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**MD simulations of laser-induced ultrashort shock waves in nickel**

IVAN OLEYNIK, BRIAN DEMASKE, VASILY ZHAKHOVSKY, University of South Florida, NAIL INOGAMOV, Landau Institute for Theoretical Physics, CARTER WHITE, Naval Research Laboratory — The dynamics of ultrashort shock waves induced by femtosecond laser pulses were explored in micron-sized nickel films by molecular dynamics simulations. Ultrafast laser heating causes stress-confinement, which is characterized by formation of a strongly pressurized 100-nm-thick zone just below the surface of the film. For low intensity laser pulses, only a single elastic shock wave was formed despite pressures several times greater than the experimental Hugoniot elastic limit. Since the material remains uniaxially compressed for less than 50 ps, comparatively slow processes of dislocation formation are not activated by the elastic shock wave. For high intensity laser pulses, the process of double wave breaking was observed with formation of a leading elastic shock preceding that of the plastic shock wave. Presence of a trailing rarefaction wave acts to attenuate the plastic shock until it disappears completely. The mechanisms of plastic deformation in the plastic front will be discussed. Agreement between the experimental and simulated plastic branch of the Hugoniot was facilitated by a new EAM potential designed to simulate nickel in a wide range of pressures.

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