Mixed Matrix Membrane for CO_2 Separation with Amphiphilic Copolymer and Mesoporous $MgTiO_3$ Perovskite

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A graft copolymer, poly(vinyl chloride)-g-poly(oxyethylene methacrylate) (PVC-g-POEM), was synthesized via atom transfer radical polymerization (ATRP), and then the copolymer was composed of hydrophilic site, PVP, and hydrophobic site, POEM. Mesoporous $MgTiO_3$ perovskite showing a high porosity was prepared with solvothermal reaction using the above copolymer as structure-directing agent. Then the mixed matrix membrane (MMM) was prepared with solution containing the mesoporous $MgTiO_3$ perovskite dispersed the copolymer solution. The mesoporous $MgTiO_3$ was well-dispersed in PVC-g-POEM solution due to its similar density with the copolymer as compared to dense perovskite. Because the average pore diameter the $MgTiO_3$ perovskite was about 10.4 nm, it was effective to facilitating gas transport via Knudsen diffusion. The permeability of MMM was greater than those of MMM with only MgO or TiO_2, indicating the simultaneous improvement of solubility and diffusivity in the former. The MMM with $MgTiO_3$ 25 wt % exhibited a CO_2 permeability improvement of 140% up to 138.7 Barrer without a large loss of CO_2/N_2 selectivity.