Impact of stabilization environment and heatingmrates on P84 co-polyimide/nanocrystaline cellulosemcarbon membrane for hydrogen enrichment

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Abstract

These past few decades, the separation of various gas mixtures problems in order to obtain high purity gases can be overcome by the introduction of membrane-based technology. This current research was focusing on the development of tubular carbon membranes (TCMs) from polymeric precursors for the separation of hydrogen and nitrogen. The fabrication of TCMs involved the dip coating technique and was using P84 co-polyimide as the main precursor by blending of nanocrystaline cellulose (NCC) as an additive. It was believed a slight adjustment on time, temperature, or environment of the carbonization protocol for the commercially available PI/NCC membranes can alter the final properties of the carbons produced. The modifications on the carbonization parameters such as stabilization conditions and heating rates during fabrication of PI/NCC-based carbon membranes could also affect their gas separation performance. A large variety of TCMs for gas separation have been developed by simple carbonization of a PI/NCC deposited on a ceramic tubular support. Herein, in this study, the effect of different heating rates (1, 3, 5, and 7 °C/min) and stabilization environment (Argon, Nitrogen, and Helium) were investigated for all resultant TCMs. As a result, it was observed that stabilization under Argon environment with heating rate of 3 °C/min produced carbon membranes with the best H_2/N_2 separation and the highest selectivity of 434.68 ± 1.39, respectively.

Keywords: Heating rates; Stabilization environment; P84 co-polyimide; Nanocrystalline cellulose (NCC); Hydrogen separation