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Modeling of early-stage plasma during femtosecond laser ablation of metals ZHAOYANG CHEN, SAMUEL MAO, UC Berkeley — We developed a model of early-stage plasma induced by intense femtosecond laser ablation of metals in an ambient gas. We consider a 100 fs FWHM, 800 nm wavelength laser pulse irradiating a copper target in 1 atm nitrogen environment. Electron and lattice temperature of laser-irradiated target were calculated based on a two-temperature model, with surface electron emission due to thermionic and photoelectric effects utilized as the boundary condition for plasma initiation. Plasma development was calculated based on conservation laws for electrons, ions, as well as atoms from ambient gas. Inverse Bremsstrahlung laser absorption by electrons and electron impact ionization were found to be responsible for plasma development, and the simulation results yielded the laser intensity threshold for femtosecond laser-induced plasma formation.

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