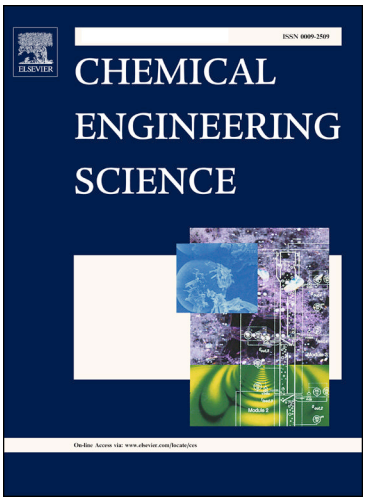

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A Solvent 'Squeezing' Strategy to Graft Ethylenediamine on $Cu_3(BTC)_2$ for Highly Efficient CO_2/CO Separation

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Abstract

Highly efficient separation of residual carbon dioxide (CO_2) from syngas, mainly composed of carbon monoxide (CO) and hydrogen (H_2), could not only make its utilization more energetically efficient but also avoid catalysts poisoning in some industrial applications. In the attempts to address this issue, it is acknowledged that CO_2/CO separation is the vital step since H_2 is a nonpolar molecules, difficult to be polarized and could be easily separated from CO_2. Herein, we report a novel strategy to graft basic ethylenediamine (ED) molecules onto porous metal-organic frameworks (MOFs) as solid adsorbents for CO_2/CO separation via solvent 'squeezing' approach, in which $Cu_3(BTC)_2$ (BTC = 1,3,5-benzenetricarboxylate) MOF was employed as the pristine MOF. Surprisingly, the ED-grafted $Cu_3(BTC)_2$ shows unprecedented enhancement of CO_2/CO selectivity of 226% at 273 K and 861% at 298 K, respectively, in comparison with the solvent-free $Cu_3(BTC)_2$. Moreover, despite the large isosteric heats of adsorption of CO_2 on the ED-grafted $Cu_3(BTC)_2$, it could be easily regenerated at moderate temperature. This work provides an