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PERFORMANCE TESTING OF 1N HYDROGEN PEROXIDE THRUSTER AT FOTEC PROPULSION TEST FACILITIES

Abstract

This paper presents the results of a performance testing campaign for a 1N hydrogen peroxide (HTP) monopropellant thruster with a novel catalyst developed in FOTEC laboratories. The test campaign was conducted as part of a project aimed at developing a greener alternative propellant to replace toxic hydrazine propellant, which is a substance of concern within the European Union's Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH). The objective of the project is to advance the thruster to a Technology Readiness Level (TRL) of 7, and the test campaign was conducted during phase B of the project.

The test campaign included pulse mode and steady state operation of the thruster. The thruster was mounted on an aerostatic bearing inside a vacuum chamber, which was designed to simulate the space environment. The aerostatic bearing provides frictionless support and allows for precise thrust measurements. The vacuum chamber was equipped with a pressure regulated propellant supply system, which provided the HTP propellant to the thruster. The performance testing was carried out at various pulse widths, frequencies, and duty cycles in pulse mode operation to investigate their effect on the specific impulse and thrust output. The throughput of the thruster was also evaluated in steady-state operation, with tests conducted at different chamber pressures. The test campaign investigated the performance of the thruster in terms of specific impulse, thrust output, catalyst efficiency, and thermal stability.

The results of the experiments showed that the specific impulse and thrust output of the thruster increased with increasing pulse width and decreasing frequency in pulse mode operation. The testing also showed that the catalyst efficiency was high, providing excellent thrust performance with high c* efficiency. In steady-state operation, the performance of the thruster improved with increasing chamber pressure, the thrust roughnes and throughput of the thruster was found to be stable and reliable.

The testing facility used in this study proved to be reliable and suitable for conducting performance tests of HTP thrusters. The data obtained from these tests with the novel catalyst will be useful for the development of greener alternative future spacecraft propulsion systems and contribute to the achievement of EU green deal goals.