Zeolite like MOF membranes and their related gas separation properties

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Recently, we introduced successfully a new approach based on liquid phase epitaxy (LPE) to construct continuous ZIF-8 thin film on gold support.[1] Consequently, the achieved control over film growth thickness and continuity offer potential to effectively implement the LPE technique for the fabrication of continuous ZIF-8 membranes on porous supports.[2-5] Here we report the use of the LPE method for the successful controlled growth of ZIF-8 film on a porous alumina support. The range of gas permeance measured on the ultrathin ZIF-8 membrane fabricated by the LPE growth method was at least 100 times lower than the corresponding results reported in the literature although its thickness is one of the thinnest ever reported (0.5 and 1.6 μm). This, in conjunction with clear time-lag behavior and high O_2/N_2 selectivity (2.5) indicates high quality, reproducible membranes with negligible defects and gaps. The resulting ZIF-8 membrane was thoroughly characterized using state-of-the-art adsorption and permeation techniques. Single-gas permeation studies were performed for relevant gases (H_2, CO_2, O_2, N_2, CH_4, C_2H_4, C_2H_6, C_3H_6,C_3H_8 and *n*-C_4H_{10}) and gas mixtures (C_3H_6/C_3H_8 and CH_4/*n*-C_4H_{10}) using the time-lag method.[25] Particularly, we report for the first time unprecedented and unique findings pertaining to CH_4/*n*-C_4H_{10} mixture permeation through the ZIF-8 membrane.

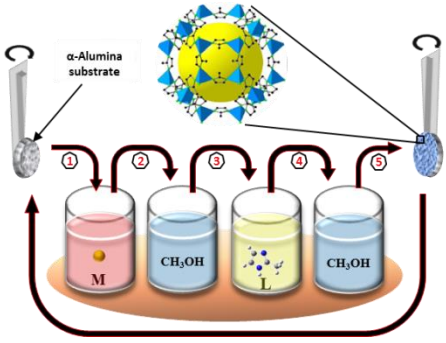


Figure 1. A schematic representation of the LPE method used for the growth of ZIF-8 membrane. The substrate is immersed in metal ions solution (1), washed with solvent (2), immersed in linker solution (3) washed with solvent (4). The process is repeated to grow more cycles (5).

References

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