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INSTALLATION FOR STUDYING THE INTERACTION OF PLASMA WITH MATERIALS BASED ON A HELICON-TYPE RF SOURCE: FIRST RESULTS *)

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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 facing it (PFM). Thus, during operation of the reactor, PFM will interact with large stationary thermal and corpuscular flows, which will lead to surface erosion, dislocation of atoms from crystal lattice sites (DPA), and activation. In addition, processes of uptake with subsequent diffusion into the coolant of the heavy isotope of hydrogen - tritium, will occur, affecting fuel recycling and imposing additional restrictions related to radiation safety, and synergistic effects [1]. Despite the importance of studying the interaction of plasma with PFM, TNR in operation today is not able to provide the necessary parameters of the plasma flow and pulse duration, at the level expected in ITER and DEMO. Therefore, for PFM science research, it is advisable to create high-flux plasma sources. Electrodeless sources based on RF generators, including the helicon type, are sensitive to external parameters, such as gas pressure and magnetic field strength [2], but have a high plasma density and homogeneity, and also have a number of advantages, including: the ability to vary plasma density and flux in a wide range, absence of eroding electrodes and high plasma density $\sim 10^{11} \div 10^{13}$ cm^{-3}.

To conduct research on the interaction of deuterium plasma with promising TNR materials, the National Research Center "Kurchatov Institute" assembled an experimental stand GPI-2, created on the basis of a 2 kW RF generator operating at a frequency of 13.56 MHz [3]. Previously, using probe diagnostic, some plasma parameters were determined, the density ($n_e = 2.5 \cdot 10^9 \div 1 \cdot 10^{11}$ cm^{-3}) and temperature ($T_e = 2.3 \div 7$ eV) of electrons, depending on the amount of input power (W = 300 ÷ 5000 W), deuterium pressure (0.6 ÷ 6 Pa) and magnetic field in the area of the helicon antenna (0 ÷ 90 mT). To date, the first stage of modernization of the experimental stand has been completed, including: installation of an intra-vacuum magnetic field coil (up to 0.4 T) for the possibility of varying the linear profile, optimization of the geometry of the helicon antenna [4], creation of Langmuir probes with the possibility of linear movement, to determine the radial density profile, automation of experimental data collection.

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