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Induced Assembly of Two-Dimensional Metal–Organic Framework Nanosheets for Gas Separation

Metal–organic framework nanosheets (MONs), a new category of two-dimensional material composed of organic ligands and metal ions or clusters,[1] have been considered as promising adsorbents and membranes for gas separation because of their structural diversity, extremely low mass-transfer barrier and precise molecule-size recognition.[2] However, the mechanical strength and stability hinder the development of MONs-based adsorbents and membranes.[3] Recently, we developed induced assembly strategy to fabricate MONs based composite adsorbents and composite membranes.[4] Supports or fillers with functional groups (-OH, -COOH) are adopted, these functional groups act as nucleation or anchor sites for the growth or assembly of MONs. Taking advantage of the intimate interaction between MONs and the support or filler, metal organic framework (MOF) nanosheets confined in supports and continuous two-dimensional MOF composite membranes with enhanced performance and mechanical strength can be obtained. MOF nanosheet within the support exhibits an enhanced CO_2 adsorption capacity, which is 4 times higher than that of bulk MOF at 150 mbar and 273 K. Compare to parent unselective MONs membrane, GO/MONs membrane displays a remarkable H_2/CO_2 separation performance, with a superior H_2 permeance of 1.1×10^{-6} mol m^{-2} s^{-1} Pa^{-1} and an ideal separation selectivity of 96.5.

References

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[3] L. Prozorovska; P. R. Kidambi, Adv. Mater. (Deerfield Beach, Fla.) 2018, e1801179-e1801179.
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Figures

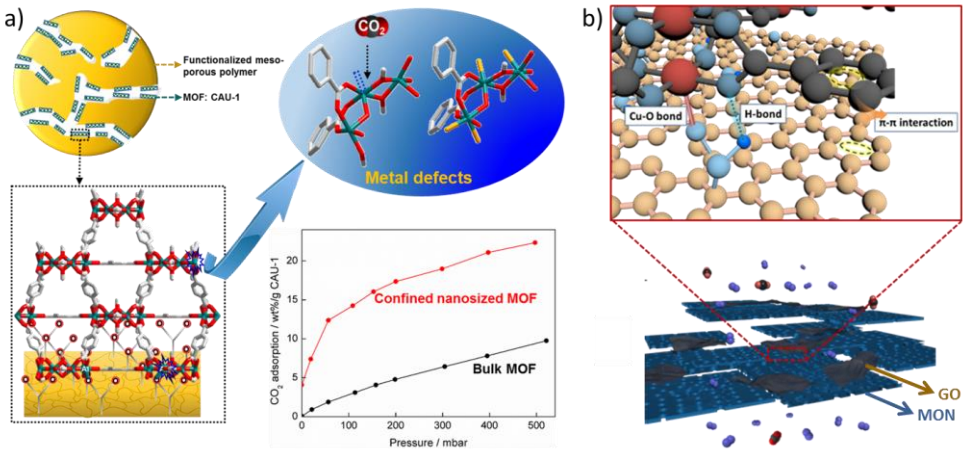

Figure 1: Scheme for the fabrication of: a) MOF nanosheets confined in porous support; b) MON (CuBDC)-GO composite membranes.