time dependence of the spectral transmission of plasma created by radiation ablation of thin indium foils irradiated by X-ray emission pulse of Z-pinch

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The transmission of the plasma obtained by irradiating a thin In film with a powerful X-ray radiation (SXR) generated by a tungsten Z-pinch on the Angara 5-1 facility was measured [1]. The original target irradiation scheme provided the spatial distribution of the irradiation energy close to one-dimensional with an accuracy of no worse than 10% with a power flux density of up to 0.5 TW/cm2 on both the front and back sides of the target. Images of the Z-pinch X-ray emission spectrum and the plasma transmission spectrum were obtained using a grazing incidence spectrograph simultaneously in frame mode, with a 1 ns frame exposure time. This made it possible to determine the instantaneous transmission coefficient of irradiated mylar (0.5 μm) targets with an *In* metallization layer (0.11 μm). Its amplitude and spectral dependence differs significantly from the transmission of a “cold”, non-irradiated foil, and changes dramatically during an SXR pulse. An increase in the transmission of X-rays by the plasma at λ ≥ 50–70 Å induced by the irradiation of a powerful Z-pinch is observed. After the peak of the SXR pulse (t ≥ 10 ns), intense own emission of the plasma created by radiated ablation of the target material is recorded. During this time, the own emission of this plasma exceeds the emission of the Z-pinch. Comparison of radiation registered at this time behind targets with and without a metallization layer makes it possible to determine emission bands of indium plasma, which according to calculations correspond to transitions in indium ions from In V to In XIII, and a series of emission lines of carbon and oxygen ions from C III, O III to C IV, O VI in the wavelength range greater than 120 Å. Simulation of heating and expansion of a combined indium-mylar target irradiated with powerful Z-pinch radiation was performed using the two-dimensional radiative gas-dynamic code RALEF2D [2]. The instantaneous transmission values obtained in the experiments, their change with time, the irradiation-induced increase in the transmission of X-rays by the plasma were confirmed in these calculations. Based on their comparison, data were obtained to verify the used simulation codes of energy transfer in a heated substance.

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