HELICON TYPE HF-Plasma SOURCE FOR plasma-material STUDIes: First results [[1]](#footnote-1)\*)

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Low-temperature plasma sources are currently widely used in various fields of science and technology and industry: household usage as light sources; production of microelectronics; plasma processing of materials; scientific research devoted to various aspects of the plasma-material interaction, incl. promising materials for usage in a thermonuclear reactor. Plasma sources are based on various methods of gas ionization: ionization of molecules in a glow-discharge, ionization by electron impact, excitation by high-frequency (HF) and microwave sources, and etc. For applied research in the field of plasma-surface interaction in relation to the problems of thermonuclear installations, the most interesting are high-flux plasma generators that simulate plasma fluxes typical for fusion reactors.

A promising type of compact plasma sources for plasma-material interaction studies are HF plasma sources, in particular, with an inductive discharge of the helicon type [1-2]. The advantage of such plasma sources is the ability to vary the plasma density (and, accordingly, the plasma fluxes) over a wide range, as well as the absence of electrodes eroding during the discharge, which significantly affects the plasma purity. At the same time, installations of this type allow achieving a plasma density of the order of 1017–1019 m-3 and are compact.

This paper presents the results of laboratory experimental setup GPI-2 based on a 13.56 MHz helicon plasma source with a power of 2 kW, designing and creating. The installation is designed to study the interaction of plasma with materials promising for usage in thermonuclear reactors. The paper also considers the prospects for further modernization: an increase in the input RF power and the use of additional magnetic coils (up to 0.3 T) to create magnetic focusing in order to increase the plasma flux density. In the current configuration of the installation, hydrogen isotopes are used as a working gas: protium or deuterium, also with the possibility of adding impurities - helium, neon or argon.

The paper also presents the first experiments results including ion currents depending on the introduced RF power, as well as data obtained using Langmuir probes. Obtained results confirm the possibility of operation of the plasma source in the expected range of ion flux densities 1020–1022 ions/(s·m2).

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References

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