UCI Samueli School of Engineering

Department of Materials Science and Engineering UCI

UNIVERSITY OF CALIFORNIA, IRVINE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

IS PROUD TO HOST A SEMINAR BY

"STRESS HISTORY IN RARE EARTH ORTHOPHOSPHATE CERAMICS"

CORINNE PACKARD

PROFESSOR
DEPARTMENT OF CHEMICAL ENGINEERING & MATERIALS SCIENCE
UNIVERSITY OF SOUTHERN CALIFORNIA

Thursday, March 6, 2024

2:00 PM - 3:20 PM

McDonnell Douglas Engineering Auditorium

Abstract: In materials science, rare earth orthophosphate ceramics are being investigated for a range of turbine applications because of their ability to withstand extreme environments, while in the geosciences, the persistence of these same materials allows them to record geologic events. In this talk, I will discuss the impacts of stress state on mechanical behavior in rare earth orthophosphates ceramics which we have elucidated using diamond anvil cells with in situ Raman spectroscopy, x-ray diffraction, and photoluminescence spectroscopy, and nanoindentation. Superimposed shear stress dramatically reduces the onset pressure of a phase transformation in these materials by facilitating the distortion of the network of polyhedral units. We find that direct excitation photoluminescence spectroscopy detects the xenotime-monazite phase transition onset and end pressure consistent with synchrotron x-ray diffraction results, while also showing more subtle changes in certain band intensity ratios that can be connected to stress history. Even in the absence of phase transition, stress generates interesting deformation phenomena. Using various characterization modalities provides a richer understanding of structure and deformation.

Bio: Dr. Corinne Packard recently joined the University of Southern California as a Professor in the Mork Family Department of Chemical Engineering & Materials Science. From 2010-2024, Packard progressed through the professorial ranks in the George Ansel Department of Metallurgical and Materials Engineering at the Colorado School of Mines while simultaneously jointly appointed at the National Renewable Energy Laboratory. Prior to appointment at Mines, Packard earned her Ph.D. in Materials Science & Engineering from MIT. Packard researches fundamental and applied mechanics of materials, with a focus on ceramics for solar energy, electronics, and aerospace. Her research has elucidated principles and mechanisms of deformation behavior in brittle materials at the micro- and nanoscales. Specific examples include determining the role of chemistry in controlling the deformation behavior in rare-earth orthophosphate ceramics; engineering fracture in photovoltaic semiconductors to enable dramatic cost reduction through wafer reuse; and high-throughput materials discovery and optimization to design for durable thin film coatings. The thread that ties these diverse projects together is a deep interest in understanding how complex stress state can be controlled to yield desirable mechanical behavior in materials. She has an impactful research portfolio with more than 60 archival publications and 4 issued patents, and has been recognized with notable awards including the Acta Materialia Silver Award, AIME Robert Lansing Hardy Award, a National Science Foundation Faculty Early Career Development (CAREER) Award, and the Colorado School of Mines Faculty Excellence Award.