

Impact of stabilization environment and heating rates on P84 co-polyimide/nanocrystalline cellulose carbon 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 nanocrystalline 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 H₂/N₂ separation and the highest selectivity of 434.68 ± 1.39, respectively.

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