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FEATURES OF X-PINCHES OPERATION ON SMALL-SIZED CONDENSER INSTALLATIONS *)

Shelkovenko T.A., Tilikin I.N., Mingaleev A.R., Romanova V.M., Pikuz S.A.

P.N. Lebedev Physical Institute of Russian Academy of Sciences, offis@lebedev.ru

X-pinches of various configurations have proven to be the best point sources of MRI for projection radiography over the years. Projection radiography is a very useful tool for the study of exploding objects such as: X-pinches, wires, liners, foils, that is, where contact between the radiation source and the object is impossible [1]. In the last decade, small-sized high-current pulse generators for working with X-pinches and other loads have been more or less successfully created and tested in different countries. In order for the generator to be used to power X-pinches, it must provide a current derivative value above 1 kA/ns per load and a current of at least 50 kA [1, 2]. In such conditions, the formation of bright and hot spots in X-pinches is possible [2]. The KING generator at our disposal (200 kA, 200 ns, 45 kV) is an assembly of four fast capacitors combined with gas arresters and boundary parameters for powering X-pinches [3]. To reduce the total inductance of the discharge circuit, the reverse current line of the generator was made in the form of a solid cup with small holes for diagnostic access and radiation output. For some experiments, in particular for studies of the generation of UV radiation during the explosion of thin foils, such a design turned out to be extremely inconvenient: the installation of foils was difficult, and the field of view was limited. Therefore, the solid current line was replaced by separate rod current lines, which significantly facilitated access to the diode in which the load was installed, and allowed changing the cathode-anode gap within wide limits. This change led to an increase in inductance and, accordingly, to an increase in the front duration from 200 ns to 230-260 ns and a decrease in the current derivative. Under new conditions, experiments were carried out with both standard 4-wire and hybrid X-pinches (90 shots) with Al, Cu and Mo wires, in which it was shown not a deterioration, but an improvement in the operation of X-pinches and the nature of radiation sources was analyzed. The results obtained indicate that in most experiments on condenser installations, it is a bright point that is formed and its parameters in most cases are quite sufficient to obtain high-quality images by projection radiography. At the same time, the rate of current rise in the range of 0.6 – 0.9 kA/ns is satisfactory for practical applications. To obtain extreme radiation source parameters, the use of generators with generating lines and current rise rates greater than 1 kA/ns is more preferable. In these experiments, a hotspot with dimensions less than 3 microns was formed only in every eighth X-pinch, and one or two bright dots in 80% of X-pinches.

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