

# DEPARTMENT OF MECHANICAL ENGINEERING

## WILLIAM MAXWELL REED SEMINAR SERIES

### “Oxidation Behavior of High Temperature Aerospace Materials Using High Enthalpy Flows”

Erica L. Corral, Ph.D.

Materials Science and Engineering Department, University of Arizona

**Abstract:** An approach towards understanding the oxidation behavior of carbon-carbon composites, ultra-high temperature ceramics, and coatings is presented. The oxyacetylene torch facility is used to measure the ablation rates of graphite and the surface temperatures of different aerospace materials. The free stream flame environment is characterized as a function of flame chemistry for heat flux,  $pO_2$ , and flow velocity. Measured ablation rates for graphite increase as a function of increasing heat flux and  $pO_2$  which are validated by applying an oxygen diffusion based model. The model uses experimentally measured values for temperature,  $pO_2$ , and gas velocity in order to confirm torch testing results are reliable and reproducible. Surface temperatures of ultra-high temperature ceramic composites are measured as a function of increasing heat flux and show an enthalpic cooling effect on the flame during oxidation testing. A diffusion limited model for oxidation of high temperature ceramics is also presented in order to discuss the effect of flow velocity and high enthalpy testing on observed oxidation behavior for different aerospace materials.

**Abstract:** Dr. Erica L. Corral initiated her academic career in, August 2008, as an Assistant Professor of Materials Science and Engineering at The University of Arizona in Tucson, Arizona. Her research programs are focused on advancing the fundamental understanding of high-temperature materials for use in extreme environmental applications. Specifically, her research efforts investigate processing science of high temperature ceramics using direct current sintering, coatings for oxidation of carbon-carbon composites, graphene-reinforced ceramic matrix composites, joining of ceramics, and oxidation behavior of aerospace materials in high enthalpy flows. Her postdoctoral training was conducted at Sandia National Laboratories, in the Ceramic Processing and Inorganic Materials Department, in Albuquerque, NM. Her Doctor of Philosophy Degree is in Materials Science and her Bachelors of Science Degree is in Metallurgical and Materials Engineering, were obtained from William Marsh Rice University, and The University of Texas at El Paso, respectively. Her scholarly efforts are recognized with the National Science Foundation Early Faculty Career Award, and the Air Force Office of Scientific Research Young Investigator Program Award. She was also recently awarded the title and honor of Distinguished Scholar as an outstanding mid-career faculty who is a leading expert in her field and a highly-valued contributor to teaching, research, and outreach priorities set out by The University of Arizona.

**Date:** Friday, April 13th  
**Place:** CB 122

**Time:** 3PM  
**Contact:** Dr. Alexandre Martin 257-4462

Meet the speaker and have refreshments  
Attendance open to all interested persons