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POCKET ROCKET: A RADIO-FREQUENCY ELECTROTHERMAL PLASMA MICRO-THRUSTER

Abstract

A radiofrequency (13.56 MHz) electrothermal plasma micro-thruster for use on micro-satellites, called 'Pocket Rocket', is being developed in the Space Plasma, Power and Propulsion Laboratory at The Australian National University. The thruster principle is based around propellant heating from ion-neutral collisions within the plasma discharge creating higher exhaust velocities than a cold gas thruster, hence producing more thrust. Rovibrational spectroscopy experiments have been used to measure the temperature of the discharge, confirming propellant heating occurs and validating the thruster concept. Spatially resolved temporal evolution of propellant temperature within the discharge has allowed for identification of various heating mechanisms within the thruster, showing heating occurs through both volumetric collisions processes and through wall heating from ion bombardment of the thruster walls. Experimental findings are complemented with 2D computational fluid dynamics simulations, performed using the commercial CFD-ACE+ package. The current research and design status of the Pocket Rocket thruster and its role in future micro-satellites space and astronomical missions will be presented.