Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

**Laser Compression of Nanocrystalline Tantalum** CHIA-HUI LU, University of California, San Diego, BRUCE REMINGTON, BRIAN MADDOX, LLNL, BIMAL KAD, University of California, San Diego, HYE-SOOK PARK, LLNL, MEGUMI KAWASAKI, Hanyang University, TERENCE LANGDON, University of Southern California, MARC MEYERS, University of California, San Diego — Nanocrystalline tantalum (g.s. ∼70 nm) prepared by severe plastic deformation (HPT) from monocrystalline [100] stock was subjected to high energy laser driven shock compression (up to ∼850 J), generating a pressure pulse with initial duration of ? 3 ns and amplitude of up to ∼145 GPa. TEM revealed few dislocations within the grains and an absence of twins at the highest shock strengths, in contrast with monocrystalline tantalum, which exhibited twinning at $P > \sim 45$ GPa. Hardness measurements were conducted and show a rise as the energy deposition surface is approached, evidence of shock-induced defects. The grain size was found to increase at a distance of 100 $\mu$m from the energy deposition surface as a result of thermally induced grain growth. Calculations using the Hu-Rath analysis are consistent with the experimental results. The experimentally measured dislocation densities and threshold stress for twinning are compared with predictions using analyses based on physically-based constitutive models. The predicted threshold stress for twinning increases from ∼45 GPa for the monocrystalline to ∼165 GPa for the nanocrystalline tantalum.

Chia-Hui Lu
University of California, San Diego

Date submitted: 25 Feb 2013 Electronic form version 1.4