Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

An x-ray probe of nickel nanoparticles generated by laser ablation[1] C.S. LEHMANN, G. DOUMY, S.H. SOUTHWORTH, A.M. MARCH, A.D. DICHIARA, Y. GAO, E.P. KANTER, B. KRÄSSIG, D. MOONSHIRAM, L. YOUNG, K.W. CHAPMAN, P.J. CHUPAS, Argonne National Laboratory — A plume of nickel atoms and nanoparticles can be generated by an intense laser pulse hitting a solid nickel surface. We set up a Ni ablation source in a vacuum chamber on an x-ray beamline at the Advanced Photon Source and used x-ray absorption, x-ray emission, and ion spectroscopies to probe the ablation plume at x-ray energies above the Ni K-edge at 8.33 keV. The laser and x-ray pulses were overlapped in time and space with variable delay to measure the time evolution of the ablation plume. Measurements of the charge states produced by x-ray absorption were not possible due to the intense prompt ions ejected in the ablation process. However, Ni $K\alpha$ x-ray emission was measured as functions of laser fluence and pump-probe delay. The fluorescence yield was also used to record the near-edge x-ray absorption spectrum of the nanoparticles in the plume. The nanoparticles were collected and their diameters were determined to be ∼9 nm from x-ray scattering pair-distribution-function measurements. The experiments demonstrate the use of x-ray techniques to characterize laser ablation processes.

[1]Work supported by the Chemical Sciences, Geosciences, and Biosciences Division, Office of Basic Energy Sciences, Office of Science, US Dept of Energy, Contract DE-AC02-06CH11357.

Stephen Southworth
Argonne National Laboratory

Date submitted: 31 Jan 2014 Electronic form version 1.4