G2-P-006301

LONG-PULSE PLASMA SOURCE FOR FLOW FORMING IN SMOLA MAGNETIC MIRROR DEVICE

[1,2]V. O. USTYUZHANIN, [1]I.A. IVANOV, [1]A.A. INZHEVATKINA, [1]A.V. SUDNIKOV

[1]Budker Institute of Nuclear Physics SB RAS, Novosibirsk, Russia
[2]Novosibirsk State University, Novosibirsk, Russia
e-mail: V.O.Ustyuzhanin@inp.nsk.su

The key problem of plasma confinement in open magnetic traps is the suppression of particle and energy losses from the mirrors. To solve this problem, the concept of helical plasma confinement was proposed [1]. The main idea of this concept is the creating magnetic plugs moving in the reference system of plasma, whose motion relative to the plasma is created by the rotating plasma in crossed electric and helical magnetic fields. This process is reversible, and redirection of plugs movement out of device permits to accelerate the plasma. SMOLA device has been designed and developed for experimental verification of this confinement concept at the BINP SB RAS.

The plasma flow in SMOLA device is created by a magnetically insulated discharge in axisymmetric plasma gun with a hot LaB_6 cathode [2]. Using an infrared heater, the cathode is heated to T ~ 2000 K, and the electrons emitted by the cathode ionize and generate plasma with a density of $n \sim 10^{12} \div 10^{13}$ cm^{-3} and T ~ 5÷30 eV at a distance of 0.4 m from the gun anode. Discharge's time is controlled by power supply, gas system and varies in 0.1 ÷ 2 seconds.

To optimize the transport and confinement of the plasma in the trap, it is important to monitor and regulate the primary parameters of the plasma jet. For this purpose, a diagnostic complex has been created. It consists of electrical probes' system (density, electron's temperature, electrical potentials), optical spectroscopes with high spatial resolution (rotation velocity, ion's temperature and electrical fields) and instruments for electrical parameters of discharge, vacuum (gas balance), as well as power systems control for all high-power circuits measurement.

The present report is devoted to the analyze of the plasma source effectiveness in the SMOLA device. This report includes the dependences of plasma parameters on the gun characteristics and experimental conditions.

REFERENCES

[1] Sudnikov, A.V., et. al. SMOLA device for helical mirror concept exploration. Fusion Engineering and Design, vol. 122, pp. 86-93, 2017, doi: 10.1016/j.fusengdes.2017.09.005

[2] Ivanov, I.A., et al. Long-pulse plasma source for SMOLA helical mirror. Journal of Plasma Physics, vol 87, doi: 10.1017/S0022377821000131