Preparation of mixed-matrix membranes based on graft copolymer and nanocrystals for gas separation

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In this work, mixed-matrix membranes (MMMs) based on amphiphilic graft copolymer, poly(vinyl chloride)-g-poly(oxyethylene methacrylate) (PVC-g-POEM) and nanocage-like hollow ZIF polyhedral nanocrystals (H-ZIF) have been prepared and applicated for gas separation of CO_2/CH_4. Using the ZIF-67 as sacrificial templates, the H-ZIF polyhedral nanocrystals were sucessfully synthesized. H-ZIF had been well dispersed in the membrane because of the micro-phase separation of the polymer induced by the amphiphilic properties of PVC-g-POEM. By the addition of H-ZIF, CO_2 permeability drastically increased from 43.5 barrer to 210.6 barrer, while the CO_2 / CH_4 selectivity maintained as 14.3 which is close to Robeson upper bound (2008). This might be due to the decrease of gas diffusion resistance induced by the hollow structure of H-ZIF. In addition, molecular sieving effect of H-ZIF and CO_2-philic amine groups of imidazole linkers might also have increased the gas separation performance of the membrane.