

Title:

Porous graphene oxide/ZIF-8 hybrid membranes with improved rejection performance by regulating the interlayer d-spacing

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The structural instability of graphene oxide (GO) membranes in aqueous media deteriorates their separation performance. The selective intercalation of nanoporous materials into the interlayer spacing of GO membranes is a new strategy to address this issue. In this study, we fabricated porous GO (PGO)@ZIF-8 hybrid membranes via selective in-situ growth of ZIF-8 nanoparticles in the interlayer d-spacing of membranes, demonstrating promising water permeance and dye rejection. PGO membranes with different pore sizes and controlled water permeance were prepared via vacuum filtration and were immersed in a metal (zinc nitrate) solution for a specific time. XPS spectra confirmed metal ions coordination with oxygen functional groups of PGO nanosheets (Fig. 1A). The metal ions-loaded PGO membranes were then put into the ligand solution (methylimidazole) to selectively grow ZIF-8 nanoparticles as confirmed by XRD spectra (Fig. 1B). The in-situ growth solvent was found to significantly impact the ZIF-8 nanoparticle growth in the laminar structure of PGO membranes. Fig. 1C&D show cross-sectional SEM images of PGO@ZIF-8 membranes fabricated in water and methanol, respectively. The water permeance and dye rejection (disperse red, MW=314 g. mol⁻¹) data showed that methanol controls the ZIF-8 particle size and growth patterns in PGO membranes. This considerably improved the dye separation performance of hybrid membranes compared with GO and PGO membranes, as displayed in Fig.1E&F. Various characterization techniques, including SEM, HR-TEM, XPS, EDX, and XRD, were employed to optimize membranes structure.

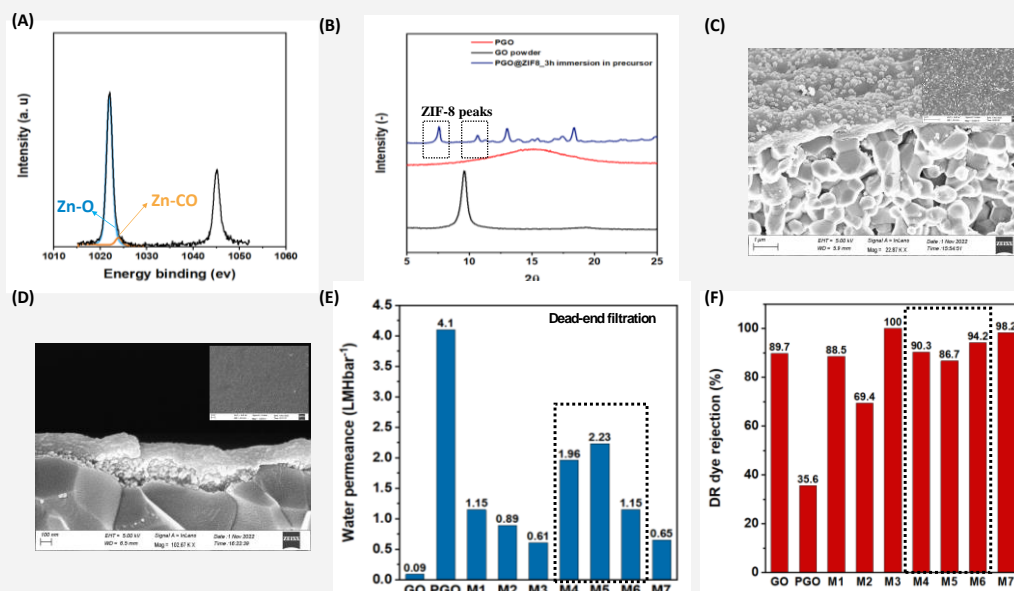


Fig. 1. (A) Zn XPS spectra of PGO@ZIF-8 membrane, (B) XRD spectra of GO, PGO, and PGO@ZIF-8 membranes, (C), (D) cross-sectional images of hybrid membranes prepared in water and methanol, respectively. Insets are surface images, (E) water permeance, and (D) DR rejection of membranes. M1-M3&M7 and M4-M6 are hybrid membranes fabricated in water and methanol, respectively.

[1]. F. Moghadam et al., 2D Materials 6.4 (2019): 042002.