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Preparation of hydrogen separation membranes using disiloxane compounds

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ABSTRACT

Hybrid silica membranes were prepared using 1,1,3,3-tetraethoxy-1,3-dimethyldisiloxane (TEDMDS) as a silica precursor. Hybrid silica sol was synthesized by the acetic acid catalyzed hydrolysis and condensation of TEDMDS in ethanol as a solvent with different water molar ratio. Porous silica membranes were fabricated by coating the TEDMDS-derived hybrid silica sol, followed by drying and firing at 300°C or 450°C in nitrogen atmosphere. Single gas permeation characteristic of He, H_2, N_2, and SF_6 through TEDMDS-derived silica membranes were measured at 200°C. It was found that TEDMDS-derived silica membranes had loose amorphous structure than TEOS-derived silica membranes. TEDMDS-derived silica membrane fired at 300°C using TEDMDS/H_2O = 1/20 sol showed H_2 permeance of 2.05×10^{-6} m^3 m^{-2} s^{-1} kPa^{-1} with H_2/SF_6 selectivity of 260°C at 200°C. The water contact angles of TEDMDS-derived silica film were constant even after kept in humid atmosphere (60 RH%, 40°C) for about 35 d, suggesting a hydrophobic property due to the presence of CH_3 groups.

Keywords: 1,1,3,3-tetraethoxy-1,3-dimethyldisiloxane; Structured silica network membrane; Hydrophobic property; Hydrothermal stability

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