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MUTATION OF PERMANENT MAGNET HALL THRUSTER: CENTRAL CATHODE CONFIGURATION

Abstract

Today's technological advancement not only inspire us to know where we stand in the universe but also provide us with full blown machinery to fulfil this dream. Deep space exploration drives us to enhance our present mechanics and work towards a broader goal. The next step is the requirement of such deep space propulsion systems that are efficient, feasible and are low in cost. Hall Effect thruster is one of the existing technologies that utilizes high speed plasma to propel. With few variations in conventional design the present demands can be met. The paper focuses on the alterations that can be done on Hall Effect thrusters for the same. The efficiency of Hall Effect thruster is directly affected by the total power consumption of the system. Using permanent magnets instead of conventional electromagnets for low power hall thruster allows an observable increase in its efficiency. Two cylindrical permanent magnets are used to construct the prototype and hence study the plasma characteristics against a conventional Hall Effect thruster to determine the effect of the changes. The thruster performance is analysed at various mass flow rates and low power ranging from 50 to 100 Watt. The second design advancement includes the placement of the emitter cathode in the inside of the central magnet pole piece guiding the electrons in the direction of exhaust. This alteration reduces the overall size of the hall thruster and increases the compactness of the system. A non-contaminating propellent Xenon is used for analysis. The transverse electric and magnetic fields are generated by the permanent magnets (magnetic field) and the electrons from the cathode utilize the magnetic field to create an electron sheet near the ionization chamber exit, developing a potential difference, and hence the electric field. The objective also includes apprehension, experience and realisation of the obstacles faced during fabrication of miniature Hall Effect thruster for enhanced understanding of electric propulsion systems, thereby exploring peaks of advancement and scope in near future technologies. Both the alterations in conventional design also reduce the total mass of the system and increase the overall efficiency of the thruster.