SHOCK17-2017-000082

Abstract for an Invited Paper
for the SHOCK17 Meeting of
the American Physical Society

George E. Duvall Shock Compression Science Award Talk: Extreme Materials Behavior in Laser-Induced Shock[1]

MARC MEYERS, UCSD

The use of high-power pulsed lasers to probe the response of materials at pressures of hundreds of GPa, time durations of nanoseconds and fractions thereof, and strain rates of $10^6 - 10^{10}$ s^{-1} is revealing novel mechanisms of plastic deformation, phase transformations, and amorphization. This unique experimental tool, in combination with advanced diagnostics, analysis, and characterization, allows us to address fundamental questions on the extreme response of materials, such as the roles of shear and pressure, dislocation velocities, the transition between thermally-activated and phonon drag regimes, the slip-twinning transition, the flow stress at these strain rates, the ultimate tensile strength of metals, the mechanisms of void growth, phase transitions, and amorphization. In parallel with experiments, molecular dynamics simulations provide modeling and visualization at comparable strain rates (10^8-10^{10} s^{-1}) and time durations (hundreds of picoseconds). This powerful synergy is illustrated in our past and current work, using representative face-centered cubic, body-centered cubic, hexagonal, and diamond cubic materials. This research was conducted in collaboration with researchers from LLNL, U. of Cuyo (Argentina), U. of Rochester, and ORNL.

[1]Research funded by the UC Labs, LLNL, and NNSA/DOE.