

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

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HT20K HALL THRUSTER DEVELOPMENT STATUS

Abstract

High power Hall thrusters offer a favourable combination of performance, reliability, and lifetime for a variety of deep space exploration missions to the cislunar space, to asteroids and planets of the inner solar system, as well as for private commercial space missions. As a consequence, a high-power solar electric propulsion capability is considered today as a necessary element to cope with future space transportation needs.

SITAEL's HT20k Hall thruster and its associated high current hollow cathode, the HC60, are the result of activities performed in SITAEL between April 2015 and June 2017 in the framework of a Technology Research Project (TRP) funded by ESA. During this first experimental campaign, carried out in SITAEL's IV10 Large Vacuum Facility, the HT20k was tested from 250 V to 1 kV discharge voltage. During a 250 hours test campaign to characterize the thruster and assess channel erosion aspects, the HT20k demonstrated efficiency levels up to 68% and thrust values larger than 1 N. In addition, total specific impulse values of 3000s were demonstrated at 800 V and 20 kW.

Further development activities of the HT20k are ongoing as a part of EU's H2020 CHEOPS programme, an ESA/GSTP programme and a dedicated, pre-qualification ESA programme. The CHEOPS work plan includes upgrading the thruster design by implementing magnetic shielding to increase the total thruster lifetime. The goal of the GSTP project is to develop a 20kW-class Hall Thruster with Extended Capabilities (the HT20k XC) to be offered to the Space Transportation market. The HT20k XC will be optimized to operate at high-voltage, high specific impulse conditions. In parallel, pre-qualification

activities on the HT20k are underway in framework of the relevant ESA programme, aimed at thruster optimisation in high thrust conditions. Thruster optimization is carried out through a combination of theoretical analysis and experimental activities. In particular, a variable-geometry thruster prototype, based on the HT20k model, is being designed and manufactured in order to characterize the thruster performance for different geometric configurations.

This paper presents the status of activities in progress on SITAEL's 20 kW class HT20k Hall propulsion system under the above programs, as a part of converging efforts underway to make such a propulsion system available for future space missions.