Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Microstructural evolution in void coalescence induced by plate-impact loading in ultrapure aluminum DUAN FAN, CHAO LUO, MEI-LAN QI, Institute of High Temperature and High Pressure Physics, Wuhan University of Technology, Wuhan, 43007, XIAO-LIANG DENG, HONG-LIANG HE, WEN-JUN ZHU, FU-QIAN JING, Laboratory for Shock Wave and Detonation Physics Research, Institute of Fluid Physics, CAEP, Mianyang, 621900 — Under dynamic tensile loading, Spallation damage results from the nucleation, growth and coalescence of voids in a ductile metal. Microvoid nucleation is the major damage process of damage evolution. The microstructures of microvoid, which result from dynamic tensile loading in high pure aluminum 99.999%, were characterized by a transmission electron microscope (TEM) and a high-resolution TEM. It was found that there may be a new nucleation mechanism of damage evolution in a ductile metal, which might be called melt nucleation. During shock compression, shock energy gives rise to local melting in high pure aluminum, and then a new free surface is generated under the tensile stress in the melting areas. Nanocrystalline amorphous metal is produced by rapid quenching a molten aluminum. In our experimental observations, the grain size of Nanocrystalline amorphous aluminum is 5-20 nm. This will increase understanding of the physical processes of dynamic tensile fracture of materials under high strain rate deformation.

Duan Fan
Institute of High Temperature and High Pressure Physics,
Wuhan University of Technology, Wuhan, 43007

Date submitted: 17 Feb 2011 Electronic form version 1.4