UNIVERSITY OF CALIFORNIA, IRVINE

THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

Is Proud to Host a Seminar by:

PROFESSOR KATHERINE T. FABER

Department of Materials Science and Engineering

California Institute of Technology

Thursday, February 2, 2023

2:00-3:20 PM

Location:

McDonnell Douglas Engineering Auditorium

Probing Pore Space: Crafting Porous Ceramic Architectures Using Principles Of Solidification

Abstract: Pores have long been regarded as undesirable in the search for the perfect ceramic. The deleterious role of pores on mechanical properties notwithstanding, porosity has now become important, even critical, in expanding the utility of ceramic materials. In addition to lowering density, pores have become the conduits for fuels and reaction products in fuel and electrolysis cells. They serve as the size limiter in filtration, the source of high surface area for catalysts, and the path for cell growth in biomedical implants. In this presentation, strategies for producing various pore structures in oxide and carbide ceramics are explored. One approach, built on the fundamentals of solidification, is directional freeze casting or ice-templating, in which a fluid, upon freezing, pushes ceramic particles or preceramic polymers aside and serves as a sacrificial template for the pore network. Pore size, fraction, and distribution, as well as connectivity and tortuosity of porous systems, all vital for understanding pore effects on material properties, are evaluated using porosimetry, microscopy, and 3D images produced using synchrotron X-rays. Pore network-property relations, necessary for understanding filtration and deformation, are also discussed with respect to applications for pathogen capture, bioprocessing, and shape memory functional ceramics.

Bio: Katherine T. Faber is the Simon Ramo Professor of Materials Science at the California Institute of Technology. She earned her PhD in materials science and engineering from the University of California, Berkeley. Prior to joining Caltech, she held appointments at the Ohio State University and Northwestern University. Professor Faber is a fellow of the American Academy of Arts and Sciences, a Distinguished Life Member of the American Ceramic Society, and a fellow of ASM International. Among her awards are the Society of Women Engineers Distinguished Educator Award, the Toledo Glass and Ceramics Award and the John Jeppson Award, both of the American Ceramic Society, and the Edward DeMille Campbell Memorial Lecture of ASM International. She served as president of the American Ceramic Society in 2006–07. While at Northwestern University, she co-founded and co-directed the Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts, where advanced materials characterization and analytical techniques are used in support of conservation science. Her research interests also include the fracture of brittle materials and the mechanisms by which such materials can be toughened, ceramics for energy-related applications, including thermal and environmental barrier coatings for power generation, porous solids for filtration and flow, and cultural heritage science.