THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT FALL COLLOQUIUM SERIES PRESENTS:

Fine Lecture

Professor Elizabeth Opila

Chair and Professor of Materials Science and Engineering and Mechanical and Aerospace Engineering
University of Virginia

Oxide stability in high-temperature, high-velocity steam

High-temperature, high-velocity steam conditions are prevalent in power and propulsion applications and present challenging environments for materials durability. Test capabilities relevant for use in this environment are crucial for life prediction of materials undergoing thermochemical degradation mechanisms. In this presentation, a “steam-jet furnace” concept will be presented that is relevant for testing thermochemical stability of oxide-based environmental barrier coatings for SiC composite components used in the hot section of turbine engines. However, the capabilities of this test method go well beyond validating engineering applications, providing a tool for more fundamental materials science investigations. The presentation will address use of the steam-jet furnace to determine enthalpies of formation for gaseous metal hydroxides, complex oxide phase diagram determination, as well as the potential for oxide surface energy determination. Finally, remaining challenges in our understanding of the stability of complex oxides in high-temperature, high-velocity steam will be discussed.

Elizabeth Opila is Chair and Professor of Materials Science and Engineering, the Rolls-Royce Commonwealth Professor of Engineering at the University of Virginia with a courtesy appointment in the Department of Mechanical and Aerospace Engineering. She is also the Director of the Rolls-Royce University Technology Center for Advanced Materials Systems at the University of Virginia. Prior to 2010, she held the position of Materials Research Engineer at the NASA Glenn Research Center in Cleveland, OH for 19 years where she worked primarily on ceramics for applications in turbine engines, rocket engines, hot structures for thermal protections systems, and other power and propulsion applications. Her current research focus includes understanding thermodynamic and kinetic mechanisms for material degradation in extreme environments, development of life prediction methodology based on understanding of fundamental high temperature chemical reaction mechanisms, and materials development for protection of materials from extreme environments. She studies thermochemical stability of ceramic matrix composites, refractory metals and alloys, ultra-high temperature ceramics, and environmental and thermal barrier coatings using a variety of specialized experimental approaches, materials characterization, and computational methods. Prof. Opila received her BS in Ceramic Engineering from the University of Illinois, her MS in Materials Science from the University of California Berkeley, and her PhD in Materials Science from the Massachusetts Institute of Technology. She is Fellow of the American Ceramic Society and the Electrochemical Society and recipient of the 2021 American Ceramic Society’s Arthur L. Friedberg Award. She has approximately 150 publications, is editor of 10 proceedings volumes, and coinventor on six patents.

Tuesday, October 29 • 4 pm CT • Tech L211

Small reception to follow in the Willens Wing Atrium

In person only; no Zoom

Questions? Contact allison.macknick@northwestern.edu

Northwestern | McCORMICK SCHOOL OF ENGINEERING