Highly Permselective Mixed Matrix Membranes Consisting of Amphiphilic Graft Copolymer

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Gas separation has become a leading research topic due to energy efficiency and environmental concerns. Membrane technology has gathered a great deal of attention as an alternative to conventional industrial processes such as absorption and distillation method because of lower operational cost, an eco-friendly process and high energy efficiency. ZIF-8 is especially attractive due to its facile synthetic method, exceptional thermal/chemical stability and molecular sieving in gas separation. Mixed-matrix membranes (MMMs) have been developed to take advantage of the benefits of characteristics of the matrix and filler at the same time. To achieve high performance in MMMs, ZIF-8 shows enhanced gas separation performance due to an appropriate pore size to exclude gas molecules and an affinity for specific gases to improve sorption. We report an interface and interaction tuning approach for a high-performance MMM that not only improves the CO_2 permeability from 70.2 to 687.7 Barrer but also improves the CO_2/N_2 selectivity from 30.5 to 34.9. These improvements were achieved by using ZIF-8 nanoparticles dispersed in an amphiphilic poly(vinyl chloride)-g-poly(oxyethylene methacrylate) (PVC-g-POEM) graft copolymer.