Controlled Carbonization Heating Rate for Enhancing CO_2 Separation Based on Single Gas Studies

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Abstract

Concerns about the impact of greenhouse gas have driven the development of new separation technology to meet CO_2 emission reduction targets. Membrane-based technologies using carbon membranes that are able to separate CO_2 efficiently appears to be a competitive method. This research was focused on the development of carbon membranes derived from polymer blend of polyetherimide and polyethylene glycol to separate CO_2 rendering it suitable to be used in many applications such as landfill gas purification, CO_2 removal from natural gas or flue gas streams. Carbonization process was conducted at temperature of 923 K and 2 h of soaking time. To enhance membrane separation properties, pore structure was tailored by varying the carbonization heating rates to 1, 3, 5, and 7 K/min. The effect of carbonization heating rate on the separation performance was investigated by single gas permeabilities using CO_2, N_2, and CH_4 at room temperature. Carbonization heating rate of 1 K/min produced carbon membrane with the most CO_2/N_2 and CO_2/CH_4 selectivity of 38 and 64, respectively, with the CO_2 permeability of 211 barrer. Therefore, carbonization needs to be carried out at sufficiently slow heating rates to avoid significant loss of selectivity of the derived carbon membranes.

Keywords

CO_2, carbonization, molecular sieve, permeation, heating rate

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