UCLA College | Physical Sciences Chemistry & Biochemistry

Chem 218: Student Exit Seminar

Controlling the Architecture of Nanoporous Materials to Regulate their Thermal Conductivity and Optical Transparency for Energy Efficient Windows

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Transparent, low thermal conductivity coatings can be applied to windows to increase the energy efficiency of buildings. Amorphous material such as silica make good thermal insulators due to their local atomic disorder that impedes heat conduction. Moreover, pores can be added to the material to further reduce heat conduction by decreasing the material density while adding interfaces can additionally scatter heat carriers. This concept is often used in highly porous silica aerogels, which are valued for their ultra-low thermal conductivities. However, these aerogels significantly scatter light, and therefore cannot be used for applications that require high optical transparency. This talk focuses on our ongoing efforts to design silica-based coating that are insulating as well as optically transparent. First, I will describe our efforts using mesoporous thin films to expand on our fundamental understanding of heat transport in nanoporous, silica-based materials. Next, I will discuss how the knowledge gained from these thin film studies influenced our design of novel precursors and a scalable synthetic method to produce monoliths that can be used in thermal insulation applications. Finally, I will describe our efforts to use small angle X-ray scattering (SAXS) to follow structural changes in porous materials with the goal of understanding how surface chemistry and drying dynamics influence pore structure to produce materials with desired thermal conductivity and optical quality.

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12:00 p.m.
Via Zoom

For questions, please contact: jzabala@chem.ucla.edu