Fundamental Insight into the Hierarchical Engineering of Nanoparticulate and Templated Porous Films for Molecular Separations



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<u>Motivation</u>: The ability to synthesize ultra-thin porous inorganic films with tunable, highly ordered pore topologies holds implications for molecular selectivity and flux as it relates to membrane-based gas, vapor, and liquid separations with potential impact on energy savings.

Goal: Establish a facile strategy for simultaneously tuning pore size and film thickness of porous inorganic films, the latter to the level of just tens to hundreds of nanometers by decoupling template assembly from chemistries of film formation.



Carbon Films

Scaffolded Zeolite Films

Outcomes:

- Realization of *defect-free, mechanically flexible* porous carbon films scalable to *tens of nanometer in thickness*.
- Three-dimensionally ordered mesoporous (*3DOm*) and *3DOm-supported, ultra-thin microporous film morphologies* achieved by control over film templating conditions.
- Scaffolded growth of thin zeolite films results in tunability of zeolite film thickness to ~O(100 nm) or less.