Qualification of HEMPT Hollow Cathode Neutralizer with integrated getter

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ABSTRACT

Thales Microwave Imaging and Subsystems (MIS) at Ulm site in Germany qualified a thermionic gas discharge dispenser hollow cathode neutralizer [1] HCN6500, impregnated with Ba/Ca-Aluminate. This neutralizer is operated with an internal hot getter to dispense with an external purifier of the flow control unit (FCU), which removes cathode poisoning contaminants as oxygen and water from the propellant. The HCN6500 is derived from the fully space qualified HCN5000, which is currently demonstrating in-orbit operation with the HEMPT-3050 (High Efficiency Multistage Plasma Thruster) Electric Propulsion (EP) System on the Heinrich Hertz Satellite supported by the DLR (Deutsches Zentrum für Luft und Raumfahrt) and is integrated into the new HEMPT-EV0 EP technology which is expected to finish its lifetime test in Q1/2027 [2]. The HCN6500 is based on the HCN5000 cathode technology. As the EV0 [3] it was redesigned in terms of production costs and industrialisation to account for the needs of the growing space satellite constellation market with numbers of up to thousands of satellites per constellation [4,5]. The use of an internal hot getter instead of an external purifier is beneficial in handling during performance testing and satellite integration and in terms of costs for the thruster system. High getter capacity allows the choice of rather low propellant grades to save costs and to maintain the flexibility for the loading process from the source to the spacecraft. Thales MIS presents results of the HCN6500 qualification in the context of getter operation. Two qualification vehicles have been vacuum tested at the Thales MIS test facility in Ulm. To accelerate the test campaign, the neutralizers have been fed with a specifically contaminated Krypton gas to demonstrate the getter capacity. One device under testing was operated continuously in Keeper or plasma mode while the second was submitted to 10600 complete on/off cycles consisting of a heating and a subsequent Keeper phase. The hollow cathode performance was monitored by continuous data acquisition, notably Keeper voltage, heater resistance as indicator for the cathode temperature and inlet pressure. The operating point was chosen to comply with the specification of the HEMPT-EV0 lifetime test.

References

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