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Modulation on interlayer channels of LDH/polymer hybrid membranes for efficient CO2 separation

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Abstract

Two-dimensional (2D) nanosheets with thickness of one to several atoms serve as ideal building units for separation membranes. Herein, we report the construction of ultrathin membranes with layered double hydroxides (LDHs) nanosheets, polyacrylic acid (PAA) and polyethyleneimine (PEI) alternately deposited on porous substrates. The chemical tuning of PEI leads to an accurate regulation of interlayer spacing in angstrom scale, resulting in selective nanochannels for CO2 permeation. The laminar membranes with CO2 transport-facilitated channels exhibit excellent gas separation performance and exceed the limit of the state-of-the-art membranes with CO2 permeance of 1068 GPU, CO2/N2 and CO2/CH4 selectivity of 126 and 330 respectively. A synergistic effect of solution-diffusion and molecular sieving was proposed for this prominent CO2 separation performance. The strategy demonstrated in this work would open up new avenues for effective CO2 separation and capture in recycling of carbon resources.

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