Materials Science & Engineering Seminar Series

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Path Dependency of High Pressure – Phase Transformations in Titanium and Zirconium

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ABSTRACT:

At high pressures titanium and zirconium are known to undergo a phase transformation from the hexagonal close packed (HCP), alpha-phase to the simple-hexagonal, omega-phase. Under conditions of shock loading, the high-pressure omega phase can be retained upon release. It has been shown that temperature, peak shock stress, and texture can influence the transformation. Moreover, under these same loading conditions, plastic processes of slip and twinning are also active and affected by similar differences in the loading path. To understand this path dependency, in-situ velocimetry measurements along with post-mortem metallographic and neutron diffraction characterization of soft recovered specimens have been utilized to qualitatively understand the kinetics of this transformation, quantify the volume fraction of retained omega-phase and characterize the shocked alpha and omega-phases. Mostly recently, the evolving structure during shock loading has been examined at the Dynamic Compression Sector at the Advanced Photon Source (DCS@APS) where in-situ diffraction during plate impact loading has been utilized to monitor transformation. These results have begun to offer insight into the completeness of transformation during dynamic loading. Together the work described here can be utilized to map the non-equilibrium phase diagram for these metals and lend insight into the partitioning of plastic processes between phases during high pressure transformation.

BIOGRAPHY:

Ellen Cerreta is the Group Leader for the Materials in Radiation and Dynamic Extremes Group (MST-8) at Los Alamos National Laboratory. She received her B.S in Aerospace Engineering from the University of Virginia and her M.S. and Ph.D. degrees in Materials Science and Engineering from Carnegie Mellon University. Ellen has been at LANL since 2001 and her research focuses on the relationship between microstructure and dynamic materials properties. At Los Alamos, Ellen has led a number of projects to investigate dynamic materials performance and provide insight toward advanced predictive capabilities for strength and damage in extreme environments. Ellen serves on the TMS and ASM Board of Directors and Board of Trustees, respectively. She was inducted into the 2016 ASM Fellows Class.

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