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DEVELOPMENT AND TESTING OF AN ADDITIVE LAYERED MANUFACTURED NOZZLE FOR A
COLD GAS MICRO THRUSTER

Abstract

The present study is a part of an ESA project concerning the assessment of the use of additive layer manufacturing to improve and expand space hardware capabilities. In particular this project was initiated to further develop a small cold gas thruster. The thruster was previously manufactured through machining and joining, which impose significant material waste and qualification of the welding critical process. This paper discusses the design optimization, ALM process development, manufacturing and testing of the aforementioned cold gas thruster. The requirements for the thruster performance are pre-defined since the improved thruster is to be used in the currently in development Portuguese, earth observation, INFANTE micro satellite (16U, 25kg) whose precursor satellite (qualification unit) is expected to fly in 2020. The design is based on a heritage design with improvements made to both the nozzle section and the valve section to enhance the performance (Isp) and comply with more demanding leakage and actuation requirements. The development includes a trade-off study on the materials and ALM processes used for the manufacturing of the nozzle part. In addition, the design process and the steps of additive manufacturing and post processing leading to the thruster assembly and the testing. The results encompass standard leakage and proof pressure testing of the thruster to verify the compliance of the new design with the requirements and also performance testing including thrust measurements.