

Radio frequency wall conditioning discharges at low magnetic fields in Uragan-2M stellarator

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For removing impurities accumulated at the inner surfaces of fusion devices, the ion cyclotron wall conditioning is used (see, e.g. [1]). It is also possible to use radio-frequency (RF) discharges with frequencies above the ion cyclotron frequency $\omega \gg \omega_{ci}$ to sustain the wall conditioning discharges. This method is routinely used at the Uragan-3M [2] and Uragan-2M stellarators [3]. The main advantages of this method of wall conditioning are: the reliable start-up, the intense particle recycling, good antenna-plasma coupling and a possibility to create low-temperature weakly ionized plasma.

In the present work, an RF wall conditioning scenario with the usage of the two-strap antenna which mimics the W7-X stellarator antenna is studied at a low magnetic field $B_0 \approx 0.01$ T. In the experiments, the frequency of the RF generator was 5 MHz, the input RF power was up to ≈ 70 kW. The experiments were carried out in a hydrogen atmosphere. The plasma parameters were measured for different values of pressure and RF power. Plasma production with an average plasma density up to $\sim 7 \times 10^{11} \text{ cm}^{-3}$ was observed. The ions charge state and plasma elemental composition were determined through the optical emission spectroscopy. The partial pressure of residual gases was measured with a mass-spectrometer during the series of the wall conditioning discharges. The results of the measurements indicate a good wall conditioning effect.

[1] T. Wauters et al., Plasma Phys. Control. Fusion 62, 034002 (2020)

[2] A.V. Lozin et al., Plasma Phys. Rep. 39, 624-631 (2013)

[3] A.V. Lozin et al., Probl. At. Sci. Technol. Ser.: Plasma Phys. 6, 10-14 (2020)