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STUDY OF SPECTRAL TRANSMISSION OF NICKEL PLASMA CREATED BY RADIATION ABLATION OF FINE FOILS UNDER THE ACTION OF A Z-PINCH X-RAY RADIATION PULSE *)

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The two main tools for irradiating targets with intense X-ray fluxes, which heat materials in bulk to significant temperatures to measure their opacity, are high-power lasers and Z-pinches [1, 2]. Current implosion in generators of ultrahigh electric power makes it possible to obtain high-temperature dense Z-pinch plasma, which is a source of powerful thermal radiation and is widely used in experiments on high energy density physics [3]. These experiments require the creation of macroscopic quantities of matter that is uniformly heated to extreme conditions. At the Angara-5-1 pulse power facility, an X-ray flux with energy of up to 150 kJ allows this to be achieved. A series of works was carried out to study the spectral transmission of plasma of various substances in the range of extreme vacuum ultraviolet (EUV). In carrying out these works, an original scheme was developed for simultaneous irradiation of two samples of a thin target from the substance under study with a high-power flux of Z-pinch X-ray photons, which provides a uniform spatial distribution of the irradiation energy density on the target up to 10 kJ/cm^2. Simultaneously, images of the X-ray emission spectrum of the tungsten Z-pinch, the spectrum of the radiation transmitted through the target plasma, and the self-emission of the target plasma in the frame mode with a frame exposure time of 1.5 ns were obtained simultaneously in one shot of the facility on one spectrograph. The developed scheme makes it possible to obtain experimental data on the plasma velocity on the irradiated and rear sides of the target, which reached 100 km/s. Targets made of thin Al foils and Ni, Sn, In, Au, and Bi layers on a Mylar film were studied [4–8]. An irradiation-induced multiple increases in the target transmission in the EUV range compared to the target transmission in the solid state was observed. Using the two-dimensional radiative gas-dynamical code RALEF-2D, numerical modeling of target heating and expansion was performed; data were obtained on the spectral transmission of the target plasma and on the spectrum of its own radiation. A comparison of the performed calculations with experiments was carried out.

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