290h Hydrogen Permeation through Microporous Silicon Carbide-Based Membranes Derived from Polycarbosilane Precursor

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Microporous silicon carbide (SiC)-based membranes derived from commercially available polycarbosilane (PCS) precursor have been prepared and characterized. A homogeneous solution containing an appropriate amount of organic solvent and PCS was coated onto a porous tubular ceramic substrate, followed by drying and pyrolysis under various conditions. SiC amorphous membranes prepared under an optimum condition were shown to exhibit excellent hydrogen/nitrogen permselectivity at high temperature. To investigate the effects of structural modifier on the membrane performance as well as to decrease the percentage of siloxane bonds in the SiC membranes, PCS was cross-linked with a non-oxygen bond by using the hydrosililation reaction of an unsaturated compound, p-diethynylbenzene. This cross-linking treatment was revealed to give SiC membranes with better porous structure and hydrogen separation performance. To tailor the membrane separation performance, some other factors encountered during and pre/post pyrolysis steps were also investigated. It was found in the present study that addition of a pore-making agent polystyrene, appropriate oxidation of the as-prepared SiC membranes, and low-temperature thermal cross-linking contribute to further improve hydrogen permeation performance.