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DEVELOPMENT OF A VACUUM ARC THRUSTER WITH MULTI-LAYER INSULATOR

Abstract

A vacuum arc thruster is an electric thruster used for space propulsion. Traditional vacuum arc thrusters add thin graphite between the anode and cathode to enable the thruster to generate arcs in a vacuum. The working principle of the vacuum arc thruster is to use the heat generated when the current passes through the thin graphite to vaporize the graphite and induce an arc. The design of thin graphite can reduce the arc generated in the vacuum from tens of kilovolts to hundreds of volts.

The previous work found that the conductive layer above the insulator was essential. For instance, the VAT would not generate an arc when the experiment coats a graphite layer on the insulator too thick because the resistance of graphite was too low to a short circuit between the anode and cathode in the thruster. If the experiment coats too thin a graphite layer, the VAT would open a circuit between the anode and cathode.

Therefore, a multi-layer insulator was developed in this experiment, which applied the physical phenomenon of the triple junction. The triple junction shows that when a high voltage is applied to three different materials, the electric field is distorted at the junction of the different materials. It means that plasma will produce easier at the junction.

Finally, the experiment results demonstrate that VAT is more steady and has a longer life if using a multi-layer insulator.