IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (1) (5)

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INDUCTIVE PLASMA THRUSTER: DESIGN, SET-UP, AND FIRST IGNITION.

Abstract

The IRS inductive plasma thruster (IRS IPT) is designed within the framework of the H2020 EU-funded DISCOVERER project. The IPT is an RF, contact-less thruster based on helicon-wave plasma discharge using a birdcage antenna. The contact-less characteristic of the thruster removes any issues regarding potential electrode erosion due to aggressive gases (see RIT, HET), such as atomic oxygen highly present in Earth orbit, extends propellant flexibility and can easily cope with variations of propellant flow and composition. This paper deals with the design, set-up, and first ignition of the inductive plasma thruster (IPT). Such thruster makes use of a birdcage antenna tuned at resonance to the frequency of the RF generator of f=40.68 MHz. Birdcage antennas are commonly used in magnetic resonance imaging (MRI) machines in the medical sector and only recently applied for plasma purposes. The birdcage antenna at resonance is a partially matched load for the RF circuit and, at the chosen resonance mode, provides linearly polarized electromagnetic fields that lead to an exhaust velocity for both ions and electrons along the same axial direction, enabling an efficient use of the power combined with a neutral plasma exhaust that removes the need of a neutralizer. The IPT is a laboratory model with an external electromagnet for variable static magnetic field application. The IPT design procedure supported by software simulations, its implementation and the first ignition tests will be presented with an early evaluation of the plasma discharge based on power, mass flow, and propellant.