Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

Shock Consolidation of Nanocrystalline Aluminum Powders for Bulk Component Formation DAVID A. FREDENBURG, Georgia Institute of Technology, TRACY VOGLER, Sandia National Labs, CHRISTOPHER SALDANA, Purdue University, NARESH THADHANI, Georgia Institute of Technology — Shock compression is used to consolidate micron-size nanocrystalline metal particles formed from Al-6061 T6 stock through frequency modulated severe plastic deformation (SPD) machining methods. Compaction characteristics are developed in the quasi-static and dynamic regime. Shock recovery experiments are performed to determine the degree of densification, and the microstructure and mechanical properties of compacts following shock compression. At lower impact velocities compacts show slight increase in crystallite size and reduction in residual strain for bulk compacts reaching 85-92% theoretical density, with microstructures revealing a lack of mechanical bonding between neighboring particles. At higher impact velocity of 650 m/s compacts reach 95-96% theoretical density. Mesoscale simulations using real microstructures obtained from powder compacts are performed to examine the shock propagation characteristics through the simulated compacts and determine the effect of particle morphology on compaction characteristics. Simulations will also aid in design of the compaction experiments to ensure fabrication of bulk compacts with retention of nanocrystalline grain structure.

David A. Fredenburg
Georgia Institute of Technology

Date submitted: 19 Feb 2007 Electronic form version 1.4