High-performance composite hollow fiber membrane for flue gas and air separations

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High-performance composite hollow fiber membrane for flue gas and air separations

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Abstract

A defect-free membrane with a very high gas permeance is greatly attractive to both academia and industry. Thin film composite (TFC) membranes are promising candidates. However, it is always challenging to have a reproducible and up-scalable method to fulfill the needs. Herein, we report a novel and straightforward strategy to fabricate a high-performance hollow fiber composite membrane using a crosslinked polydimethylsiloxane (PDMS) with a high inherent viscosity obtained from a novel post-crosslinking method. The evolution of inherent viscosity with various cross-linking conditions and substrate morphology from different spinning conditions have been investigated. The resultant defect-free composite membrane shows excellent O_2 and CO_2 permeances higher than 1000 and 5000 GPU, respectively; while the corresponding selectivities of O_2/N_2 and CO_2/N_2 are about 2 and 11, respectively. The newly developed methods may provide useful insights to fabricate next-generation high-performance composite membranes for gas separation.

Keywords: Composite hollow fiber membrane; Gas separations; Crosslinked PDMS; Flue gas; Oxygen enrichment

1. Introduction

Human activities, particularly, the extensive usage of fossil fuels, have led to an increase of about 25% in atmospheric CO_2 concentration during the period between 1960 (about 320