

IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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DEVELOPMENT STATUS OF THE HT5K HIGH VOLTAGE MODEL

Abstract

Many future mission scenarios may considerably benefit from an electric propulsion system capable of highly-efficient operations and high specific impulse levels. These kinds of missions also require longer lifetimes, which may be stymied by the erosion of the ceramic channel in a conventional SPT-type Hall Thruster.

The magnetic-shielding concept has been demonstrated to be as a viable solution to increase the lifetime. However, the high voltages which are needed to ensure high levels of specific impulse, pose the need for further design refinements to obtain a mature and reliable flight product.

SITAEL has significantly improved the design of its HT5k, especially through the development of a magnetically-shielded version. Numerical and experimental activities were focused on the design and testing of different magnetic field configurations [1-2] Various technological aspects were also investigated over the last two years to increase the thruster behavior at high voltages.

The long-life 5kW-class thruster, HT5k LL resulting from such activities was extensively characterized, showing competitive performance and efficient thruster operation in the 3 kW to 7 kW discharge power range. Test campaigns were performed in SITAEL's IV10 large vacuum facility to explore the thruster performance and stability within the whole operational domain.

The anode/gas distributor design was updated to improve propellant distribution into the channel while simplifying the thruster fluidic interface. A dedicated test was also performed to evaluate the azimuthal uniformity of the gas distribution. In parallel, an alternative electrical insulation solution (AVIS) was developed. A specific test campaign on two commercial breaks and the AVIS insulator was carried out to verify the capability of AVIS to operate without breakdown within a broader temperature range compared to commercial breaks.

SITAEL also studied a programmatic rescheduling of the activities needed to qualify and put into service

the HT5k LL. The thruster will undergo environmental tests representative of the targeted space mission scenarios, and a coupling tests with SITAEL's 5kW dual-mode PPU, currently under development. The qualification of the HT5k LL will then proceed in accordance with mission requirements and market opportunities that will materialize within the next decade. Results of the HT5k LL test activities are presented in detail in the paper.

[1] T. Andreussi et al., "Influence of the magnetic field configuration on the plasma flow in Hall thrusters", Plasma Phys. Control. Fusion 60, 2018;

[2] A. Piragino et al. "Experimental characterization of a 5kW magnetically shielded Hall Thruster" SP2018 427