FORCE PRODUCTION AND PLASMA PROPERTY MEASUREMENTS OF A HELICON SOURCE WITH MAGNETIC NOZZLE*

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This work presents the axial force production and downstream plasma properties of a cylindrical helicon plasma source operating with a variety of downstream magnetic field geometries. The experimental apparatus consists of an assembly of six solenoid magnets surrounding an antenna and a quartz tube. Each solenoid can be operated independently, and the assembly is surrounded by a steel case to increase the magnetic field strength and uniformity. The maximum uniform strength produced is 1.1kG along the length of the device. The antenna is a half-wavelength helical antenna intended to excite the m = +1 helicon wave in the plasma, and is powered by a solid-state RF power supply that is capable of continuously providing up to 3 kW at 13.56 MHz. The quartz tube is 44cm long and has an inner diameter of 9cm. The assembly is mounted on a thrust stand and operated within the Large Vacuum Test Facility at the University of Michigan, with feed gas flowing into the source through an orifice at one end of the quartz tube. The thrust stand is a displacement-type, inverted pendulum thrust stand designed at NASA's Glenn Research Center, and is used to measure the force produced. Calibration of the thrust measurement is performed in situ before and after operation in order to ensure its accuracy. Plasma properties downstream of the source are measured using an RF-compensated Langmuir Probe system manufactured by Hiden Analytical.

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