SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

OFFICE OF ECONOMIC DEVELOPMENT

Multilayer Thin Film Nanocomposite Membranes Prepared by Molecular Layer-by-Layer Assembly

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LICENSING OPPORTUNITIES

South Dakota School of Mines Office of Economic Development is actively seeking exclusive and/or nonexclusive licensing opportunities. Joint development opportunities are also available.

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Overview

Current state-of-the-art membranes used for molecular-level liquid separations (reverse osmosis, forward osmosis, nanofiltration and ultrafiltration) are often thin film composite (TFC) membranes. TFC membranes prepared by interfacial polymerization usually consist of a separating layer formed on a porous polymeric support that provides adequate separation capability. However, many TFC membranes have relatively low permeability and are inconsistent due to poor dispersion of the composite material. Researchers at the South Dakota School of Mines & Technology have developed a unique approach to easily and rapidly prepare TFC membranes using molecular layer-by-layer (mLbL) assembly.

Description

Thin film nanocomposite membranes for reverse osmosis were prepared by forming a high permeability selective layer on highly porous electrospun polyacrylonitrile (PAN) nanofiber mats by molecular layer-by-layer (mLbL) assembly. mLbL has the potential to form highly crosslinked and dense polyamide layers on top of any support while incorporating an evenly dispersed and controlled nanocomposite filler. Compared to the traditional interfacial polymerization method, the superior performance of these mLbL modified TFC membranes was attributed to the precise control over thickness, homogeneity of the composite surface and decrease in overall surface roughness. Thus, mLbL is an ideal platform for forming selective layers with desired thickness, chemical structure and composition needed for high efficiency reverse osmosis and nanofiltration applications.

Advantages

- A new class of filtration membranes for sea water desalination and waste water reclamation with high permeability, low fouling and robust integrity (higher chlorine stability).
- The method can be extended to a variety of membrane substrates and many combinations of molecular layering and composite materials.
- Molecular layer-by-layer (mLbL) has recently emerged as an alternate method for the preparation of TFC membranes by forming well controlled smooth selective layers on any microporous support that are easily manufactured at larger scale.