

Internal pressure measurement in nano/micro satellite

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Nowadays, many satellites use large electricity. For some components, a high voltage are necessary. Therefore, an accident caused by the electrical discharge is one of the trouble causes of the satellite. This problem is important for not only conventional large satellite but nano/micro satellite with 50 kg because a current nano/micro equips a high voltage components as ion thruster.

In this search, we focus an electric discharge in the satellite during the vacuum testing and orbit operation in nano satellite. One of important parameter is an internal pressure of the satellite. To restrain the electric discharge in the orbit operation, a calculation of conductance and predicting the pressure in the satellite are required.

In the past result for a discharge accident in Japanese satellite, there was Kiku7(EST-VII) as example. Kiku 7 demonstrated an automatic rendezvous and automatic docking. In the case of Kiku 7, the electric discharge occurred at both time of a thermal vacuum testing and orbit operation. It was expected that the discharge accident in orbit was caused by the reducing insulation due to the discharge accidents occurring in the thermal vacuum testing.

In this research, we measured the pressure in the satellite using the dummy satellite. This dummy satellite is based on QSAT-EOS developed by universities and companies in Kyushu was made. This satellite has 4 tatamis half structure with 50kg/50cm. A hot cathode ionization gauge was set in the mission space of dummy satellite to measure the differential pressure with a vacuum gauge installed a vacuum chamber. We actually performed the pressure monitoring in the satellite in the simulated situation when a satellite experiences in actual orbit and in vacuum thermal vacuum testing. In the test simulated thermal environment in an orbit, the extreme low temperature panel storing LN2 was used. Therefore, the pressure of vacuum chamber reached at the order of 10^{-5} Pa.

Finally, we calculated differential pressure measured in a vacuum testing and estimated the outgassing from the satellite. The conductance of the satellite was calculated by using obtained values in experiments. In addition, from a position and dimension of hole in the dummy satellite, we calculated the rough conductance.