Experimental Reasearch of Effect of PARAMATERS OF HELICON PLASMA SOURCE ON ANTENNA-pLASMA COUPLING EFFICIENCY [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.139

Bunin E.A., Kamin D.V., Sukhov A.E., Strizhakov M.G.

NRC "Kurchatov Institute", Moscow, Russia, [Sukhov\_AE@nrcki.ru](mailto:Sukhov_AE@nrcki.ru)

Helicon plasma discharge is a promising source of low-temperature plasma with a high degree of ionization and high density. Such plasma sources have found application in many areas, and in particular as plasma sources for rocket thrusters.

The efficiency of power delivering into plasma is one of the key issues in the operation of a helicon plasma source (HPS) at powers exceeding tens of kilowatts. Antenna-plasma coupling during a helicon discharge depends on such parameters as the configuration of the external magnetic field, the flow rate and pressure of the working mass in the discharge chamber. A number of theoretical works [1, 2] are devoted to these dependences, including analytical and numerical calculations. One way or another, these works are based on the idealization of some parameters. Thus, in the application of powerful plasma sources, experimental studies are required to obtain empirical dependences.

Technically, the efficiency of the antenna-plasma connection determines the resistance introduced by the plasma into the circuit of the antenna-feeder device of the HPS. As a consequence, the power delivering into the plasma, as well as the discharge efficiency, depend on the above parameters.

A series of experiments, the results of which are presented in this paper, were carried out at the PN-3 facility. This stand is a prototype of an electrodeless plasma thruster, in which the HPS is the source of the primary low-temperature plasma.

The paper presents the results of parametric measurements of the impedance of the antenna-plasma load, high-frequency discharge parameters, and plasma parameters.

Based on the obtained empirical dependences, general recommendations are formulated for the design of high-frequency HPS systems in order to optimize the power delivering to the plasma.

References

1. Gospodchikov E. D., Timofeev A. V. Excitation of helicons by current antennas //Plasma Physics Reports. – 2017. – Т. 43. – №. 6. – С. 638-647.
2. [Tian B., Merino M., Ahedo E. Two-dimensional plasma-wave interaction in an helicon plasma thruster with magnetic nozzle //Plasma Sources Science and Technology. – 2018. – Т. 27. – №. 11. – С. 114003.](http://www.fpl.gpi.ru/Zvenigorod/XLV/Zven_XLV.html)

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