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Efficient H₂/CO₂ separation using PVA/[EMIM][DCA] polymer blend membranes

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Nowadays, the fossil fuels represent the predominant source of the energy supply. For the sustainable development of our society in future, it is of a great importance to develop more efficient ways with less impact on the environment. In this context, hydrogen has been extensively accepted as a clean and efficient energy carrier and storage medium

The room temperature ionic liquid (IL) – polymer blend membranes were prepared for potential effective CO₂/H₂ gas separation applications. Membranes materials based on polyvinylalcohol (PVA) and 1-ethyl-3-methylimidazolium dicyanamide ([EMIM][DCA]) via spin-coating with different IL content ranging from 0 to 53 wt.% [1]. Single gas permeation experiments were tested using the time-lag method [2] at 1.1 bar (feed) and at 25°C. In case of the CO₂/H₂ gas mixtures, experiments were performed at 25°C and at different CO₂/H₂ compositions and conditions (dry/humid feed). A self-developed apparatus with on-line mass spectrometry was used for monitoring gas separation processes [3]. Gas and water vapour sorption of prepared samples was studied using gravimetric and pressure decay apparatuses.

Obtained results revealed promising separation performance towards CO₂. The presence of IL has a more positive effect on CO₂ transport characteristic compared to H₂, the sample with 53 wt.% of IL exhibited the highest CO₂ permeation of 67 Barrer and the highest CO₂/H₂ selectivity (7.7).

Acknowledgements

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[1] Friess et al., in preparation

[2] Šimčík M., Růžička M., Kárászová M., Sedláková Z., Vejražka J., Veselý M., Čapek P., Friess K., Izák P.: Polyamide Thin-Film Composite Membranes for Potential Raw Biogas Purification: Experiments and Modelling. *Sep. Purif. Technol.* 167, 163-173 (2016)

[3] Fraga S.C., Azevedo M.A., Coelho I.M., Brazinha C., Crespo J.G.: Steady-state and Transient Transport Studies of Gas Permeation Through Dense Membranes Using On-line Mass Spectrometry *Sep. Purif. Technol.* 197, 18-26 (2018)