

The Department of  
**Mechanical Engineering**  
PRESENTS

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Friday, May 31, 2019  
Bourns Hall A265  
11:10-12:00PM

## ***Morphologically controlled composites: emerging materials for extreme environments***

### ***Abstract:***

This talk will present an overview of the microstructure and phase stability of hexaboride ceramics of controlled morphologies. Hexaborides are a unique class of non-oxide ceramics with many interesting electronic, magnetic and optical properties. The cubic crystal structure consists of covalently bonded boron octahedra surrounding a loosely-bonded metal ion, which donates electrons to the boron framework and directly influences the compound's conductivity. Compatible metal ions are restricted in size by the boron sublattice, and therefore readily form solid solutions in mixed-ion compounds. CaB<sub>6</sub>, SrB<sub>6</sub>, and BaB<sub>6</sub> powders have been produced, along with binary mixtures of each in 10 mol.% increments. Synchrotron radiation and detailed Raman spectroscopy have been used to detail the crystallography and bonding states in the materials. X-ray diffraction was used to study the phases formed, and while the (Ca-Sr)B<sub>6</sub> and (Ba-Sr)B<sub>6</sub> systems form single solid solutions, the (Ba-Ca)B<sub>6</sub> system separates into two solid solution phases. Atomic-resolution TEM was subsequently used to determine defects in the materials. We will also present preliminary results on the formation of carbides. The compositionally diverse TaC<sub>1-x</sub> phase is an interstitial carbide having a rocksalt crystal structure and mixed covalent, metallic, and ionic bonding. Therefore, this material has an interesting combination of properties that in some respects are intermediate between typical ceramics and metals.

### ***About the Speaker:***

Prof. Olivia Graeve is a Professor in the Department of Mechanical and Aerospace Engineering at UC San Diego, Director of the CaliBaja Center for Resilient Materials and Systems, and Faculty Director of the IDEA Engineering Student Center. She holds a Ph.D. in Materials Science and Engineering from the University of California, Davis, and a Bachelor's degree in Structural Engineering from the University of California, San Diego. Her area of research focuses on the design and processing of new materials for extreme environments, including extremes of temperature, pressure, and radiation. She has been involved in many activities related to the recruitment and retention of women and Hispanic students in science and engineering and has received several prestigious awards including the National Science Foundation CAREER award, the 2006 Hispanic Educator of the Year award by the Society of Hispanic Professional Engineers, the 2010 Karl Schwartzwalder Professional Achievement in Ceramic Engineering Award by the American Ceramic Society, among many others. More recently, she has been inducted into the Tijuana Walk of Fame (2014) and to the Mexican Academy of Engineering (2016), and has been named Fellow of the American Ceramic Society (2017). In addition, Forbes Magazine named her one of the 100 Most Powerful Women of Mexico (2017).