Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Real-time Studies of Shocked Polycrystalline Materials with Single-Pulse X-ray Diffraction DANE MORGAN, National Security Technologies, LLC — Recent advances in pulsed x-ray diffraction (XRD) diagnostic techniques have enabled real-time XRD studies of atomic-scale mechanisms within shocked polycrystalline materials. The direct correlation between solid-state structures and their associated XRD patterns enables direct observation of a material's bulk properties, including phase, grain-size distribution, texture, and micro-strain, during the very short time interval of shock-induced pressure loading. For shock-compressed polycrystalline solids, real time single-pulse XRD probes a macroscopic sample volume, and the measured diffraction pattern is the sum of the responses from the microscopic coherently diffracting domains. These experiments have utilized a Marx-generated, cable-coupled, needle-and-washer diode that emits a 40 ns pulse of line-and-bremsstahlung x-rays. The x-rays are collimated by a circular pinhole, and detected by an image plate or CCD camera coupled to a phosphor. The line emission is selectable to either 0.71 A or 0.56 A, and the hard bremsstahlung direct beam provides a zero-order reference mark in the image. Results from studies of shock-loaded materials including aluminum, tin, and zirconium are shown. Planned experiments and future diagnostic development are discussed.

Dane Morgan
National Security Technologies, LLC

Date submitted: 22 Feb 2011 Electronic form version 1.4