

IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

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PULSED PLASMA THRUSTER USING A METAL COMPOSITE POLYMER AS A PROPELLANT

Abstract

A widely used electric propulsion system for CubeSats is the pulsed plasma thruster (PPT). PPTs generate plasma by applying a high voltage between two electrodes, causing breakdown and ionization of the solid propellant. The discharge of the thruster produces a high current that interacts with its own induced magnetic field, resulting in plasma acceleration and exhaust, producing thrust. One of the significant advantages of PPTs is their high specific impulse, enabling their operation in low-power conditions. Additionally, PPTs have trim sizes, a simple structure, and a longer lifespan. However, they suffer from low thrust efficiency, approximately 10%, and low power-to-thrust ratio compared to other electric propulsion systems. To enhance the thrust performance, we propose the use of a metal composite polymer (PMMA\Fe) that mixes iron powder with Polymethylmethacrylate as the propellant, replacing Teflon (Polytetrafluoroethylene). The results demonstrate that PMMA\Fe has a lower breakdown voltage and higher power-to-thrust ratio than Teflon, which may be due to the addition of iron powder that affects the propellant's electrical properties. Additionally, it increases the electromagnetic thrust of PPTs.