



## Dual-sorption model for H<sub>2</sub>/CO<sub>2</sub> permeation in glassy polymeric Matrimid membrane

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### ABSTRACT

This work deals with the membrane separation of hydrogen and carbon dioxide. Permeation experiments of pure and binary mixtures of H<sub>2</sub> and CO<sub>2</sub> were performed using the constant pressure technique and a planar membrane made of the commercial polyimide Matrimid 5218. For pure gases permeability values of 23.4 Barrer for hydrogen and of 5.2 Barrer for carbon dioxide were obtained leading to an ideal selectivity of 4.5 at 6 bar feed pressure. In the case of gas mixtures, H<sub>2</sub> permeability decreases with increasing contents of CO<sub>2</sub>, while the permeability of carbon dioxide in mixtures presents similar values to pure gas permeabilities. As a result, the H<sub>2</sub>/CO<sub>2</sub> selectivity obtained from mixed gas experiments decays to an average value of 3. The dual-sorption model with a partial permeant immobilization was used to predict each component permeation behavior for pure gases and binary mixtures. The carbon dioxide diffusion coefficients through the Matrimid polymer in the Henry and Langmuir mode were obtained,  $D_{D,CO_2} = 2.14 \times 10^{-8}$  cm<sup>2</sup>/s and  $D_{H,CO_2} = 2.79 \times 10^{-9}$  cm<sup>2</sup>/s. The model and the estimated parameters provide a reasonable agreement between experimental data and predicted permeability values with correlation coefficient  $R^2 > 0.95$  and mean squared relative error (MSRE) lower than 0.01.

*Keywords:* Mixed gas separation; Matrimid membrane; Dual-sorption model

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