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SHIELDING OF A TUNGSTEN TARGET FROM IMPACT OF A POWERFUL HYDROGEN PLASMA FLOW BY MEANS OF A NEON GAS SCREEN *)

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Material protection from the impact of powerful plasma flows is of undeniable interest for addressing a broad range of fundamental and applied problems. For example, experimental data obtained can be relevant to the development of the ITER dissipative divertor concept, within which it is assumed that the energy entering the divertor region from the plasma column will dissipate in the form of radiation from injected impurities such as nitrogen or neon [1]. It is necessary to experimentally determine the effectiveness of gas shielding and obtain comparative data on which of the impurities is more preferable [2]. The paper presents the results of a study of the influence of a neon gas screen on the shielding of a tungsten target when exposed to a powerful flow of hydrogen plasma, as well as a comparison of the effectiveness of nitrogen [3] and neon gas shielding.

The plasma flow with a velocity of $(4 \div 6) \times 10^7$ cm · s^{-1} and an energy content of about 50 kJ was created by a pulsed electrodynamic accelerator MK-200 (SRC RF TRINITI). Hydrogen was used as a plasma-forming gas. The plasma stream was transported in a longitudinal magnetic field with an induction of $1 \div 2$ T. A supersonic neon gas jet was directed along the surface of the tungsten target by a flat Laval nozzle [3]. The maximum density in the gas screen reached 10^{17} cm^{-3} with a thickness of ≈ 5 cm and a width of ≈ 15 cm. A tungsten target measuring 120 mm × 140 mm and 8 mm thick was located at a distance of 20/40 mm from the central plane of the gas screen, depending on the experimental conditions.

For the registration of the spatial distribution of soft X-ray radiation from the plasma formed during the interaction of the hydrogen plasma flow with the tungsten target and the gas curtain, a multi-frame X-ray camera (MCP camera) was used. To register the spectra of plasma radiation in the wavelength range of $1 \div 70$ nm with spatial-temporal resolution, a transmission grating spectrometer was used. A multi-channel thermocouple calorimeter was used to measure the absorbed energy by the target and analyze its distribution over the target surface. The absolute radiation power of the target plasma was measured by photodiodes. An infrared pyrometer was used to determine the temperature dynamics on the target surface.

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