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COLLOQUIUM SERIES

"From dislocations to structural elements: Using modeling and simulation to predict the mechanical behavior across multiple spatial and temporal scales"

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Refreshments at 3:15, 204 Thurston Hall

Abstract
Unraveling the mechanical behavior of advanced materials and their response to extreme environments is critical from both scientific and engineering viewpoints. In particular, discovering, manufacturing and deploying these advanced materials in a shorter time and reduced cost are some of the goals of multi-agency initiatives like the Materials Genome Initiative. In this talk, I will present my recent work using modeling and simulation to provide insights and enrich the experimental knowledge about the materials innovation infrastructure. First, specific attention is drawn to a physically-based multiscale model of tungsten that uses atomistically-informed Crystal Plasticity simulations. This approach is capable of predicting the experimentally-measured temperature dependence of yield strength for tungsten single crystals without parameter-fitting of any kind to experimental data. Second, ongoing efforts to assess the prediction of fragment-size and fragment-mass statistics of heterogeneous brittle materials exposed to extreme conditions are presented. The fragmentation process is found to be sensitive to the heterogeneous states of strain rates and the micro-mechanical definition of the material. Opportunities exist to exploit these techniques to design advanced materials for energy applications, protection and security.

Biographical Sketch
Dr. David Cereceda is a Postdoctoral Fellow at Johns Hopkins University, within the Hopkins Extreme Materials Institute. His research is aimed at understanding the dynamic fragmentation of brittle materials under extreme loading conditions. Dr. Cereceda received his Ph.D. in Mechanical Engineering from Polytechnic University of Madrid in 2015. His Ph.D. research, performed at Lawrence Livermore National Laboratory and University of California Los Angeles, was focused on the multiscale modeling of body-centered cubic metals like tungsten. His research continues the development of computational models to predict materials behavior across multiple spatial and temporal scales.