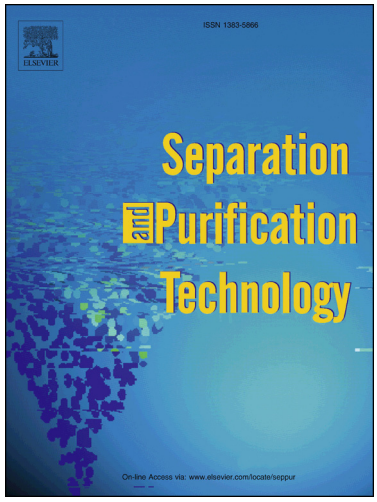

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Surface-etched halloysite nanotubes in mixed matrix membranes for efficient gas separation

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Abstract

Possessing the advantages of both polymeric membranes and the specific inorganic nanoparticles or nanotubes, mixed matrix membranes (MMMs) have captured the imagination of researchers for a possible technological breakthrough for efficient gas separation. However, it is still very challenging to achieve defect-free interface between fillers and polymer matrix. In this study, the naturally abundant and low cost halloysite nanotubes (HNTs) were applied as fillers for MMMs synthesis. To improve the filler dispersion and filler-matrix interface affinity, the raw HNTs were modified by either alkali etching or (3-Aminopropyl) triethoxysilane grafting. After surface etching, the defect holes were formed on the surfaces of etched-HNTs, resulting in the rougher HNT walls and significant increment of surface area and CO_2 adsorption capacity. The filler/polymer interfacial voids and filler dispersion were quantitatively assessed by tomographic focused ion beam scanning electron microscopy. HNTs surface etching significantly improved the HNTs/polymer interfacial affinity (void%=0.06% for Raw-HNTs MMM, 0.02% for Etched HNTs MMMs) and filler dispersion, while grafted-HNTs mainly contribute to the filler dispersion. Compared to the pure polymer membrane and MMMs with untreated HNTs,

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