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Numerical Study on the Effect of Magnetic Shielding Configuration on Hall Thruster Discharge Channel

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The distribution of electromagnetic field in the Hall thruster discharge channel directly affect the propulsion efficiency by controlling the plasma beam flow. Magnetic shielding technology is an effective way to reduce wall corrosion and improve the on-orbit running lifetime of Hall thruster, thus it's an important step in the development of Hall thrusters for deep space exploration. In our work, we simulate the variation rules of particle-wall collision frequency, specific impulse and push-power ratio under different magnetic shielding configurations constructed by electromagnetic simulator (Fig. 1). As the results shown, compared with the traditional magnetic configuration, the electron temperature of shielding configuration increases, electron-wall collision frequency decreases, specific impulse increases under four different kinds of shielding configurations. Especially when the magnetic shielding material is applied to the entire wall, and the zero-magnetic field region is located near the anode, the axial electric field intensity at the outlet of the channel is the largest, and the ion beam is effectively focused. In our next step of research, sloping wall at the channel exit of Hall thruster is also considered in order to mitigate wall corrosion (Fig. 2). Besides, we also did some work on The Influences of Segmented Electrode with High Biased Voltage on Plasma Discharge Characteristics of Hall Thruster

Fig. 1. Magnetic field simulation of Hall thruster

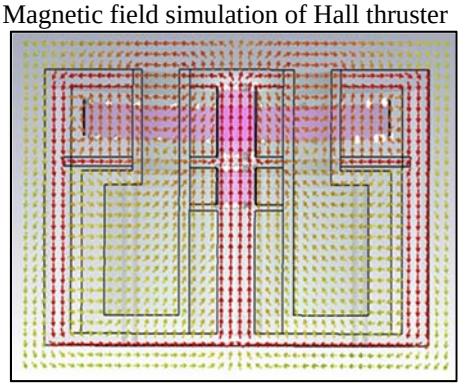


Fig. 2. Schematic diagram of sloping wall at the exit of thruster channel

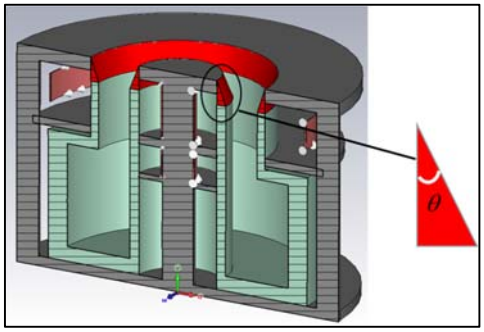
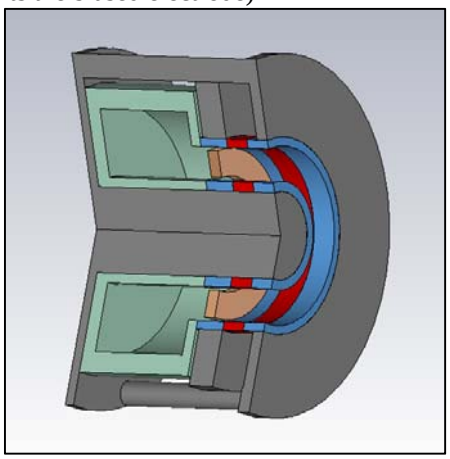


Fig. 3. The schematic diagram of segmented electrode (blue region represents the channel walls; red region represents the biased electrode)



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