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Improved MOF and zeolite membranes by support modification

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Separations and purifications play an important role in industry. In comparison with the conventional separation methods like pressure swing adsorption (PSA) and fractional/cryogenic distillation, the membrane-based separation has been considered to be the most promising alternative because of its low energy consumption, ease of operation and cost effectiveness. In the last 25 years, supported zeolite molecular sieving membranes and MOF membranes have attracted intense interest in the gas separation due to their uniform pore structure and high thermal stability. Despite much progress in the development of zeolite molecular sieving membranes, so far, no industrial gas separation using zeolite membranes is available with the exception of de-watering of bio-ethanol by steam permeation using hydrophilic zeolite LTA membranes. Therefore, synthesis of molecular sieve zeolite membranes and MOF membranes with gas separation selectivity is still challenged.

To promote the nucleation and growth of the zeolite layers, seed coating of the supports surface is usually indispensable to offer nucleation center. Recently, an alternative road for the seeding-free synthesis of high-quality zeolite membranes [1-3] and ZIF membranes [4,5] by using 3-aminopropyltriethoxysilane (APTES) as covalent linker to built a “bridge” between the porous ceramic support and the zeolite layer, which result in the improved synthesis of dense zeolite membranes with shape selectivity due to the promotion of the nucleation and growth of a continuous zeolite layer on the functionalized supports.

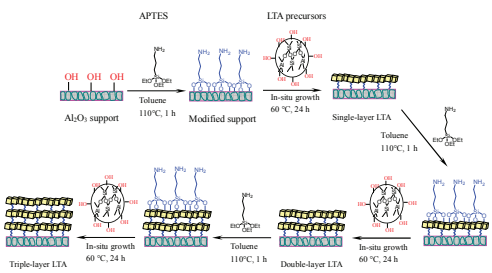

Figure 1: Scheme of the layer-by-layer hydrothermal synthesis of multi-layer LTA membranes by using APTES as covalent linker.

Followed by this concept, in the present work, we report the seeding-free synthesis of multi-layer zeolite LTA membranes (Figure 1) and ZIF-95 membrane on the APTES-modified porous alumina support. Through the APTES modification, well intergrown and phase-pure multi-layer zeolite LTA membranes (Figure 2) and ZIF-95 membrane (Figure 3) with enhanced hydrogen selectivity can be formed.

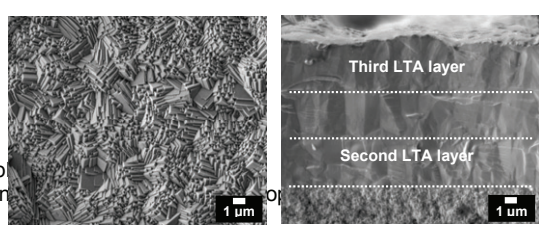

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Figure 2: SEM images of top view (left) and cross-section (right) of the triple-layer LTA membranes.

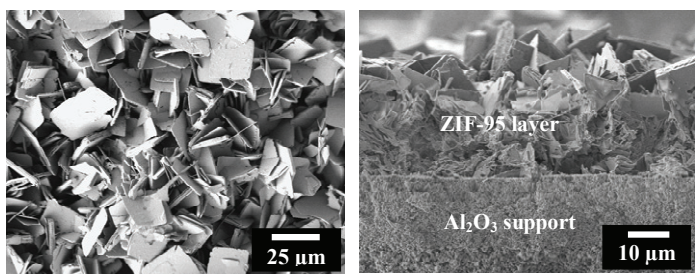

Figure 3: SEM images of top view (left) and cross-section (right) of the ZIF-95 membrane.

References

[1] A. Huang, F. Liang, F. Steinbach and J. Caro; J. Membr. Sci.; 2010; 132; 5.

[2] A. Huang, N. Wang and J. Caro; J. Membr. Sci.; 2012; 389; 272.

[3] A. Huang and J. Caro; J. Mater. Chem.; 2011; 389; 272.

[4] A. Huang, H. Bux, F. Steinbach and J. Caro; Angew. Chem. Int. Ed. 2010, 49, 4958.

[5] A. Huang, W. Dou, J. Caro; J. Am. Chem. Soc.; 2010; 132; 15562.

Keywords: LTA zeolite membrane, ZIF-95 membrane, Covalent linker, Layer-by-layer synthesis