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Melting Kinetic Effects in Metals Caused by a Femtosecond Laser Pulse POLINA KRASNOVA, DMITRY MINAKOV, MIKHAIL POVARNITSYN, PAVEL LEVASHOV, KONSTANTIN KHISHCHENKO, JIHT RAS — Melting of metals induced by a femtosecond laser pulse represents a non-equilibrium process. At the initial stage of melting and medium evolution the temperature of electrons is significantly higher than that of the ions one. This difference may lead to the increasing of the crystal melting temperature, and also to more complex relations between the temperature of electrons and ions and the transport coefficients (permittivity, thermal conductivity, electron-ion exchange). We have investigated the influence of these effects on the temperature of electrons and ions of an aluminum target using the two-temperature model. A simple kinetic model based on the evaluation of the overheated crystal lifetime was used. We estimated the increasing of the melting temperature by means of quasi-harmonic model and Lindemann criterion, and the equation of state for electrons and spinodal parameters of the crystals by means of numerical modeling using DFT and quantum molecular dynamics. The equation of state for ions is semiempirical. We provided the analysis of kinetic effects of melting of an aluminum target induced by a femtosecond laser pulse for variety of intensities.

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