

**The Department of  
Mechanical Engineering**  
PRESENTS

**Irene J. Beyerlein, Ph.D.**

Professor

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**Friday, May 11, 2018  
Bourns Hall A265  
11:10-12:00PM**

**Twin Formation, Propagation, and Intersection at  
the Mesoscale**



**Abstract:**

Hexagonal close packed (HCP) crystalline materials, such as Mg and Ti, can provide a potential solution to the ever-increasing portfolio of structural applications that require advanced materials with unprecedented combinations of mechanical properties. Successful incorporation of HCP materials into engineering designs is, however, hindered by their limited plasticity. Perhaps one of the most important and puzzling underlying mechanisms governing their plastic behavior is deformation twinning, a crystalline defect that forms in these materials under straining and most often from the boundaries between the crystals. The nucleation of twins both inside the crystal and at crystalline boundaries has mostly been addressed computationally at the atomistic scale level. In our research, we employ crystal plasticity based micromechanics modeling to establish and understand the first formation of twin embryos, propagation inside crystals and across their boundaries, and twin expansion. We apply it to Mg and Ti and many of their alloys of great technical interest in order to elucidate the role of solutes. The insight gained from these series of calculations aims to benefit the design of low-density, high strength, and high toughness HCP crystalline alloys, for reducing weight and fuel consumption.

**Biosketch:**

Prof. Beyerlein's research focuses on the creation and design of advanced materials with unprecedented structural performance under extremes of strains, stress, and temperature. The overarching research goals will seek to understand and predict how to design and make novel lightweight materials that attain strengths nearer to their theoretical limits. Prof. Beyerlein was recently honored with the 2016 NSF ADVANCE STEM Professor Fellowship at the University of New Hampshire. In 2014, she received a fellowship to be a Visiting Professor at the University of Lorraine in Metz, France. Previously, Prof. Beyerlein received the Los Alamos National Laboratory (LANL) Distinguished Postdoc Mentor Award, LANL Fellow's Prize, and International Journal of Plasticity Young Researcher Award. She received recognition for writing top-five and top-ten most-cited articles for Philosophical Magazine and International Journal of Plasticity, respectively. Prof. Beyerlein is a Fellow of the Institute of Physics and serves as Editor of Acta Materialia and Scripta Materialia, as well as Associate Editor of Journal of Engineering Materials and Technology.