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6FDA-DETDA: DABE Polyimide-Derived Carbon Molecular Sieve Hollow Fiber Membranes: Circumventing Unusual Aging Phenomena

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Abstract

Transport properties are reported for asymmetric carbon molecular sieve (CMS) hollow fiber membranes based on polyimide precursors derived from a butanol esterified diamino benzoic acid (DABA) based polyimide, 6FDA-DETDA:DABE. Precursor fiber pretreatment with 10% Ethenyl(trimethoxy)silane [vinyltrimethoxysilane (VTMS)] solution in hexane followed by pyrolysis at 550°C in ultra-high purity argon created asymmetric CMS fibers with CO_2 permeance above 1000 GPU and CO_2/CH_4 selectivities > 25. Storage of the as-made modules for 72 days in 7 bar CO_2 suppressed undesirable aging typically seen under vacuum or atmospheric pressure air and provided CO_2 permeance and CO_2/CH_4 selectivity of 780 GPU and 48 respectively. These results are in contrast to significant losses in CO_2 permeance and CO_2/CH_4 selectivity for CMS created under equivalent pyrolysis conditions from non-esterified 6FDA-DETDA: DABA variant, even under CO_2 storage. The 6FDA-DETDA: DABA-derived CMS results were surprising, since dense film CMS samples from the same precursors did not