Semi-interpenetrating polymer network membranes with a self-crosslinkable comb copolymer for CO_2 capture

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The high-performance semi-interpenetrating polymer network (semi-IPN) membranes are prepared by incorporating a self-crosslinkable comb copolymer into the matrix of Pebax. The comb copolymer, poly(glycidyl methacrylate-g-polypropyleneglycol)-co-poly(oxyethylenemethacrylate) (PGP-POEM) is synthesized via one-pot free-radical polymerization and undergoes epoxide-amine self-crosslinking reaction. As the PGP-POEM loading is increased, CO_2 permeability increases without significantly losing CO_2/N_2 selectivity. The self-crosslinked PGP-POEM comb copolymer not only degrades the crystalline structure of the Pebax by disrupting the chain-packing, but also provides a large number of CO_2-philic groups increasing both diffusivity and solubility of CO_2. As compared to neat Pebax membrane, the semi-IPN membrane containing 40 wt% PGP-POEM exhibits approximately 2.5-fold enhancement in CO_2 permeability (up to 236.6 Barrer) with similar CO_2/N_2 selectivity(38.8). This study suggests that semi-IPN membrane based on self-crosslinkable comb copolymer has great promise for applications in CO_2 capture.