Paper ID: 18068
oral
student

SPACE PROPULSION SYMPOSIUM (C4)
Poster Session (P)

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DEVELOPMENT AND TESTING OF THE INERTIAL ELECTROSTATIC CONFINEMENT DIFFUSION THRUSTER

Abstract

The Inertial Electrostatic Confinement Diffusion Thruster is an experiment in active development. The hardware involved takes advantage of an artifact found in operation of the Inertial Electrostatic Confinement device. The Inertial Electrostatic Confinement (IEC) device is a fusion reactor design that relies on a traditional electrostatic design in a spherical geometry. The design incorporates two radially symmetric, spherical electrodes. Often the inner electrode utilizes a grid of wire in a sphere of 15 to 50 percent radius compared to the outer electrode. This can be scaled; the author is familiar with operating the IEC with .6 meter maximum diameter. The inner electrode traditionally has 90 percent or more transparency to allow particles to recombine in the dense plasma core. When operating the IEC, one can observe an unsteady plasma leak. The plasma leak stretches through the lattice grid of the inner electrode in the reactor. This artifact of a leak is under investigation and will be discussed.

The Inertial Electrostatic Confinement Diffusion Thruster utilizes the radial symmetry found in the IEC device. A cylindrical configuration is preferred here, as it will produce the desired dense core the length of the grid while promoting the plasma leak to exhaust through a nozzle at one end of the inner electrode. The IEC Diffusion Thruster is operational and in testing. Argon is being used as the propellant, and considerations are being made to upgrade hardware to allow measurement of thrust.

I will present the IEC device and the IEC Diffusion Thruster. I will show the modeling and simulation completed in the thruster development. I will present the hardware and its installation, as well as the completed testing. Finally, I will share the contributions of this development to the community and future development of the hardware.