
Beyond Reverse Osmosis: 2D Materials-Based Membranes for Next-Generation Separations

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Abstract: Graphene and other 2D materials-based membranes have attracted significant attention for separation and filtration because of their unique, tunable transport properties. Unlike traditional polymeric membranes, these systems exploit fundamental differences in the behaviour of water, ions and molecules within sub-nanometre to nanometre-scale channels and pores. By precisely controlling channel width and interlayer spacing, it is now possible to design membranes that span applications from microfiltration through nanofiltration to reverse osmosis, with performance tailored to the target separation. Notably, 2D laminar and pore-engineered membranes have demonstrated high water flux alongside strong salt and molecular rejection in nanofiltration (NF) and reverse osmosis (RO) regimes. In this talk, I will discuss how these membranes enable opportunities beyond conventional filtration, including energy-efficient water treatment, pointing to practical routes from laboratory prototypes to field deployment.

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