MODERNIZATION OF THE ARC-DISCHARGE PLASMA GENERATOR FOR HIGH-POWER ATOMIC INJECTORS OF THE SECOND DURATION RANGE [[1]](#footnote-1)\*)

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Arc-discharge plasma generators with a cold cathode have found wide application as plasma sources for diagnostic and heating atomic injectors. The great advantage of such plasma generators is the simplicity and cheapness of the power supply system; in addition, such plasma generators provide the lowest content of molecular ions in the extracted beam and have high gas efficiency.

The disadvantage of such plasma generators is the significant erosion of the cathode and near-cathode structural elements, which limits the service life and leads to the need for periodic cleaning and replacement of elements, which is especially inconvenient for atomic injection systems with parallel operation of many injectors.

For diagnostic injectors with a beam current of few amperes, the plasma generators with a cold cathode have been created with a pulse duration of several seconds and a resource of ~ 1 year [1, 2]. However, for high-power heating injectors, where a beam current of tens and hundreds of amperes is required, and their duration is limited to the order of hundreds of ms [3, 4].

This paper describes the testing of several design modifications of the arc generators in order to increase the pulse duration. In case of the technological applications, the thermal loads on the cathode elements of the generator can be reduced due to an increased flow of working gas carrying away the heat. Since this is usually unacceptable in fusion applications, emphasis was placed on the use of insulators and electrodes of increased heat resistance and thermal conductivity. To prevent metallization of the insulator surfaces due to sputtering of the cathode material, insulators of various shapes were tested, the geometry of the floating near-cathode electrode, which prevents metal deposition, and the configuration of interelectrode gaps with arc-extinguishing properties were tested.

The basic design of the plasma generator for a powerful injector with extracted current in 150 A ions [3, 4] had a service life of ~2 years of active experiments with a pulse duration of 30 ms and a discharge current of ~ 600A. The total injected current of the neutral beam system of the C-2W installation was about 1 kA at a power of up to 20 MW [3]. The modernization of plasma generators and the resource tests carried out allow us to count on operation with an order of magnitude longer pulse duration - from 300 ms to 1 s with an acceptable reduction in resource up to ~ 1 year of operation.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Mu/ru/BJ-Deichuli.docx) [↑](#footnote-ref-1)