Liquid transport mechanisms and surface interactions in nanoporous materials

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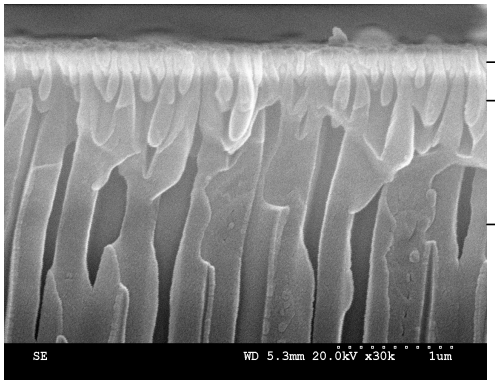
In nanoporous materials, solvent-surface interactions and nanoscale confinement greatly influence liquid transport and phase behavior. Our research examines solvent transport through ceramic membranes, as model nanoporous materials, to elucidate these effects as a function of the chemical and physical properties of the solvent and membrane.

In the figures below, thermoporometry has been employed as a tool to study solvent-surface interactions in nanoporous materials with native (bare), alkane (C8H), and perfluoroalkane (C8F) octylsilane grafted Anopore™ alumina membranes. These results provide insight into how water and decane penetrate into each of the three membrane layers with pore radii or 10, 50, and 100 nm. Comparisons between predicted and experimental values illustrate the effects of surface chemistry and nanoscale confinement on solvent phase behavior.



→ Selective layer (r_p = 10 nm, t = 500 nm)

→ Intermediate layer (r_p = 50 nm, t = 800 nm)

→ Support layer (r_p = 100 nm, $t \sim 5.9 \times 10^4$ nm)