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RESULTS OF OVERMASS Z-PINCH IMPLOSION IN EXPERIMENT WITH MAGNETO-CUMULATIVE GENERATOR

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This paper demonstrates experimentally recorded peculiarities of a dynamical Z-pinch powered with the current from a magneto-cumulative generator. The overmass load represents a cylindrical multiwire array consisted of 680 tungsten wires of diameter $d=11\text{ }\mu\text{m}$ and length $l=1.5\text{ cm}$ (total mass $M=4.14\text{ mg}$). The wires were evenly located on a cylindrical surface of the radius $R=3\text{ cm}$. Maximum amplitude of a current passed through the load was $I\approx 4.3\text{ MA}$ (current rise time $\tau\approx 0.9\text{ }\mu\text{s}$ on a level of $0.1\cdots 0.9$). That was significantly lower than the current of $\sim 14\text{ MA}$ that was used in optimal implosion regime of arrays with such initial mass and radius. In spite of significantly underpowering of the load, in the experiment we recorded soft x-ray radiation (SXR) pulse that have characteristic full width at a half maximum of $\sim 10\text{ ns}$ and energy of several hundreds of kilojoules.

Two-dimensional magneto-hydrodynamic (MHD) code FLUX-rz (developed in RFNC-VNIIEF) was used for numerical simulation and analysis of the obtained results. The calculation-physical model includes the radiation transfer in a multi-group diffuse approximation [1]. The process of a substance ablation from the array wires under the influence of the conducting current is described in the model of prolonged plasma formation [2].

Performed simulation allowed to find a number of peculiarities of the overmass load implosion and reproduce the main SXR pulses parameters (implosion time, full width at a half maximum, irradiated energy) that were recorded with scintillation detectors, and derive the plasma temperature of the pinch.

References

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- [2]. B.G. Repin, A.P. Orlov // Int. Conf. XII Khariton's Topical Sci. Readings, Dig. Tech. Papers, Sarov, Russia, 2010, pp. 526–531.

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