

Preparation of Ceramic Hollow Fiber Membranes for CO₂ Capture

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Abstract : The purpose of this study is to have chemical resistance, high heat resistance and mechanical strength of ceramic hollow fiber membrane into a membrane contactor, and the combustion process is applied (Post-combustion capture) of the carbon dioxide absorption device. In this paper, we would investigate the effect of the ceramic membrane hydrophobicity to the flux of the carbon dioxide adsorption. To improve the applicability of the ceramic film. We use the dry-wet spinning method with the high temperature sintering process for preparing a ceramic hollow fiber membranes to increase the filling density per unit volume of the membrane. The PESf/Al₂O₃ ratio of 1:5 was prepared ceramic hollow fibers membrane precursors and investigate the relationship of the different sintering temperature to the membrane pore size and porosity. It can be found that the membrane via the sintering temperature of 1400 °C prepared with the highest porosity of 70%, while the membrane via the sintering temperature of 1600 °C prepared although has a minimum porosity of about 54%, but also has the smallest average pore size of about 0.2 μm. The hydrophilic ceramic hollow fiber membranes which after high-temperature sintering were changed into hydrophobic successfully via the 0.02M FAS modifier. The hydrophobic ceramic hollow fiber membranes with different sintering temperature, the membrane which was prepared via 1400 °C sintering has the highest carbon dioxide adsorption about 4.2×10^{-4} (mole/m²s). The membrane prepared via 1500 °C sintering has the carbon dioxide adsorption about 3.8×10^{-3} (mole/m²s), and the membrane prepared via 1600 °C sintering has the lowest carbon dioxide adsorption about 2.68×10^{-3} (mole/m²s). All of them have reusability and in long time operation, the membrane which was prepared via 1600 °C sintering has the smallest pores and also could operate for three days. After the test, the 1600 °C sintering ceramic hollow fiber membrane was most suitable for the factory.

Keywords : carbon dioxide capture, membrane contactor, ceramic membrane, ceramic hollow fiber membrane

Conference Title : ICIM 2015 : International Conference on Inorganic Membranes

Conference Location : Tokyo, Japan

Conference Dates : May 28-29, 2015