Paper ID: 21095
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SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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DEVELOPMENT AND MEASUREMENT OF A MICROWAVE MICROPLASMA SOURCE FOR MICROPROPULSION

Abstract

Currently, spacecrafts utilizes a variety of propulsion system technologies for space exploration. However, the cost of launching space vehicles, satellites, and other equipment has become very expensive and this has made it difficult to continue space discovery. In order to persist in developing our awareness of space, it is necessary to develop cheaper and effective solutions for propulsion technologies. For the purpose of miniature satellites, a low cost propulsion system is required. This proposed research seeks to develop and demonstrate a new scalable in-space micro-propulsion system. This project investigates a technology that can change our methods of space exploration by utilizing low power microwave microplasma microthrusters. A microwave microplasma microthruster (3MT) design is proposed here to present a printable thruster that is simple, cost-effective, and light weight. With the use of split ring resonator technology, microplasma discharges are generated in a variety of different microstrip structures. In this design, electromagnetic fields are transferred through a ring microstrip into a small air gap (approximately 500 microns) by connecting a microwave input source to an SMA connector on the microstrip and ground plate. Teflon will be used as the dielectric substrate and copper will be used to create the microstrip. The frequency and input power of the microwave source will be operating from 0.9 GHz to 1.0 GHz and 1-5 W, respectively. An analysis will focus on the thickness of the ring of the microstrip and determine if this physical characteristic of the microstrip can change the microplasma properties. The thickness of the microstrip (500-1000 nm) will also be taken into consideration. The electron density and temperature will be measured experimentally with optical emissions spectroscopy as they are important plasma properties that affect the performance of a microthruster using this technology. Micropropulsion thruster concepts will then be considered to provide an overview for a feasible, cost-effective, microwave microplasma microthruster (3MT) space propulsion device.