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Reduced Wrinkling in GO Membrane by Grafting Basal-plane Groups for Improved Gas and Liquid Separations

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Abstract

Graphene oxide (GO) membrane assembling through edge-edge or plane-plane connection has huge influence on membrane microstructure and thus separation performance. In this work, plane-plane connection of GO sheets was promoted in supported GO membranes by grafting oxalic acid (OA) molecules in GO basal plane. With subsequent crosslinking by ethylene diamine (EDA), better packing structure can be achieved with reduced wrinkling in GO membrane. With this unique approach, restricted swelling, tightly packed laminar structure, reduced wrinkling and improved separation property can be simultaneously achieved. Specifically, membranes were prepared on polydopamine coated porous polyethersulfone (PES) support via pressurization filtration method. GO membrane thickness was controlled within the range of 100-400 nm with *d*-spacing of < 1.0 nm. The OAGO/EDA membrane shows good permselective H₂/CO₂ separation with separation factor of 16.14 and H₂ permeance of $1.362 \times 10^{-8} \text{ mol.m}^{-2}\text{s}^{-1}\text{Pa}^{-1}$. This membrane also excels in liquid separation, where methylene blue rejection rate of 99.9% and ion (Na⁺, K⁺, Mg²⁺, Cl⁻, and SO₄²⁻) rejection rate of > 98.1% were achieved.

Graphical abstract

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