Spectral Diagnosis Of Hall Thruster Coupling With Hollow Cathode

Shilin Yan ; Zhongxi Ning ; Tianhang Meng ; Daren Yu
Lab of Plasma Propulsion, Mail Box 458, Harbin Institute of Technology, 150001 Harbin, China

Abstract: Hollow cathode is one key component of electric propulsion system, and it is difficult to explain the relationship between hollow cathode operating parameters and thruster performance. But spectral diagnosis of Xenon plasma from hollow cathode makes it possible to evaluate the coupling relationship between Hall thruster and cathode. In a 250V Xenon Hall thruster experiment, on certain operating points of anode flow rate and magnetic field, cathode flow rate and keeper current have been changed. It is found that intensity of 3 Xenon atom spectrum (823.2nm, 828nm, 881.9nm) as well as thruster performance changed significantly as cathode operating parameters altering. As is seen in Fig.1, with keeper current equaling 2 A, as cathode flow rate is increased from 1 sccm, intensity of 3 Xenon spectrum rise slowly at first, then decrease sharply at 4 sccm flow rate, and finally keep stable after flow rate exceeding 8 sccm. Result shows that characteristics of plume and oscillation of the thruster have got better and the thruster has been more efficient, when Xenon spectrum intensity is low.

![Graph showing the spectral intensity of Xenon at different cathode flow rates.](image)

Fig.1 Intensity of 3 Xenon spectrums (823.2nm,828nm,881.9nm,)at representative cathode fluxes in the 1-10sccm when keeper current intensity =2A

Similar result appears when keeper current is changed. As is seen in Fig.2, with cathode flow rate equaling 8 sccm, intensity of 3 Xenon spectrum decrease sharply as keeper current is increased from 0 A, and then it is almost invariable after current exceeding 2 A. It is also found that thruster performance get better when spectrum intensity is low.
To be concluded, low cathode plasma spectrum intensity represents stable thruster discharge condition and high efficiency from one side.

**Key words:** Hollow Cathode; Hall Thruster; Coupling; Spectral Diagnosis;

[3] Juan Yang,Shigeru Yokota,etc, Diagnosing on plasma plume from xenon Hall thruster with collisional-radiative model,Physics Of Plasmas 17, 103504 ,2010