Investigation of target heating by high-intensity laser pulse irradiation with x-ray spectroscopy

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Experiments to determine the degree of aluminum target heating from multicharged ions spectra were carried out on the picosecond laser facility at intensities of 10^{17}-10^{19} W/cm^2.
A Johann-type spectrograph with KAP crystal was used to measure the characteristic spectrum of aluminum plasmas.
Aluminum ions inner shell transitions were observed upon irradiation of foils with a thickness of 1 to 400 microns. A decrease in the radiation yield of H- and He-like ions from 400 microns foils was found.
Hydrodynamic calculations were performed for targets irradiated with 10^{17}-10^{18} W/cm^2 laser intensity. In the calculations, the relative populations of all ionic states in plasma corresponds to the actual radiation density. The homogeneous line broadening is also taken into account. Reasonable agreement of the calculated and experimental spectra was obtained.
The obtained dependence of the characteristic radiation yield of multicharged ions on the intensity of laser radiation shows the presence of electron refluxing in the targets. Inclusion of this effect into hydrodynamic model may further improve the agreement with the experimental results.