Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Molecular dynamics simulation of ablation and spallation in nickel films irradiated by ultra-short laser pulses BRIAN DEMASKE, VASILY ZHAKHOVSKY, University of South Florida, NAIL INOGAMOV, Landau Institute for Theoretical Physics, CARTER WHITE, Naval Research Laboratory, IVAN OLEYNIK, University of South Florida — Ablation and spallation of micron-sized Ni films irradiated by ultra-short laser pulses were investigated via large-scale molecular dynamics simulations. The interatomic interactions are described by a new embedded atom method potential that was specifically developed to accurately simulate response of Ni to strong compression and tensile waves as well as to high temperatures. It was shown that ablation results from cavitation within strongly stretched molten layer beneath the surface of the Ni film. Owing to a superposition of tensile waves, ablation threshold fluence is an increasing function of film thickness, which asymptotically approaches the experimental value for micron-sized films. Processes of wave-breaking and formation of ultra-short shock waves were also investigated in detail. Fluence threshold for onset of spallation at the rear of the film and spall strength of solid Ni subjected to ultrahigh strain rates were predicted.

Brian Demaske
University of South Florida

Date submitted: 19 Nov 2010 Electronic form version 1.4