Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

Hugoniot and velocity history data using heterodyne techniques
P. ASOKA-KUMAR, R. CHAU, N.C. HOLMES, W.P. AMBROSE, K. KRAUTER, O.T. STRAND, J. NGUYEN, M. KUMAR, J. STOLKEN, LLNL — Heterodyne interferometry using Doppler-shifted coherent laser light offers a novel way to access the instantaneous velocity of a moving surface. Light scattered from a moving surface is shifted in frequency and when allowed to superpose with the original light will result in intensity modulation at the beat frequency of the two light fields. Such a system is capable of recording shock arrival time and particle velocities in a gas gun experiment. We describe a 13-channel heterodyne interferometry system that measures shock arrival times in materials to a wide range of pressure values. The response time for shock arrival detection is similar to or better than the conventional pin recording system. EOS measurements from single crystal copper show no orientation dependence in the pressure range of 9-45 GPa. The U_s-U_p relationship for all crystal orientations is consistent with previously reported data on polycrystalline copper. We compare velocity history data derived using several software analysis tools, short-time Fourier transform, Gabor transform, Wigner-Ville transform, and wavelet transform.

The work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7450-ENG-48.

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Date submitted: 28 Feb 2007 Electronic form version 1.4