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3P22 - Performance of a Pulsed Electromagnetic Micropropulsion System with Low Energy Surface Flashover Igniter

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The rapid development and application of nanosatellite technology has vastly accelerated mission complexity –sparking interest in robust, low power, and high specific impulse micropropulsion systems. Pulsed plasma thrusters (PPTs) have been extensively explored and employed to fill this role. However, the technology's longevity has been historically plagued by the durability of an igniter subsystem. In this work, a pulsed plasma accelerator (PPA) design with a novel low energy surface flashover (LESF) igniter is presented –enabling upwards of 1.5 million flashover events. A 3μF / 2kV flyback-supplied capacitor bank, offering shot energies of ˜6J, supported current pulse durations of ˜4μs with observed peaks ranging from several kA to tens of kA. Intensified charge coupled device (ICCD) photography was leveraged to visualize the propagation of plasma. Parametric studies on capacitance, propellant, and mass flow rate were conducted to minimize current reversal and maximize performance. Several gaseous and liquid propellants were assessed, with additional testing on the LESF igniter location and dielectric material.

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