Interaction of femtosecond laser radiation with gold foil: molecular dynamics simulation

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We study the melting of a thin (35 nm) golden foil irradiated by ultrashort laser pulses (duration 130 fs). Calculations were done within classical molecular dynamics with a highly-optimized EAM potential by Sheng et al (Phys. Rev. B 83, 134118, 2011). Laser pulse (LP) absorption by electrons and energy transfer from electrons to the crystal lattice were described with a two-temperature model. Absorbed energies from 0.18 to ∼2 MJ/kg were studied. The calculated time of complete foil melting as a function of absorbed LP energy is compared with experimental data. Also compared with experiment is the temporal evolution of the diffraction peak (220) after target irradiation. Calculations were done for a number of the currently available dependencies of the gold electron-phonon coupling factor on electron temperature. The accuracy of these dependencies is discussed.