Helical PLASMA rocket thruster

A.D. Beklemishev

Budker Institute of Nuclear Physics, Russian Academy of Sciences and Novosibirsk State University, Novosibirsk, Russia, [bekl@bk.ru](mailto:bekl@bk.ru)

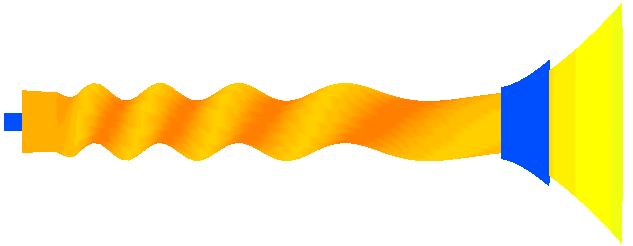
A new scheme of plasma thruster is proposed. It is based on axial acceleration of rotating magnetized plasmas in magnetic field with helical corrugation [1]. The idea is that the propellant ionization zone can be placed into the local magnetic well, so that initially the ions are trapped. The ExB rotation is provided by an applied radial electric field that makes the setup similar to a magnetron discharge. Then, from the rotating plasma viewpoint, the magnetic wells of the helically corrugated field look like axially moving mirror traps. Specific shaping of the corrugation can allow continuous acceleration of trapped plasma ions along the magnetic field by diamagnetic forces. A wide range of working parameters of the accelerating structure is considered: from the single-ion limit to collisional MHD regime. The accelerated propellant is expelled through the expanding field of magnetic nozzle [2]. By features of the acceleration principle the helical plasma thruster may operate at high energy densities but requires a rather high axial magnetic field, which places it in the same class as the VASIMR rocket engine [3].

Figure. Magnetic surface and electrodes of the helical plasma thruster

References

1. A. D. Beklemishev, Fusion Science and Technology, 2013, 63 (1T), 46
2. A. D. Beklemishev, Physics of Plasmas, 2015, 22, 103506
3. F. R. Chang-Diaz, Sci. Am., 2000, 283, 90