West Virginia University
Department of Mechanical and Aerospace Engineering

**MAE Graduate Seminar**

*(Rm 355, ESB on October 27th, 2:30pm-3:30pm)*

# Fuel Oxidation in Solid Oxide Fuel Cells: From Electrocatalyst to Integrated Systems

Gregory S. Jackson
*Dept. of Mechanical Engineering*
*University of Maryland, College Park, MD 20742*
e-mail: gsjackso@umd.edu

*Abstract*

Solid oxide fuel cells (SOFC's) have the potential to operate stably on carbonaceous fuels – either syngas from fuel pre-reforming or direct hydrocarbon feeds – with high-efficiency for applications ranging from small-scale autonomous systems to large-scale central power plants. However, the potential for carbonaceous fuels to form carbon deposits in the anode has challenged SOFC design and promoted research for new electrocatalyst materials and improved microarchitectures for operation with hydrocarbons or syngas. A multi-disciplinary team at the University of Maryland (UMD) in collaboration with other institutions has been exploring both how anode microstructure and materials influence electrochemical oxidation in SOFC anodes. These efforts include the use of micro-fabricated SOFC anode structures and have attempted to isolate key chemical and physical processes for the development of modeling tools to explore SOFC design – both at the micro-structural level and the larger system level. This presentation will review combined experimental and numerical efforts to understand the complexities of electrochemical oxidation of fuels in SOFC anodes and to translate that understanding into higher-level models for integrated system design and evaluation. These efforts will be placed within the larger context of challenges and opportunities in SOFC research and development in the expectation that they will realize their potential for efficient power generation for a wide array of applications.

*Bio Sketch*

*Dr. Greg Jackson* is currently an Associate Professor in the Department of Mechanical Engineering at the University of Maryland and chair of the Steering Committee for the campus-wide University of Maryland Energy Research Center. His group is active in research exploring electrocatalysis in solid oxide fuel cells, reformate-tolerant PEM fuel cells, and catalysis for hydrocarbon oxidation and $H_2$ production from hydrocarbons. Dr. Jackson received his Ph.D. from Cornell University in Mechanical Engineering where he performed research on droplet combustion. After graduating from Cornell, Dr. Jackson spent several years at Precision Combustion Inc. where he managed research and development of catalytic systems for ultra-low-$NO_x$ combustion and for ignition stabilization in diesel engines and gas turbines. Dr. Jackson joined the faculty at the University of Maryland in 1997 where he now directs the Ballard Power Systems Fuel Cell Laboratory, and in collaboration with colleagues in the Dept. of Chemistry, he co-directs the Center for Fuel Cell Research.