Cost-effective CO_2 separation membrane consisting of high molecular weight poly(ethylene oxide) matrix

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Although high molecular weight poly(ethylene oxide) (high-M_w PEO) has low cost and good solubility in mild solvents like water and alcohols, it cannot be used effectively in polymeric membrane for CO_2 separation due to its inferior separation performance. Here, we demonstrate the novel method to fabricate a high performance, defect-free membrane for CO_2 separation based on high-M_w PEO by incorporating the crosslinkable poly(glycidyl methacrylate-g-polypropylene glycol)-co-poly(oxyethylene methacrylate) (PGP-POEM) comb copolymer. Not only the CO_2/N_2 and CO_2/CH_4 selectivity but also the thermal and mechanical properties are enhanced significantly with increasing comb copolymer content. The incorporation of the comb copolymer can effectively obstruct the formation of spherulites and tightly fill the interlamellar and interfibrillar defects of PEO matrix. The best performance was obtained from a membrane with a comb copolymer loading of 30 wt%, in which the CO_2 permeability was 120.9 barrer with CO_2/N_2 and CO_2/CH_4 selectivity of 44.9 and 14.5, respectively. Also, it has the tensile strength of 7.5 MPa and elongation at break of 1490%, respectively.