

New approach to fabricate PDMS thin-film composite membrane toward CO₂ capture

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Abstract:

Polydimethylsiloxane (PDMS), as a representative membrane material with superior permeability, attracts great attention in gas separation, pervaporation and nanofiltration. However, the fabrication of defect-free ultrathin PDMS membrane remains great challenge mainly due to the difficulty in controlling the processability and substrate pore penetration of casting solution. This talk will present our recent attempts to develop new approach to fabricate PDMS thin-film composite membrane. The first approach is based on ultraviolet (UV) crosslinking of PDMS monomer terminated with acryloyloxy groups (AC-PDMS). The UV reactivity between acryloyloxy groups induced fast curing of AC-PDMS casting solution, thereby realizing formation of ultrathin selective layer (~260 nm) and inhibition of substrate pore penetration. The second approach is based on interfacial polymerization of NH₂-PDMS with acyl chloride with controlled crosslinking reaction, enabling the reduction of membrane thickness to less than 10 nm. The ultra-thin PDMS membrane exhibited CO₂ permeance up to ~10000 GPU and CO₂/N₂ selectivity of ~11, showing great potential for CO₂ capture.

Keywords: PDMS; thin-film composite membrane; ultraviolet; interfacial polymerization; carbon dioxide capture.