Research of water content and the electric discharge frequency for CFRP of vacuum arc thruster

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1. Backgrounds and Purpose

In late years the development of the satellite microminiature as a solution of problems such as a large amount of development cost of the large satellite, the risk increase advanced. The setting of various missions was in this way enabled. Mission examples include posture control, an orbit adjustment. It is feasible by a thruster. From this research, Became able to be downsized than a conventional propeller by using a direct drive type, a passive ignition type, an individual propellent by a vacuum arc thruster. Incorporated water and microsilica into the cathode side of the propellent, and a research for the purpose of the improvement of the electric discharge frequency by the anode side and the cathode side has been pushed forward. Investigate the influence that difference in content of the water gives in electric discharge frequency in this research.

2. Principle of research

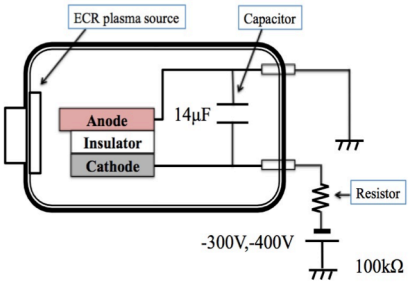

Fig.1 Circuit of vacuum arc thruster

We use a CFRP as a thruster. There are a conductor , a dielectric part on the surface of the CFRP, and a triple junction is formed by exposing it under plasma environment. Make up for plasma electric potential in the cathode side and negative bias. A dielectric is right charged with electricity, and an electric field is formed by an ion current from neighboring plasma. When an electron moves to the high electric potential side by an electric field electron emission phenomenon, a minute electrostatic discharge is generated. This electric discharge is a chance, and an anode, a cathode interval short-circuit by a vacuum arc.

3. Experiment approach

I made three samples which changed the water content on investigating relations of the electric discharge frequency by the difference in water content. I set water content with sample A (Water is 2.0g), sample B (Water is 0g), sample C (Water is 4.0g) and I conduct discharge test.

4. Test result

In this research, I apply each samples -300V, -400V. An electric discharge phenomenon was confirmed in sample A, but was not confirmed in sample B, C.

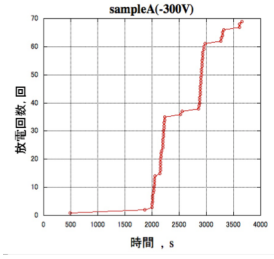

Fig.2 Frequency of discharge sample A (-300V)

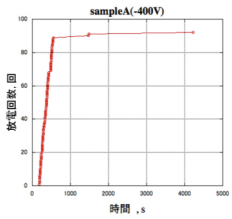

Fig.3 Frequency of discharge sample A (-400V)

5. Conclusion

I was able to acquire the value that frequency of discharge is expensive. However, the frequency of discharge decreased by lengthening electric discharge time.

6. Future tasks

We do the sample making that we can maintain of the electric discharge frequency. And, change content of the microsilica and investigate water and content of the microsilica and relations of the electric discharge frequency.