Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Effects of grain size and boundary structure on the dynamic tensile response of copper JUAN ESCOBEDO, DARCIE DENNIS-KOLLER, ELLEN CERRETA, BRIAN PATTERSON, CURT BRONKHORST, Los Alamos National Laboratory — Plate impact experiments were conducted to examine the influence of defect density, i.e. grain boundary distribution, on the dynamic tensile response of Cu. Grain boundary distribution and grain size was altered through heat treatment. The peak compressive stress was maintained at ∼1.5 GPa for all experiments, low enough to cause an early stage of incipient spall damage that can be correlated to the surrounding. The post-impact metallographic analyses showed that for the materials with grain sizes larger than 30 μm the void volume fraction and the average void size increased with increasing grain size. In the 30 and 200 μm samples, void growth and coalescence was observed to dominate the damage behavior, whereas in 60 and 100 μm sized grains samples, most of the damage was restricted to individual, isolated voids. Electron backscatter diffraction (EBSD) observations showed that voids preferentially nucleate and grow at grain boundaries with high angle misorientation. However, special boundaries corresponding to Σl (low angle, $<5°$) and $\Sigma 3$ ($\sim 60°$ <111> misorientation) type were more resistant to void formation. Finally, micro x-ray tomography results showed 3D views of the damage fields consistent with the 2D surface observations. An overall agreement was found among all the measurements. Work supported by LDRD-DR 20100026.

Juan Escobedo
Los Alamos National Laboratory

Date submitted: 15 Feb 2011 Electronic form version 1.4