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DEPARTMENT OF CIVIL ENGINEERING

SEMINAR

Recent Advance in Dendrimer Mediated Thin-Film Composite (TFC) Desalination Membrane

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Date: 19 August 2024 (Monday)
Time: 3:30 p.m. – 4:30 p.m.
Venue: Room 632C, 6/F Haking Wong Building, The University of Hong Kong

ABSTRACT

Membrane technology using well-defined pore structure can achieve high ion purity and recovery. However, fine-tuning the inner pore structure to be uniform and enhancing the effective pore area of separation nanofilms are still challenging. Here, we report two strategies to increase the control of interfacial polymerization (IP) to make better TFC membranes. First, we have used dendrimers with different peripheral groups that preferentially self-assemble in aqueous-phase amine solution to facilitate the formation of polyamide (PA) nanofilms with a well-defined effective pore range and uniform pore structure. The high permeabilities are maintained by forming asymmetric hollow nanostrip nanofilms, and their well-designed ion effective separation pore ranges show an enhancement, rationalized by molecular simulation. Second, we have fabricated the highly permselective asymmetric PA nanofilm with a dual-layer structure in which the bottom interlayer is a porous crosslinked aromatic PA dendrimer, and the top layer is a dense PA layer with a nanostrip structure. The bottom dendrimer interlayer forms nanosized cavities that may enhance the storage and confined amine monomer diffusion, leading to the construction of a striped pattern PA nanofilms. The resulting asymmetric PA membrane exhibits excellent water permeability while maintains good ion rejection. Therefore, these dendrimer-regulated interfacial polymerizations provide a groundbreaking framework for developing high-performance TFC desalination membranes via fine-tuned sub-nanometer structures in ion separation nanofilms.

ABOUT THE SPEAKER

Professor Niu is a synthetic organic/polymer chemist. He got his PhD degree from Michigan Technological University and worked for DOW Chemical Company and GE Water for dozens of years after his postdoc training at UCLA and Cornell University in USA. He is currently a Distinguished Professor of Shenzhen University. His research covers a wide scope of polymer chemistry and functional materials with particular interest in polyamide membranes for nanofiltration and reverse osmosis. In recent years, Professor Niu's research team have revealed the mechanism of nanostructure formations on polyamide membranes with different materials and methodologies. They also sorted different nanomaterials with their dimensional parameters for building interlayer layers in the thin film composite membranes for improving the desalination performance. Currently, they are focused on the development of nanofiltration and reverse osmosis membranes with ultra-water permeability using dendrimer based organic nanostructures as mediators.

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