

MSE SEMINAR

January 27, 2017

113 McBryde Hall

3:30 - 4:30 PM

Refreshments at 3:00 PM

Professor John Halloran

Materials Science and Engineering
University of Michigan

“Additive Manufacturing and Advanced Fabrication Methods for Ceramics”

ABSTRACT

I will discuss three topics related to ceramic fabrication: additive manufacturing by photopolymerization, thermoplastic co-extrusion, and freeze casting. After a brief review of the status of direct and indirect 3D printing methods for ceramics, I will discuss photopolymerization methods in detail. Emphasis will be on photopolymerization by laser drawing using commercial stereolithography machines and by DMD exposure using more recent devices, including Large Area Maskless Photopolymerization (LAMP). I will discuss the production of detailed and accurate ceramic cores and molds for investment casting of superalloys, and address issues related to commercialization. The fundamental background related to the ceramic technology of photopolymerization will be presented, including predictive models for the cured depth and cured width of the photocured features. These depend upon the energy dose, intensity, photoactive components which determine absorption and scattering and refractive index. My discussion of extrusion will involve thermoplastic co-extrusion of ceramics, used for microfabrication, anode supported SOFCs, tough composites, cellular ceramics, with an emphasis on complex and multicomponent shapes from simple extrusion dies. I will briefly discuss room temperature freeze casting of ceramics using sublimable terpenes as vehicles.

BIOSKETCH

John Halloran is the Van Vlack Professor of Materials Science and Engineering in the MSE Department at the University of Michigan. Before joining Michigan in 1990, he was with Ceramic Process Systems Corporation in the Boston area, and served on the faculty of Pennsylvania State University and Case Western Reserve University. He is an Editor-in-Chief for the Journal of the American Ceramic Society. He is a co-founder of DDM Systems, Inc., involved in direct digital manufacturing for turbine components.