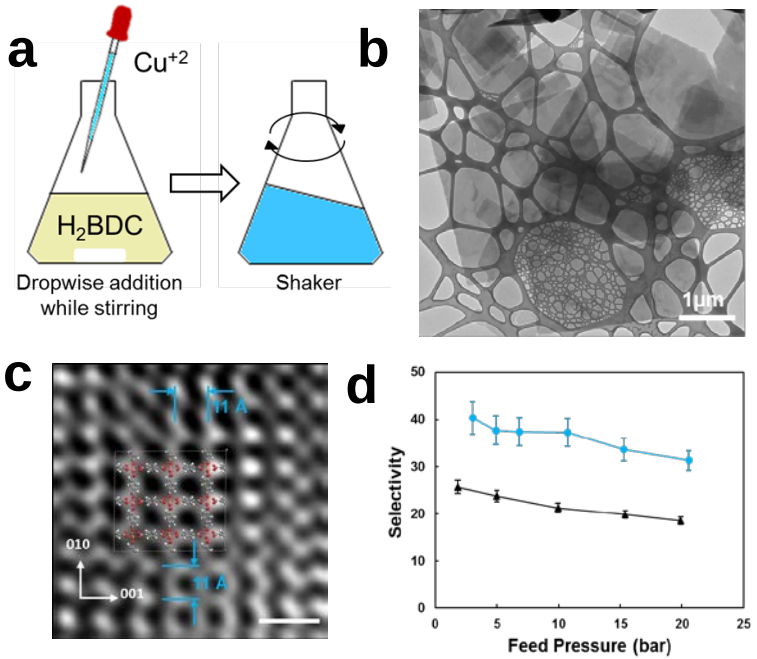
On the Direct Synthesis of Cu(BDC) MOF Nanosheets and their Performance in Mixed Matrix Membranes



(a) Schematic of direct synthesis procedure for Cu(BDC) (BDC^{2-} = 1,4-benzenedicarboxylate) nanosheets. **(b)** TEM image of Cu(BDC) nanosheets obtained by direct synthesis at 15 °C for 24 h. **(c)** Bragg filtered ADF-STEM image of Cu(BDC) nanosheet and superimposition of structure model indicating pores down *a*-axis. **(d)** Mixed gas CO_2/CH_4 selectivity from an equimolar feed for pure Matrimid and a 12 wt% loading MMM.

Scientific Achievement

High aspect ratio Cu(BDC) MOF nanosheets are obtained by direct synthesis; 70% improvement in mixed gas CO_2/CH_4 selectivity is observed for a 12 wt% loading mixed matrix membrane (MMM).

Significance and Impact

Direct synthesis procedure can be extended to other MOF nanosheet materials; analysis of permeation data using mathematical modeling gives predictive capability for choice of matrix materials in MMMs.

Research Details

- Cu(BDC) nanosheets with an average lateral dimension of 2.5 μm and an average thickness of 25 nm are obtained.
- Structure characterization using X-ray diffraction, electron diffraction and high-resolution electron microscopy reveals presence of structural disorder.

Shete, M.; Kumar, P.; Bachman, J. E.; Ma, X.; Smith, Z. P.; Xu, W.; Mkhoyan, K. A.; Long, J. R.; Tsapatsis, M. *J. Membr. Sci.* **2018**, *549*, 312–320.

Synthesis, characterization, single gas permeation measurements were performed at U. Minnesota; Mixed gas permeation measurements were performed at UC Berkeley. Thin film XRD was performed at the Advanced Photon Source, Argonne National Lab.