

Development of Hollow Cathodes for Electric Thrusters: Theoretical and Experimental Results

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Hollow cathodes are sources of electrons to ionize the propellant and neutralize the ion beam exhausted by ion and Hall effect thrusters. A complete understanding of the operation of hollow cathodes is hindered by the complexity of their driving physical processes along with the difficult plasma diagnostics due to the small size (typically a few millimeters in diameter) and high operating temperatures (above 1000 K). Nevertheless, a deeper study of hollow cathodes is important to improve the entire propulsion system, whose performance and lifetime are both affected by their operation.

The talk illustrates the main features of state-of-the-art hollow cathodes for space applications and the critical issues relevant to their operation and technological development. Recent theoretical and experimental results on hollow cathodes developed by Sitael and JPL (in collaboration with the University of Pisa) are shown. The cathodes have been designed to operate with xenon and krypton fed Hall effect thrusters ranging from 100 W to 200 kW, corresponding to current levels from 1 A to 300 A, with an expected lifetime of tens of thousands of hours.

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