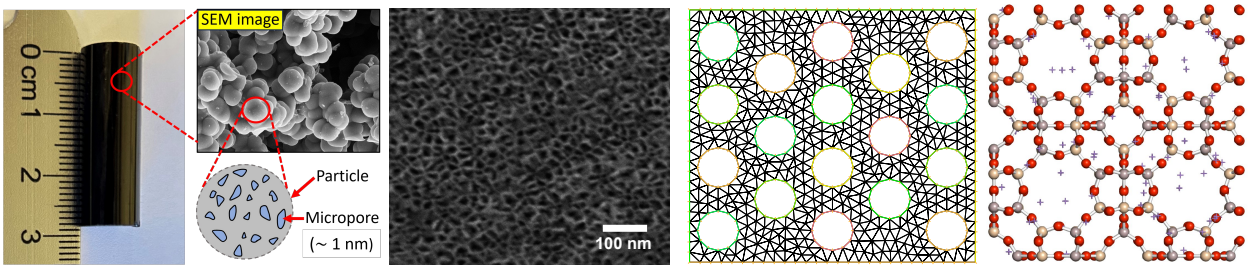
DEPARTMENT OF CHEMICAL AND MATERIALS ENGINEERING
GRADUATE ELECTIVE COURSE

MTEN 702: "Nanoporous Materials"

WHEN: Spring 2025, Fridays 1:00-3:50 PM
WHERE: Kupfrian Hall 210

Many porous materials have characteristic pore sizes in the nanometer range. These materials include natural (clays, coal, and shale), concrete, as well as synthetic materials used for separation, purification, and energy storage. In most natural or technological processes the pores in these materials contain fluids: water in clays and concrete, hydrocarbons in coal and shale, etc. In nanopore-confined fluid, tight spatial confinement and solid-fluid interactions may significantly alter the fluid's physical properties, causing, for example, the molecular structuring of the fluid, shifts of the freezing or evaporation points and the appearance of the disjoining pressure. These pore-scale effects necessarily lead to a change in the parameters of continuum models for fluid transport in nanoporous media and poromechanics; moreover, they often require introducing new physics in the governing equations.



The course includes the following topics (preliminary):

1. Gas adsorption by nanoporus materials
2. Mechanics of nanoporous materials
3. Fluid transport in nanoporous materials
4. Basics of poroelasticity
5. Polymers viewed as nanoporous materials

Additional outcome:

The final project will be implemented in groups, and completed projects can potentially result in journal publications. The final projects from the different graduate elective course, taught by the same instructor, ChE 775 in 2020 and 2022, led to papers published in *J. Phys. Chem. B* https://doi.org/10.1021/acs.jpcb.0c10505 and *ACS Appl. Mater. Interfaces* https://doi.org/10.1021/acsami.3c02713

Prerequisites:

As a special topic course, this course does not have formal pre-requisites. However the course requires background in **thermodynamics** on the graduate level, and background in math (calculus and **differential equations**) and **mechanics** on an undergraduate level.

Who should enroll:

The course is designed for **Ph.D. students** only. Outstanding MS students in physics and engineering should reach out to the instructor for permission to register as an exception.

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