Electric potential profile created by end electrodes in a magnetized rf discharge plasma

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The reprocessing of spent nuclear fuel (SNF) is one of the key challenges facing the nuclear industry. Among other technologies the plasma based methods for reprocessing SNF are actively developed [1]. To separate ions in space, it is necessary to create a configuration of crossed ExH fields immersed into plasma. In a cylindrical chamber filled with plasma and placed in a magnetic field parallel to its axis, an electric field of a specified configuration must be produced. Electrodes placed at the ends of the cylindrical vacuum chamber are used for this purpose.

The problem of generating a stationary electric field in a magnetized radio-frequency discharge (rf) plasma is studied experimentally. Helmholtz coils produce magnetic field in a cylindrical vacuum chamber with diameter of 85.6 cm and length of 220 cm. RF discharge is generated at a frequency of ~ 5 MHz. The rf power absorbed by plasma lies in the range 0.5-1.5 kW. Electrodes defining a negative potential are placed at the ends of the chamber. Two pairs of circular flat electrodes with diameter of 5.5 and 45 cm are investigated. The working gas is argon. Radial profiles of electron density and temperature are obtained. Radial profile of the plasma potential is investigated, as well as the dependence of plasma potential on the voltage applied to the end-electrodes.

[1] V. P. Smirnov, A. A. Samokhin, N. A. Vorona, and A. V Gavrikov, “Study of charged particle motion in fields of different configurations for developing the concept of plasma separation of spent nuclear fuel,” *Plasma Phys. Reports*, vol. 39, no. 6, pp. 456–466, 2013.