Carbon monoxide capture using facilitated transport membrane based on PHMEP-co-PAA copolymer

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Although carbon monoxide (CO) is an important raw material in chemical industries, its separation through solid-state polymer membranes has not been extensively studied. Here, a series of comb-like copolymers, i.e., poly(2-hydroxypropyl-2-(methacryloyloxy) ethyl phthalate-co-acrylic acid) (PHMEP-co-PAA), is synthesized and used as a matrix for facilitating CO transport membranes. $AgBF_4$ and ionic liquid ($[bmim][BF_4]$) are incorporated into the polymer matrix to improve CO separation performance. Incorporated Ag ions significantly increase the interaction energy between the membrane and CO molecules and the ionic liquid prevents comb copolymer aggregation. The highest CO/N_2 selectivity is achieved from copolymers with high PHMEP content (70 wt%) due to strong polymer-CO interaction energies. The optimized separation performance is a CO/N_2 selectivity of 16.2 with a CO permeance of 2.1 GPU. The superior performance is supported by spectroscopic analysis and molecular dynamics simulations.