

Mixed-matrix membranes comprised of amine-functionalized UiO-66 and PGMA-POEM comb polymer

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In this work, mixed-matrix membranes (MMMs) comprised of amine-functionalized UiO-66 (UiO-66-NH₂) nanoparticles and poly(glycidyl methacrylate-co-poly(oxyethylene methacrylate)) (PGMA-co-POEM) copolymer is prepared. PGMA-co-POEM comb-like copolymer is synthesized by free radical polymerization and showed adhesive, good film-forming properties, thus enabling the MMMs to be ultrathin film composite membranes without voids or defects. Moreover, covalent bonds are formed between the copolymer and UiO-66-NH₂ particles through an epoxide-amine reaction, leading to increased interfacial compatibility between them. As the number of UiO-66-NH₂ particles added into the MMMs increased, particles formed large clusters and acted as “dual transport pathway” by significantly increasing the gas permeance. An MMM containing 28.6 wt % UiO-66-NH₂ nanoparticles shows a CO₂ permeance of 1320 GPU with a CO₂/N₂ selectivity of 30.8, exceeding the target performance required for practical application in the post-combustion CO₂-capture process.