Highly selective polyetherimide membranes via polymer nanoconfinement for gas separation

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Abstract:

Efficient separation of industrial gases will have a global impact on environmental sustainability and cost-efficiency of (petro)chemical processes. Gas separation using membrane technology saves on energy consumption as it can occur at near-equilibrium. Important gas separations that require much improved energy efficiency include capture of CO_2 and N_2 enrichment. Polymer membranes are well-developed and offers low cost due to the possibility of mass-scale manufacturing. However, gas separation efficiency of homogeneous polymer membranes has been overshadowed by the well-known trade-off of gas permeability and selectivity for several industrially-relevant gas mixtures.

Polymer nanoconfinement and crystallization shift of thermoplastic polymers in hierarchical nanoporous ceramic supports, where the membranes have been shown to produce extremely high gas selectivities such as more than 2200 for CO_2/N_2 and more than 4000 for H_2/N_2 by extending beyond the theoretical Robeson's Upper Boundary [1, 2]. In this talk, I will discuss and demonstrate a new generation of interfacial diffusion membranes enabled by polymer nanoconfinement for controlling gas transport exclusively across the internal porous surface of a ceramic support and crystalline domains of thermoplastic polymers. The nanoconfinement effect has the potential to enable the tailoring of selective membrane transport for improving the purification of industrial gases.

Reference List

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