High ionic liquid content membranes for effective biogas (CO_2/CH_4) separation

Marek Lanč[1], Ondřej Vopička[1], Kryštof Pilnáček[1], Vlastimil Fíla[1], Pavel Izák[2], Zuzana Sedláková[2], Richard D. Noble[3], Matthew G. Cowan[3], Douglas L. Gin[3] and Karel Friess[1],*

[1]*University of Chemistry and Technology, Technická 5, Prague, 166 28, Czech Republic*
[2]*Institute of Chemical Process Fundaments, Czech Academy of Sciences, Rozvojová 135, Prague, 165 02, Czech Republic*
[3]*University of Colorado, Chemical & Biological Engineering Dept., UCB 424, Boulder, CO 80309, United States of America*

* presenting author, *email*: karel.friess@vscht.cz

Among different alternative energy sources to fossil fuels, biogas has probably the greatest potential. Its upgrading can provide a renewable low-cost source of energy (methane). However, raw biogas contains up to 35% of carbon dioxide and circa 5% of other contaminants (mainly water vapor) that must be removed. Therefore, the development of new separation membranes for effective methane purification represents a real challenge also because biogas composition depends on its source (farms, landfills, sewage plants) and a year season[1].

The major issue[2] for developing of membranes with enhanced separation performance is achieving high selectivity towards the target gas purity. The polymer based mixed matrix membranes with embedded ionic liquid (IL), IL-polymer gel membranes or supported ionic liquid membranes (SILMs) with entrapped room temperature IL in can be considered as a promising approach for that[2-5].

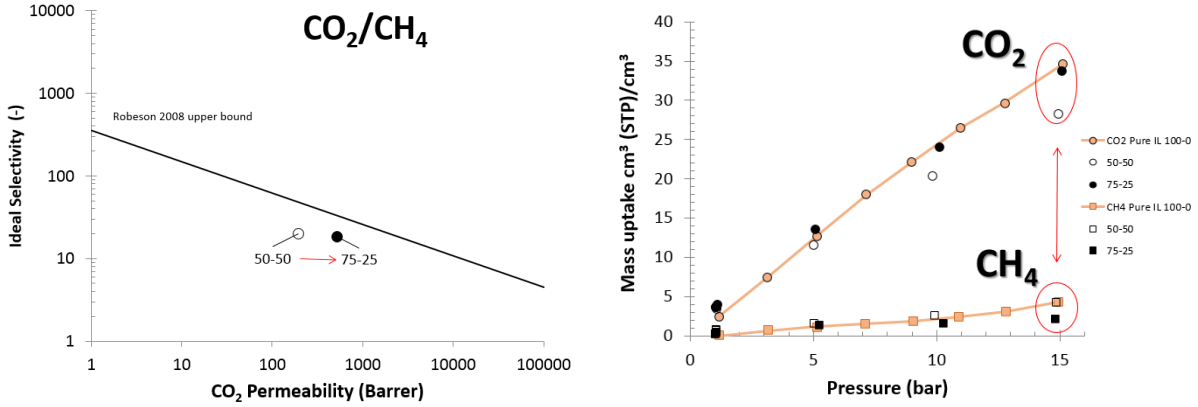


Fig. 1 The comparison of permeation and sorption properties of samples with 50 and 75 wt.% of IL. The CO_2/CH_4 Robeson plot[7] (left) and gas sorption isotherms of samples and pure IL [EmimTf$_2$N] (right).

In this work, the permeation and sorption of CO_2, CH_4 and their mixtures in membranes[5] based on polyethersulfone (PES) support containing 50 and 75 wt.% of highly CO_2 interacting ionic liquid 1-ethyl-3-methylimidazoliumbis (trifluoromethanesulfonyl)imide [EmimTf$_2$N] at 25°C is presented. The sorption experiments were performed gravimetrically[6] in pressure range of 1 to 15 bar, the permeation measurements were performed *via* time-lag fixed volume pressure increase method[4]. Dry or wet mixed gas permeation was monitored by GC. A sample with 75 wt.% ionic liquid content exhibited substantially higher CO_2 permeation and sorption and corresponding permeability and selectivity values were located close to the CO_2/CH_4 upper bound 2008[7].

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