Review

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A review of the application of carbon-based membranes to hydrogen separation

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ABSTRACT

Hydrogen (H_2) is a green clean fuel and chemical feedstock. Its separation and purification from H_2-containing mixtures is the key step in the production of H_2 with high purity (> 99.99%). Carbon membranes emerged in the 70 s and have provided promising results for applications in processes involving gas separation due to their sieving effects. Particularly, in this review, a general concept route of precursor selection-preparation-modification-performance analysis platform for the carbon membrane has been proposed to promote the development of carbon membrane material for a wide range of application. Several main parts are highlighted which are carbon membrane preparation, precursor selection, precursor pre-treatment covering pyrolysis process, carbonized membrane, pos-treatment and as well as module fabrication in order to improve the separation capability of gas mixtures in respect to permeability and selectivity. The variables of pre-treatment, the parameters of the pyrolysis process and the conditions of the post-treatment are manipulated and implied as a chance to maximize the performance of carbon membrane separation in the coming future. This review will specify an insight into the latest researches, which is expected to offer worthy implications to academicians and industry professionals working in industrial domain for the hydrogen separation. For future perspective, carbon membranes hold significant potential and great promise for further investigation, development and application.

Introduction

Membranes technology is globally recognized due to their promising gas purification and separation technology as a result of their reliability, small footprint, highly efficient energy and cheaper capital cost compared to the conventional processes of separation [1–3]. In addition, hydrogen, H_2 recovery is also known as the earliest commercial membrane implementation in the field of gas separation. The

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