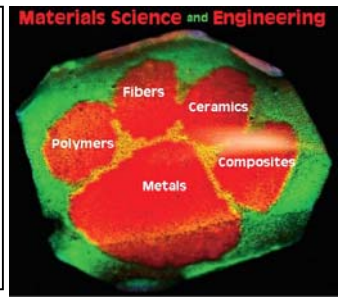


## Seminar Series

Sponsored by  
**School of Materials Science and Engineering**  
Thursday, April 3, 2008  
5:00 PM – Room 200 Olin Hall



### "Porous Ceramics by Nature and by Design"

Katherine T. Faber

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#### **Abstract:**

Porous ceramics offer a wealth of uses from water treatment to catalysis to sensors. Processing of porous materials historically has focused on foaming methods in the liquid state. Two examples of alternative processing methods for porous ceramics are presented here, one from natural materials, the second synthetic, with an eye toward optimal design. Silicon carbide, one of the hardest and most refractory materials known, does not occur in nature. Both silicon carbide powder synthesis and bulk production are energy intensive processes, often conducted in excess of 2000°C. Only limited processes are available at moderate temperatures through melt infiltration techniques, and they offer little microstructural control. An alternative, specifically used to produce porous SiC, relies on naturally derived scaffolds (wood). These so-called “biomorphic” silicon carbides are produced by pyrolyzing wood to create a carbon scaffold. The scaffold or template is then used for silicon infiltration and reaction to create versatile SiC-based cellular materials having porosities of more than 50%. Infiltration of the porous channels by Al to create SiC/Al composites is described. Thermoreversible gelcasting (TRG) has emerged as another feasible processing method for porous, complex-shaped ceramics using a low-viscosity slurry. TRG is a direct casting method in which a triblock copolymer monomer solution in solution is used to disperse a low viscosity, high solids loading ceramic slurry. Fugitive phases are included to produce the requisite porosity. Gelation is controlled solely by temperature, as the process uses a *physical* rather than a *chemical* gelation and can be reversed multiple times. This method has recently been applied to the processing of porous/dense alumina laminates for flaw tolerance.

#### **Bio:**

*Katherine T. Faber currently holds the position of Walter P. Murphy Professor of Materials Science and Engineering in the McCormick School of Engineering and Applied Science at Northwestern University. Her research interests include fracture of brittle materials, thermal shock, fatigue, and reliability. She has published more than 120 papers and edited one book in the area of fracture and toughening mechanisms in ceramics, glasses, electronic materials, cement-based materials, coatings, and ceramic-matrix composites. Educated at Alfred University with a B.S. in Ceramic Engineering (1975), she then went on to the Pennsylvania State University for a M.S. in Ceramic Science (1978) and to the University of California at Berkeley for a Ph.D. in Materials Science and Engineering (1982). She has held the positions of Invited Summer Employee at the Lawrence Livermore National Laboratory (1975, 76) and Development Associate at the Carborundum Company (1978-79) and Visiting Professor of Materials at the University of California at Santa Barbara (Winter 1996). Prior to joining the faculty at Northwestern in 1988, she was Assistant and Associate Professor of Ceramic Engineering at the Ohio State University (1982-87). Her administrative positions have included Associate Dean for Graduate Studies and Research in the McCormick School (1992-97) and Chair of the Department of Materials Science and Engineering (1998-2003). Among Professor Faber's awards are the National Science Foundation's Presidential Young Investigator Award, Fellow of the American Ceramic Society and of ASM International, the Charles E. MacQuigg Award for Outstanding Teaching at Ohio State, the Society of Women Engineers Distinguished Educator Award, and the YWCA Achievement Award for Education. She is an ISI Highly Cited Author in Materials, and recently completed a term as President of the American Ceramic Society.*