BREMSSTRAHLUNG AND K_AX-RAYS DIAGNOSTICS OF THE HOT ELECTRON ENERGY DISTRIBUTION

O.F. Kostenko[1], N.E. Andreev[1], O.N. Rosmej[2]

[1]*Joint Institute for High Temperatures RAS, Moscow, Russia,e-mail: olegkost@ihed.ras.ru*

[2]*GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany*

We have analyzed results of measurements of bremsstrahlung and K_α x-rays emission from silver targets irradiated by subpicosecond s-polarized laser pulses with intensity about 2×10^{19} W/cm^2. Modelling of measurements of bremsstrahlung x-rays from a bulk silver target obtained by the knife and the radiation attenuation methods revealed a two-temperature hot electron distribution. The temperature of the colder component (T_1 = 140 keV) was defined by fitting of the experimental and modelling data at the fixed temperature of the hotter component, determined according to the Wilks' scaling [1] (T_2 = 1.66 MeV). Obtained temperatures correspond to the results of 2D PIC simulation of hot electron generation in cone-guided approach to fast ignition [2]. It is shown that approximately 90% of the laser energy transmitted to hot electrons is contained in the colder component. Presence of such component in the hot electron spectrum is important, in particular, for effective transfer of laser energy into the core of the inertial fusion target at laser intensities of 10^{19}– 10^{21} W/cm^2 [2].

Modelling of the K_α x-rays yield from the bulk target and a silver foil of 10-µm thickness, deposited onto aluminum or plexiglass substrates, showed that the conversion efficiency of laser energy into the energy of hot electrons with two-temperature distribution is less than 2%.

A possibility to analyze parameters of the hotter electron component taking into account errors of the measurements is under discussion. It is noted that assumption about one-temperature parametrization of the hot electron energy distribution with the slope temperature described by the Wilks' scaling [3,4]strongly over estimates conversion efficiency of laser energy into the energy of the hotter electron component.

Theoretical part of the work was supported by the grant No. 14-50-00124 of the Russian Science Foundation.

References

[1] Wilks S.C.,Kruer W.L.,Tabak M., Langdon A.B.Phys. Rev. Lett.1992. V. 69. P. 1383.

[2] Chrisman B., Sentoku Y., Kemp A.J. Phys. Plasmas. 2008. V. 15. P. 056309.

[3] Myatt J., Theobald W., Delettrez J. A., Stoeckl C., Storm M., Sangster T. C., Maximov A. V., Short R. W. Phys. Plasmas. 2007. V. 14. P. 056301.

[4] Kostenko O.F., Andreev N.E., Rosmej O.N., Schönlein A. J. Phys.: Conf. Ser. 2016. V. 774. P. 012112.