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Path Dependency of High Pressure Phase Transformations

ELLEN CERRETA, Los Alamos Natl Lab

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 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 transformation, quantify volume fraction of retained omega-phase and characterize the shocked alpha and omega-phases. 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.

In collaboration with: Frank Addesssio, Curt Bronkhorst, Donald Brown, David Jones, Turab Lookman, Benjamin Morrow, Carl Trujillo, Los Alamos National Lab.; Juan Pablo Escobedo-Diaz, University of New South Wales; Paulo Rigg, Washington State University.