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Characterization of Corona Ionization Based Micro-thrusters

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Abstract :

A novel electrical micro-thruster (Corion system) has been developed over the past five years at Wits University, intended to be used commercially on small satellites and deep space probes. In this system, thrust is produced via the coupling of the corona ionization and acceleration mechanisms. The thruster consists of two oppositely charged metal needles. A neutral propellant gas emerging from the needles is ionized by the high electric field at the needle-tips. Ions and electrons are generated at their respective needles, and accelerated away. Continuous operation relies on a plasma bridge which forms between the needles. Experiments have shown that although the thruster operates, it is subject to instabilities in the plasma bridge which compromise continuous operation. Based on the previous findings, a new design is being tested. The new design shares some of the major characteristics of the previous Corion system while attempting to sidestep the plasma instability. The redesigned system consists of two tubes shaped into a 'U' that are connected to the propellant feed system. Ring electrodes are positioned near the opening of the tubes. The design features of this new system and results of initial tests on a proof of concept system consisting of a single tube open at both ends will be reported on. The results of using different construction materials and different geometries on performance will also be presented. Measurement of two important quantities in these tests, the propellant mass flow rate and the thrust, are challenging within a space-simulation environment. Novel systems have been constructed in both cases. The design, principle of operation and testing of these systems will be reported on.

Award :

Yes

Level :

PhD

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Paper :

No

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