In this work, we report on preparation, modification, and gas separation performance of self-standing, thin (~20 μm) graphene oxide (GO) membranes prepared by the gravitation assembling method. The remarkable separation efficiency of GO membranes[1] was found for H_2, CO_2, and bulky C_3 or C_4 hydrocarbons. Achieved high-flux and good selectivity at the same time manifested the tremendous separation performance that far exceeds the corresponding H_2/CO_2 2008 Robeson upper bound repeatedly (Fig. 1, left).

Furthermore, two approaches were tested in order to improve the overall material permeability and separation performance. The chemical modification of GO membranes (fluorination, amination) was performed to control the affinity between CO_2 and the GO material. However, mostly unconvincing results were obtained compared to neat GO performance under dry conditions. Contrariwise, the second tested approach with humid gas feed showed a strong positive effect of water vapor on the gas permeability (Fig 1, right).

Thus, we suppose that graphene oxide membranes may become a promising route towards the fabrication of a new class of highly permeable efficient H_2-selective separation membranes applicable in industrial applications. A selection of specific experimental conditions can even improve already good GO separation performance.

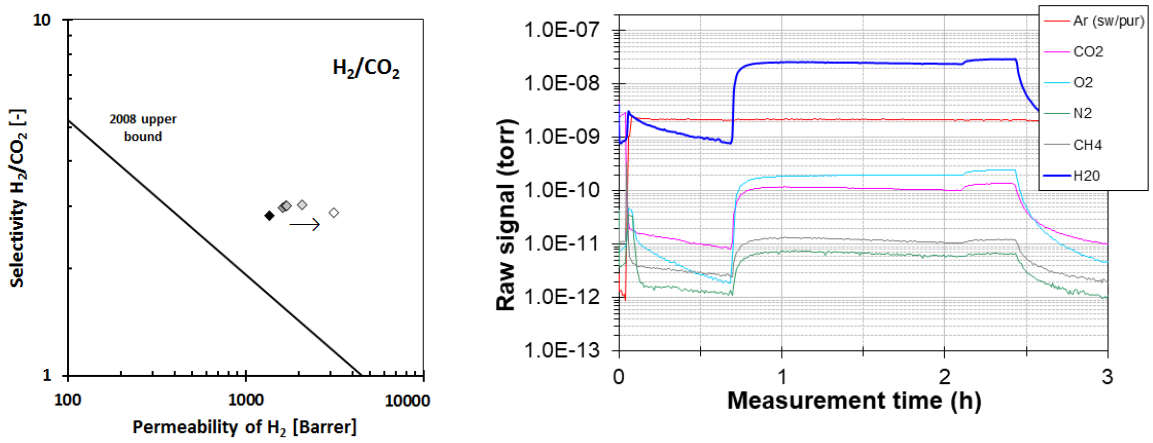


Fig. 1 The H_2/CO_2 Robeson diagram[2] with indicated GO membrane performance (left), an arrow shows an observed trend in time. The effect of humidity on various gas permeation through GO membrane determined via MS device[3] (right).

Acknowledgements
This work was supported by the Czech Science Foundation (grant No. 16-05167S and 17-05421S), by the specific university research (MŠMT No. 20-SVV/2017 and 2018), and by the CNR-CAS bilateral project 2016-2018.

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