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Title

Preliminary Investigation of A High Efficiency Liquid Micro Pulsed Plasma Thruster (L-PPT)

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Abstract

To date, several micro PPTs have been developed for nanosatellites with power levels below 10 W, owing to their high scalability and ease of miniaturization compared to other EP technologies. Virtually all developed thrusters use Teflon as a solid fuel and achieve specific impulse of 600 - 1400 s with thrust efficiency significantly below 10%. The use of solid propellant has major drawbacks: carbon deposition and uneven ablation surface which may result in thrust variation and even premature thruster failure. To address these issues and improve efficiency, a novel PPT design with liquid propellant in the form of a PFPE was proposed in the Institute of Plasma Physics and Laser Microfusion (IFPiLM) – CE FP7 283279. Conducted tests suggested that liquid-fed PPT offers less carbon deposition, a steady mass bit throughout thruster life, but most importantly, around a two-fold increase in energy efficiency compared to other PPTs of similar energy. Based on these findings, Liftero and IFPiLM have developed a low-power PPT for CubeSats integrated into a 0.5 U form factor, including the PPU, feed system and thruster head. The use of space-proven COTS components further enabled us to offer a cost effective solution that can potentially outperform other high-performance electric thrusters, depending on the mission scenario. In this paper we present the development and testing of the liquid-fed PPT with a comparison to the traditional Teflon-fed, particularly in terms of performance and reliability.