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149th Annual Meeting & Exhibition

February 23-27, 2020 • San Diego, California, USA

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Mechanics and Structural Reliability

Understanding and Predicting Dynamic Behavior of Materials

Understanding the response of materials to dynamic environments is a challenging and complex problem. In such conditions, as experienced during blast, impact, or other impulsive loading, extreme states of stress, strain, strain-rate, and temperature can be expected—with these states often varying by many orders of magnitude during the event(s). To be confident in the results of codes that are often used to simulate such events requires accurate, predictive equation of state, strength, and damage models. These models must be able to account for the various mechanisms for plasticity, such as twinning, phase transformations, dislocation motion etc. that can occur when a material is shocked above the Hugoniot elastic limit. Furthermore, they need to capture where and when these mechanisms activate, that is, how the loading path during the dynamic event affects strength and damage.

The goal of this symposium is to understand how material microstructure couples with these varying loading conditions to dictate its dynamic response – specifically, it is important to understand the macromechanical and physical processes that govern the phenomena and manifest themselves, at the micro structural level, by a dazzling complexity of defect configurations and effects. The advent of in-situ techniques available at facilities like the National Ignition Facility, Advanced Photon Source, Dynamic Mesoscale Material Science Capability (previously MaRIE), Linac Coherent Light Source, and Omega have enabled us to make significant strides towards gaining more insights into these basic mechanisms that drive materials response under dynamic loading. These, coupled with modeling tools from ab-initio to continuum computations, enable realistic predictions of material performances under these complex loading conditions and are starting to guide not only the design process but also further our micromechanical understanding of deformation processes at every level, including the basic dislocation mechanisms.

In addition to traditional materials, we have also made progress in understanding the extreme response of emerging materials, such as nano-crystalline, bulk metallic glasses, and high entropy alloys. The symposium organizers hope that, through this symposium, the materials community will become more exposed to this research field that has often been relegated to more specialized conferences.

ORGANIZERS

Saryu Fensin, Los Alamos National Laboratory, USA
Avinash Dongare, University of Connecticut, USA
Benjamin Morrow, Los Alamos National Laboratory, USA
Marc Meyers, University of California San Diego, USA
George Gray, Los Alamos National Laboratory, USA

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Abstract Deadline is July 1, 2019. Submit online at www.programmaster.org/TMS2020.

Questions?
Contact programming@tms.org