Abstract Submitted
for the SHOCK15 Meeting of
The American Physical Society

The behavior of iron under ultrafast shock loading driven by a femtosecond laser SERGEY ASHITKOV, Joint Institute for High Temperatures, RAS, Russia, VASILY ZHAKHOVSKY, All-Russia Research Institute of Automatics, PAVEL KOMAROV, Joint Institute for High Temperatures, RAS, Russia, NAIL INOGAMOV, Landau Institute for Theoretical Physics, RAS, Russia, MIKHAIL AGRANAT, GENNADY KANEL, Joint Institute for High Temperatures, RAS, Russia — The results of experimental and theoretical investigations of shock-wave propagation in bcc iron under ultra-short loads driven by femtosecond laser pulses are presented. Chirped pulse interferometry was used for continuous diagnostics of movement in a picosecond range of the rear-side surface of thin iron films. The evolution of ultra-short elastic-plastic shock waves in samples with different thicknesses and purity has been studied. The obtained HEL and spall strength are close to ultimate values of shear and tensile stresses. Response of single-crystal iron to ultra-short shock loading/unloading was also explored in micron-sized films by molecular dynamics simulations. The experimental and simulation results on shock-induced elastic-plastic transformation and phase transition from bcc to hcp iron in a picosecond range of loading are discussed.

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Date submitted: 29 Jan 2015 Electronic form version 1.4