New powerful ion source for Globus-M2 spherical tokamak injector

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Neutral Beam Injection (NBI) is one of the main methods for additional heating of tokamak plasma. In Globus-M2 spherical tokamak [1], toroidal magnetic field and plasma current will more than double and plasma density will be significantly higher than in Globus-M [2]. Thereby, in order to ensure the optimal depth of atomic beam penetration into plasma before beam ionization, it is necessary to increase the energy of injected particles. For this purpose, we developed a new three-electrode ion source with peripheral magnetic field (ISPM-1M). While ISPM-1M retains the advantages of an arc discharge plasma emitter, the design of its high-voltage insulator junction and slit ion-optical system is different from its analogues ISPM-1 and ISPM-2 [3]. The main characteristics of ISPM-1M are as follows:

- maximum atomic beam power – 1MW;
- maximum accelerating voltage – 40kV;
- maximum ion beam current – 50A;
- emission surface area – 115cm^2;
- number of electrode arrays – 4 pcs.;
- cathode heating voltage – 10.5V;
- cathode heating current – 1200A;
- discharge voltage – up to 70V;
- discharge current – up to 1300A.

This presentation details ISPM-1M structure, explains of ion-optical system geometry, and discusses experimental results on discharge characteristics and parameters of arc discharge plasma, as well as the emissivity of the new ion source and the dependence of the optimum value of emission electrode current on accelerating voltage. Furthermore, the presentation introduces calculations of fast particle losses in Globus-M2 plasmas during NBI and predictive modeling results of heating and current drive created by the neutral beam for Globus-M2 discharges.

References:

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