90°C with no obvious changes in filtration performance. Furthermore, both an accelerated chlorine-resistance test and FTIR analysis confirm excellent chlorine stability in this material, which demonstrates promise for a new generation of chlorine-resistant RO membrane materials.