

High Aspect Ratio Zeolitic Imidazole Framework-8 (ZIF-8) Nanosheets for Propylene/Propane Separation Membranes

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Hydrocarbon selective, 2D metal-organic frameworks are yet to be realized. Instead, we report the highest functioning mixed matrix membranes for C3 separation fabricated by incorporating polycrystalline ZIF-8 nanosheet fillers. Isotropic ZIF-8 crystals have been widely studied for gas separations due to their desirable, aperture sizes. Herein, a scalable synthesis pathway of ZIF-8 nanosheets by conversion of high aspect ratio templates is reported. Layered Zn hydroxide in the form of $Zn_5(NO_3)_2(OH)_8$ was employed as the precursor template. The successful phase transition occurs as a collaborative result of low template stability and the delayed delivery 2-MeIm under weak interacting solvent. The prepared nanosheets showed an average aspect ratio of 20. Bar coating was used to shear aligned the nanosheets in 6FDA-DAM polymer matrix to yield gas separation membranes. The 40 wt% ZIF-8 nanosheet membrane achieved a propylene permeability of 164 Barrer and selectivity of 33.4, which is the highest up to date. The permeation results were also consistent with the modified Cussler model indicating the performance increase is attributed to the large aspect ratio of the filler.