NuMERICAL SIMULATION OF EXPIREMENT WITH multiwire array implosion IN overmass LOAD regime

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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 overmassed load represents a cylindrical multiwire array consisted of 680 tungsten wires of diameter *d*=11 µm and length *l*=1.5 cm (total mass *Mtotal*=4.14 mg). The wires were evenly located on a cylindrical surface of the radius *R*=3 cm. Maximum amplitude of a current passed through the load was *I*max≈4.3 MA (current rise time τ ≈0.9 µs on a level of 0.1…0.9). That was significantly lower than the current of ~14 MA that was used in usual 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 half maximum of ~10 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 passing current is described in the model of prolonged plasma formation [2].

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

References

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