Octiv VI Probe in Thruster Applications

RF Measurement and Plasma Control Sensors

https://impedans.com/octiv-mono-rf-wattmeter

https://impedans.com/octiv-poly-vi-probe

https://impedans.com/octiv-suite-vi-probe
Iodine RF ion thruster (IRIT) : RF ion thrust prototype fueled by the solid iodine propellant

**Performance of a 4 cm iodine-fueled radio frequency ion thruster**

DOI: [https://doi.org/10.1088/2058-6272/ab891d](https://doi.org/10.1088/2058-6272/ab891d)

In this work, the RF incident power ($RF_{in}$), RF reflected power ($RF_{re}$) and the working frequency are measured by the Octiv Poly 2.0 VI probe. The probe was connected between the RF generator and the RF matcher (capacitor matching network) by which the impedance matching between the RF generator and thruster could be achieved.

Some example data is shown to the right.
Radio Frequency (RF) low pressure hydrogen hollow cathode discharge

Observations of a mode transition in a hydrogen hollow cathode discharge using phase resolved optical emission spectroscopy

DOI: https://doi.org/10.1063/1.4889916

In this work, a Pocket Rocket device was investigated with the electrode is driven at 12.5 MHz (80 ns period). Octiv IV probe is placed between the matchbox and driven electrode for simultaneous measurements of voltage, current, phase, and complex impedance.

Some example data is shown to the right.

Pocket Rocket system schematic and variation of plasma resistance and deposited power with changing pressure in a radio frequency (RF) low pressure hydrogen hollow cathode discharge.
Mini Pocket Rocket: RF Electro-thermal plasma micro-thruster

Low-Weight Fixed Ceramic Capacitor Impedance Matching System for an Electro-thermal Plasma Micro-thruster

DOI: http://dx.doi.org/10.2514/1.B35119

In this work, a low-weight (∼90 g) fixed ceramic capacitor and inductor impedance matching system mounted on a printed circuit board (PCB) is developed and used to couple rf power into the electro-thermal Pocket Rocket plasma micro-thruster. The Octiv Impedans IV probe is used to monitor Impedance and to obtain $I_{\text{rms}}$.

Some example data is shown to the right.

Schematic of MiniPR electro-thermal plasma thruster mounted on vacuum chamber and normalized impedance on Smith chart showing measured impedance for different frequency sweep configurations; the argon pressure is 1.6 Torr.
Interaction of RF ion thrusters with radio-frequency generators (RFGs)

Radio-Frequency Ion Thrusters—Power Measurement and Power Distribution Modeling

DOI: http://dx.doi.org/10.2514/1.B36868

In this work, a methodology to measure the power delivered to sustain an inductive plasma discharge inside radio-frequency ion thrusters. With knowledge of the actual forwarded power, the efficiency of the generator under consideration, including the power feed cable, is assessed in real time.

Neutral xenon volumetric inflow rate:
- Mode 1: Varied from $\dot{V} \sim 1$–10 sccm.
- Mode 2: Limited to $\dot{V} \sim 1$–8 sccm.

Some example data is shown to the right.

A). Schematic of experimental setup. B). Also shown the measured DC power and forward RF power. C). Experimentally and numerically obtained coil currents for a) mode 1 and b) mode 2.
Challenges in operating electric thrusters with molecular propellants

Molecular propellants for ion thrusters

DOI: https://doi.org/10.1088/1361-6595/ab2c6c

In this review, we summarize the current literature on molecular propellants for Radio-frequency ion-thruster (RIT). Also described the experimental results obtained from the operation of an RIT with iodine, representative of group I, and adamantane, representative of group II.

Some example data is shown to the right.
Pocket Rocket: A potential electrothermal plasma micro-thruster under development at The Australian National University

Pocket Rocket: An electrothermal plasma micro-thruster

DOI: https://openresearch-repository.anu.edu.au/handle/1885/104495

This work discusses the Pocket Rocket device which is under development at the Australian National University (ANU). It is an electrothermal plasma micro-thruster concept based around neutral gas heating from ion-neutral collisions.

Some example data is shown to the right.

The Pocket Rocket device with section cutaway showing electrode details. (a) The locations of two Impedans Octiv probes to measure current and voltage at A and B, and (b) power transfer efficiency through the matching network for N$_2$ at 4.0 Torr (blue circles), 1.5 Torr (green squares) and 0.5 Torr (red diamonds), and argon at 4.0 Torr (purple circles), 1.5 Torr (orange squares) and 0.5 Torr (grey diamonds).
Optimization of the physical and electrical geometry for improved performance of Pocket Rocket

Supersonic Constricted Plasma Flows

DOI: https://openresearch-repository.anu.edu.au/handle/1885/148759

This thesis presents a comprehensive model of Pocket Rocket (PR) developed with computational fluid dynamics and plasma simulations. Fine control of RF power is achieved with reference to an inline digital Octiv voltage/current (V/I) probe. A second V/I probe is used after the matching unit to monitor $V_{pwr}$ on the PR powered electrode.

Some example data is shown to the right.