Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Spall Response of Tantalum at Extreme Strain-Rates ERIC HAHN, Univ of California - San Diego, TIM GERMANN, Los Alamos National Laboratory, MARC MEYERS, Univ of California - San Diego — Strain-rate and microstructure play a significant role in the ultimate mechanical response of materials. Using non-equilibrium molecular dynamics simulations, we characterize the ductile tensile failure of single and nanocrystalline tantalum over multiple orders of magnitude of strain-rate. This comparison is extended to over nine orders of magnitude including experimental results from resent laser shock campaigns. Spall strength primarily follows a power law dependence with strain-rate over this extensive range. In all cases, voids nucleate heterogeneously at pre-existing defects. Predictions based on traditional theory suggest that, as strain-rate increases, tensile strength should increase. Alternatively, as grain size decreases, tensile strength may decrease due to an increased propensity to fail at a growing volume fraction of grain boundaries. Strain-rate and grain size dictate void nucleation sites by changing the type and density of available defects: vacancies, dislocations, twins, and grain boundaries.

Eric Hahn
Univ of California - San Diego

Date submitted: 24 Nov 2015 Electronic form version 1.4