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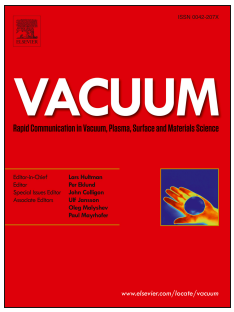

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Effect of Relative Position between Cathode and Magnetic Separatrix on the Discharge Characteristic of Hall Thrusters

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Abstract

In this paper, a new "convex" external magnetic pole structure is proposed. With this structure, two different configurations of the cathode inside and outside the magnetic separatrix can be realized by changing the position of the magnetic separatrix instead of changing the position of the cathode in the radial direction. Furthermore, the discharge plume, coupling voltage, and performance of the thruster under different configuration conditions are studied experimentally. The experimental results indicate that, when the cathode is located inside the magnetic separatrix, the effective acceleration voltage is higher, the coupling voltage between the cathode and the thruster is lower, and the thruster performance (including thrust, specific impulse, and efficiency) is higher. When the cathode is located outside the magnetic separatrix, the effective acceleration voltage is lower, the coupling voltage between the cathode and the thruster is higher, and the thruster performance is degraded. When the cathode is located inside the magnetic separatrix, the thrust and specific impulse can be increased up to 2.3%, and the efficiency—up to 4.6%. This study provides a new method for the design of the magnetic separatrix and is of great importance for the coupling-matching design of the cathode and thruster.

Keywords: Hall thruster; Magnetic separatrix; Cathode coupling