TAILOR-MADE NANO-SCALE ADDITIVES FOR CO_2/CH_4 GAS SEPARATION MIXED MATRIX MEMBRANES

FRIESS Karel, LANČ Marek, PILNÁČEK Kryštof, ČÍHAL Petr, VOPIČKA Ondřej, RADOTÍNSKÝ Daniel, FÍLA Vlastimil, ZAMIDI Ahmad, ŠTĚPÁNEK František, ŠOLTYS Marek, SARVAŠOVÁ Nina, VU Nguyen Hong, SYSEL Petr, MALÝ David, VYŠOHLÍD Jan, IZÁK Pavel, KÁRÁSZOVÁ Magda, SEDLÁKOVÁ Zuzana

University of Chemistry and Technology, Prague, Czech Republic, EU
Institute of Chemical Process Fundamentals of the AS CR, v.v.i., Prague, Czech Republic, EU

Abstract

Biogas production from renewable sources has the greatest potential to guarantee energetic demands of sustainable society. Unfortunately, biogas contains about one third of CO2 and other contaminants. Therefore, an efficient purification is needed to obtain sufficiently pure methane for further use. Recently, polymer mixed matrix membranes (MMMs) with embedded liquid or solid additives are seen as promising candidates for radical improvement in gas separations[1]. The major issue for developing effective gas separation membranes with enhanced performance is successful overcoming of well-known trade-off[2]. An achievement of high permeability and selectivity towards the target gas is crucial.

In this work, performance of (i) unique ex-situ controlled tailor-made tunable nano-additives embedding into polyimide based MMMs and (ii) of PES based MMMs with 75 wt. % of ionic liqud 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide ([EMIM][Tf2N]) targeted for CO2/CH4 separation from biogas is presented. Nano additives based on zeolite-imidazole frameworks (ZIF-8), Fe3O4 particles and surface-modified SiO2 hollow spheres were imbedded into 4,4´-oxydiphtalanhydride (ODPA) and 4,4´,4´´-triaminotriphenylmethane (MTA) (1:1 mol/mol). Properties of additives and membranes were tested via gravimetric and time-lag fixed volume pressure increase methods[3].

Keywords: Tailor-made nanoadditives, mixed matrix membranes, biogas separation

ACKNOWLEDGEMENTS:

The financial supports of Czech Science Foundation (grant GAČR No. 15-06479S) and Czech Ministry of Education, Youth and Sports - project KONTAKT II - LH14006 and a specific university research MSMT No 20/2015 are greatly appreciated.

REFERENCES:

[1] P. Bernardo, E. Drioli, G. Golemme; Ind. Eng. Chem. Res. 48 (2009) 4638.

[2] L. M. Robeson, J. Membr. Sci. 320 (2008) 390.

[3] A. F. Bushell, et al. J. Membr. Sci. 427 (2013) 48.

Author did not supply full text of the paper.