INSTALLATION FOR STUDYING THE INTERACTION OF PLASMA WITH MATERIALS BASED ON A HELICON-TYPE RF SOURCE: FIRST RESULTS [[1]](#footnote-1)\*)

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One of the priority tasks in the design of fusion reactors (TNR) of the next generations is the study of the interaction of plasma with materials of the first wall. The need for research in this direction is due to the operating conditions of plasma-facing materials (PFM). During the operation of the TNR, the first wall will be exposed to large plasma and neutron fluxes. In this case, one of the components of the fuel mixture is tritium, a radioactive isotope of hydrogen, which can permeate into the PFM and then diffuse through the structural materials of the reactor into the coolant, which in turn imposes serious restrictions in terms of radiation safety. For applied research on the interaction of hydrogen plasma with the surface, the most interesting are high-flux plasma generators that simulate the plasma flows of existing and under construction thermonuclear reactors that meet the following requirements: high plasma density and uniformity, no impurities, and the ability to operate in a stationary mode. Plasma sources based on electrodeless RF generators, in particular, with a helicon-type induction discharge, meet the necessary requirements and have a number of advantages: the ability to vary the plasma density and flux over a wide range, the absence of electrodes eroding during discharge combustion, compactness and the possibility of obtaining plasma density ~ 1017 – 1019 m-3. At the same time, installations of this type are sensitive to external parameters: gas pressure and magnetic field strength [1].

The paper presents the results of experimental series to determine the parameters of the discharge of an experimental helicon plasma source GPI-2 based on an RF generator operating at a frequency of 13.56 MHz and a maximum output power of 2 kW [2]. The facility is designed to study the interaction of hydrogen plasma with advanced TNR materials. As a working gas, a heavy isotope of hydrogen, deuterium, is used, and it is also possible to add impurities - helium or argon. For the experimental stand, plasma probe diagnostics was designed and manufactured, represented by a single and double Langmuir probe, with the help of which the temperature (varies in the range from 3.9 to 5.9 eV, with varying input power from 300 to 2000 W) and concentration (varies in the range from 7 \* 1015 to 1 \* 1017 m-3, with varying input power from 300 to 2000 W) of electrons under various operating modes, as well as the magnitude of the ion current at the installation site of the experimental samples, modernization is considered, with the addition of the possibility of linear movement. The obtained results confirm the possibility of operation of the plasma source in the expected range of ion densities of 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/L/Lt/ru/EW-Stepanov.docx) [↑](#footnote-ref-1)