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Author: Mr. Jordan Hsieh
National Cheng Kung University, Taiwan, China, jordan.h.hsieh@gmail.com

LANTHANUM HEXABORIDE HOLLOW CATHODE FOR A MAGNETIC OCTUPOLE THRUSTER

Abstract

This paper describes the design and development of a lanthanum hexaboride (LaB6) hollow cathode for the Magnetic Octupole Plasma Thruster (MOPT), which is a novel electric propulsion concept for future space missions. It also discusses the operating characteristics of such a cathode. To gain insights into the coupling behavior between the cathode plasma and the octupole magnetic field, the hollow cathode was operated with and without an octupole magnet over a range of discharge currents and flow rates. The results indicated that the discharge voltage was negatively correlated with the discharge current and flow rate. In addition, the presence of an octupole magnetic field increased the electron drift resistance toward the anode and reduced the ion-acoustic turbulence, thereby reducing the discharge voltage fluctuation in the low-discharge-current and high-discharge-current regimes. However, in the high-flow-rate regime, the applied magnetic field increased the discharge voltage fluctuation because of the enhancement of the local electric field in the cathode plume region. This research represents a crucial step in the development of a LaB6 hollow cathode for MOPT applications in space.