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Two-temperature hydrodynamics of laser-generated ultrashort shock waves in elasto-plastic solids DENIS ILNITSKY, All-Russia Research Institute of Automatics, VIKTOR KHOKHLOV, NAIL INOGAMOV, YURII PETROV, Landau Institute for Theoretical Physics of RAS, VASILY ZHAKHOVSKY, University of South Florida, KIRILL MIGDAL, All-Russia Research Institute of Automatics, SERGEY ANISIMOV, Landau Institute for Theoretical Physics of RAS — Femtosecond laser is a unique tool for generation of ultrashort shock waves producing very high deformation rates in target materials. It was recently found in experiment [1] and molecular dynamics (MD) simulation [2] that in splitting two-wave regime the elastic precursor can have longitudinal stress nearly 30 times as large as the conventional Hugoniot elastic limit. To study different regimes of shock-wave propagation including generation, interaction, and attenuation of leading super-elastic shock and following plastic wave, we developed an elasto-plastic model of solid combined with its EoS. Response of the model to ultrafast deposition of laser energy was simulated using our two-temperature hydrodynamics (2T-HD) code, which takes into account nonequilibrium of electron and ion subsystems and significant electron pressure at early stage of evolution. Results of 2T-HD simulation of plastic and super-elastic shock-wave propagation in Al and Ni at later stage are in good agreement with corresponding MD simulations. Simulation results are discussed and compared with recent experimental observations of high-speed super-elastic shock waves.

[1] S. I. Ashitkov, M. B. Agranat, G. I. Kanel', et al, JETP Letters, **92**, 516 (2010)
[2] V. V. Zhakhovskii and N. A. Inogamov, JETP Letters, **92**, 521 (2010)

Vasily Zhakhovsky
University of South Florida

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