HELICON TYPE HF-Plasma SOURCE FOR plasmsa-material STUDIes [[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 [3].

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 also considers the prospects for further modernization. In particular, the possibility of using several magnetic coils (up to 0.3 T) to create magnetic focusing and plasma density increasing is considered. The working gas is hydrogen isotopes (protium, deuterium) with the possibility of adding helium, neon or argon. The installation is designed to study the interaction of plasma with promising materials for thermonuclear reactors. The technical solutions used in the design will make it possible to obtain the flux density of deuterium ions in the interaction chamber in the range of 1020 - 1022 ions/(s∙m2) (up to 100 A/m2).

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References

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