STUDY OF VUV RADIATION of HYBRID AND STANDARD X-PINCHES ON THE KING DISCHARGE facility

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The X pinches are well-known sources of hard (< 10 Å), soft (10–100 Å) X ray radiation and VUV-radiation (> 100 Å) [1, 2]. There are two types of X pinches, the standard type formed at the intersection of two or more wires, and the so-called hybrid type, in which the discharge is formed from a short wire stretched between two massive conical electrodes. In this case, both standard and hybrid X pinches can be used for point projection radiography and for the study of the radiation properties of high-temperature dense plasma. Earlier in LPI of RAS the group of authors have been conducted a series of measurements on the BIN facility for the study of VUV radiation of hybrid X pinches [3], which showed a high output of radiation in this range. This gives the opportunity to count on the use of X pinches as a source in new applications such as absorption VUV spectrometry and, using line plasma radiation, in scattering experiments. At the same time, arose the question of the comparative efficiency of the radiative capabilities of the standard and hybrid X pinches in the VUV spectrum range.

To resolve this issue and continue to study the radiation of a hybrid X pinches in the present work we report a detailed study of radiation in the wavelength range 10–400 Å both hybrid and standard X pinches on the pulse electric-discharge facility KING (current 190–200 kA, rise time of the current 190–200 ns), which is more compact and has a different orientation of the pinch than BIN facility. As the loads for hybrid X pinch the wires from Al, Ag, Cu and Ti were used, and for standard X-pinch – wires from Al and Ti with diameters of 25 microns. The time-integrated study of the VUV radiation from the standard X pinch, performed using pinhole cameras with an aperture of 300 µm, showed the presence of intense VUV radiation from an area smaller than 1 mm around the point of intersection of the wires, while in the hybrid X pinch the one or more hot points randomly distributed along the length of the wire is occurred. The emission spectra of the discharge plasma in the VUV range with spatial resolution were obtained using a spectrograph based on a transmission diffraction grating [4] with recording on the imaging plate Fuji TR without protective coating. Their analysis and processing made it possible to determine the spectral regions with the highest radiation intensity for various load materials and to compare the spectral output of radiation for hybrid and standard X pinches. At the same time, the signals from the PCD detector allowed to carry out a comparative assessment of the total output of radiation from such X pinches in the range of 10 eV – 4 keV.

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References

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