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Tuning Microporous Ceramic Membranes for Gas Separation and Solvent Nanofiltration

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Membranes, based on ceramic materials, are interesting because of their robustness and can therefore be applied under several demanding conditions, like H_2 recovery from syngas, 'sweetening' of natural gas (CO_2/CH_4 separation) or organic solvents recovery. Industrial applications of this technology demands a robust membrane that is able to endure aggressive environments, like high temperatures/high pressures or a continuous exposure towards organic solvents. Membranes, based on ceramic materials, are interesting because of their robustness.

In the presentation fabrication, microstructure and transport properties will be discussed of two types of ceramic membranes:

1. Solgel-derived ceramic membranes for gas separation
2. Polymer-functionalized ceramic membranes for solvent nanofiltration

In order to obtain solgel-derived ceramic membranes with the desired separation properties, in-depth knowledge is necessary on the whole fabrication process, from sol synthesis, via applying a gel-type coating on a porous support to temperature treatments in order to obtain a separation layer with the desired microstructure. Several aspects of the sol-gel process, which determine the final membrane microstrucre, will be discussed during the presentation.

For organic solvent nanofiltration (OSN) state-of-the art polymeric or ceramic membranes do not always meet stability and/or selectivity demands at process-relevant conditions. We developed a new type of OSN membrane by grafting small polymer chains into the pores of a 5 nm γ-alumina ceramic membrane. In this way the best of both was achieved, meaning the robustness of ceramic membranes and the selectivity of polymeric membranes. Several examples of polymer-functionalized membranes and its properties will be given.

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