INVESTIGATION OF GAS INJECTION SYSTEM IN ELECTRODYNAMIC PLASMA GUN WITH INCREASED POWER MK-200 X8 FOR MODELING TRANSIENT PLASMA PROCESSES IN ITER [[1]](#footnote-1)\*)

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During ITER operation intense plasma and thermal impacts on the armor of divertor and the first wall are proposed. When transient plasma events (ELMs and disruptions) will occur, the intensity of heat flows to the wall will exceed the melting thresholds of tungsten and beryllium significantly thus causing their intensive erosion. To improve the design of the divertor and the first wall armour and to develop methods for their protection from plasma exposure, it is necessary to study the mechanisms of materials erosion under intense plasma flows. The conditions expected during transient plasma events in ITER are most fully reproduced in laboratories with facilities based on plasma guns.

To expand the possibilities of the transient events experimental modeling, further development of plasma gun technology is necessary. Improvements should be aimed at rising energy efficiency, achieving higher power, enhancing lifetime, increasing the efficiency of using plasma-forming gas, reducing the amount of impurities in plasma. Currently, a new generation MK-200 X8 plasma gun is under development in TRINITY Research Center of the Russian Federation (Moscow, Troitsk). A special gas injection system has been developed to inject gas into the gap between electrodes. The gas is injected into the working volume using eight high-speed valves in the direction from the external (anode) to the internal (cathode) electrode. This makes it possible to create a compact gas distribution with an increased density at the cathode. It is expected that such a distribution will allow to stabilize the instability of the plasma due to the unevenness of its acceleration along the cross-section of the gap [1], and also reduce velocity dispersion in plasma stream at the gun outlet.

The purpose of this work is to study the gas injection system of MK–200 X8 plasma gun. For this purpose, gas dynamics calculations were carried out by the control volume method and experimental measurements of the system parameters were performed. Due to the azimuthal symmetry of the system, a geometry segment with a solution angle of 45 degrees was considered in the computational model. The equations of gas dynamics were solved on a movable grid, which made it possible to take into account the movement of the valve.

Pressure sensors were used to measure the characteristics of the new gas injection system. The unevenness of the outlet along the azimuthal coordinate was measured using eight PCB Piezotronics pressure transducers. A diagnostic system based on Keller PAA-8 L piezoresistive transducers has been developed to measure the distribution of gas pressure along the length of the central electrode. Based on the measurement results, it is possible to determine the characteristics of the gas flow: velocity, density, Mach number, and also – to estimate the inhomogeneity of the gas distribution in the gap between electrodes. Comparison of the calculation results with experimental data confirmed the reliability of the numerical model.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/E/ru/IX-Biryulin.docx) [↑](#footnote-ref-1)