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Prediction, Measurement and Effects of space environment on space missions (3)

Author: Mr. Atomu Tanaka
Kyushu Institute of Technology, Japan, n350912a@mail.kyutech.jpProf. Mengu Cho
Japan, cho@ele.kyutech.ac.jp
Prof. Minoru Iwata
Japan, iwata@ele.kyutech.ac.jp
Prof. Kazuhiro Toyoda
Japan, toyoda@ele.kyutech.ac.jpADJUSTMENT OF PRACTICAL INTERFACE FOR ELFS-CHARM MOUNTING ON A SATELLITE
(ELECTRON-EMITTING FILM FOR SPACECRAFT CHARGING MITIGATION)**Abstract**

A satellite must have high reliability to ensure operation throughout its lifetime as it cannot be repaired on orbit. But examples of failures of some satellites have been reported all over the world. One cause of on orbit failure is the charge and discharge phenomenon. Especially for satellites on geosynchronous orbits, their ground point may be negatively charged to several tens of kV. In this charging process, a potential difference is generated on the surface of the satellite due to differences of each material secondary electron emission. It is believed that spacecraft can suffer a massive failure due to the discharge arising from this potential difference.

We are researching the charging and discharges of satellites at Kyushu Institute of Technology. In particular, we are developing ELFs-charm (ELeCtron-emitting Film for spacecraft charging mitigation), which is a technique to mitigate the charging and discharges of geosynchronous orbit satellites. ELFs-charm is expected to emit some electrons from the satellite and mitigate the satellite charging by mounting it on the satellite surface.

In ground tests, it has been confirmed that ELFs-charm emits some electrons under conditions that simulate the environment of space. And some electron emissions in real space environment were confirmed by the satellite "HORYU 2", which was launched in 2012. When installing ELFs-charm on "HORYU 2", we changed the configuration of the satellite for its mounting. But to be practical and useful in future applications, we must be able to install ELF-charms on satellites with minimal configuration changes.

In this paper, we describe the mounting method of ELFs-charm on satellites. ELFs-charm must keep simplicity of the interface to the satellite, which is the greatest advantage when it is mounted on a satellite. Therefore, we tried to create an electronic board for the interface. Also, the ELFs-charm development phase is orbital demonstration. Therefore, we developed a system to measure the surface potential and electron emission current of ELFs-charm. It is expected that many satellites will be launched with charge and discharge mitigation technology using this system in the future.