Shaping the Morphology of Metal-Organic Frameworks for Gas Separation *via* Mixed Matrix Membranes

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The affinity of polymer matrices to porous fillers governs the mixing efficiency and separation performance of mixed matrix membranes (MMMs). Herein, we demonstrate the shaping of the morphology of the metal-organic framework, MFM-300(Sc), into nanoplates for gas separation using MMMs. Introducing coordinatively competing modulators as inhibitors can simultaneously shape the crystallites into the desired morphology and functionalise the crystal. The steric hindrance of modulating linkers results in missing-linker defects as evidenced by solid-state NMR spectroscopy, whereas the modulated crystal structures are analysed through Rietvled refinement on synchrotron PXRD. The nanoplate particles displayed preferred growth along the (110) plane as determined by STEM. The nanoplate crystals of MFM-300(Sc) can be dispersed evenly in a polyimide matrix leading to MMMs with significantly improved performance for the separation of CO_2/N_2 as a function of the chemical derivatization of the MOF filler.

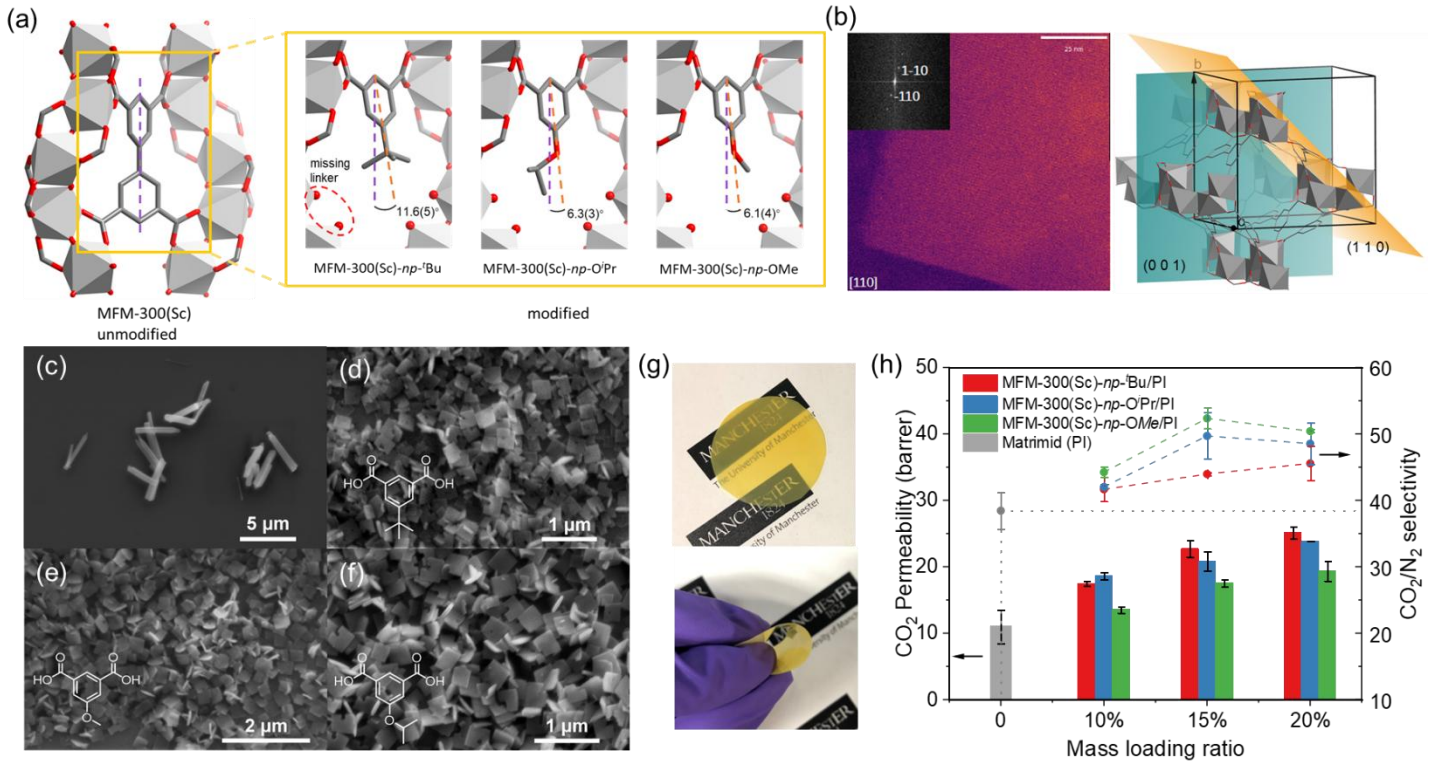


Figure 1. ***(a)*** *Crystal structures of modulated MFM-300(Sc) obtained from Rietveld refinement of synchrotron PXRD patterns;* ***(b)*** *STEM HAADF image and Fourier analysis of MFM-300(Sc)-np-O^{i}Pr nanoplate illustrating a near-[110] aligned sample;* ***(c-f)*** *SEM images of modified and unmodified MFM-300(Sc) sample with functional isophthalic acid as modulators;* ***(g)*** *Photos of the mixed-matrix membrane (MMM) containing 20 wt% modified MFM-300(Sc) as filler in a polyimide matrix;* ***(h)*** *Performance of the MMMs in separation of CO_2/N_2 as a function of MOF loading ratio.*

We acknowledge ESRF-ID22 for supporting high-resolution PXRD pattern collection during beamtime session for CH-6383.