Modeling of generation of K_α x-ray radiation under vacuum heating of electrons

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A model is developed for the generation of hot electrons near the surfaces of ionized cylinders by a laser field of nonrelativistic intensity, which allows one to go beyond the electrostatic approximation and takes into account the absorption of the laser field energy by the generated electrons. A model of characteristic x-ray generation in a copper substrate, when the cylinders are located on the substrate obliquely and parallel to each other, and the laser field propagates perpendicularly to the substrate, is also considered [1]. It is revealed that the K_α radiation yield depends rather strongly on the angle of inclination of the cylinders. The optimal parameters, the cylinder radius multiplied by the laser wavenumber, the angle of inclination of the cylinders, and direction of the linearly polarized laser electric field, are determined at the normalized laser field amplitude $a_\mathrm{L} = 0.2$. With these parameters, the yield of K_α radiation from a copper substrate covered with cylinders is 2.7 times higher than the maximum yield of K_α radiation from the substrate covered with ionized clusters under the same irradiation conditions and 4 times higher than the maximum yield of K_α radiation from a flat copper target irradiated by a p-polarized laser field of the same amplitude. An increase in the yield of K_α radiation from the substrate covered with nanocylinders as compared to the yield of K_α radiation from the substrate covered with ionized clusters is due to an increase in the number of accelerated electrons.

[1] Kostenko O F 2021 *Physics of Plasmas* **28** 103104