

Measurement of charging properties and Analysis for space materials

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1. Introduction

After the accident of the Earth observation satellite “ADEOS-2”, spacecraft charging analysis software, “Multi Utility Spacecraft Charging Analysis Tool (MUSCAT)”, was developed at Kyushu Institute of Technology. To use this software with higher accuracy, the charging properties of spacecraft materials such as Total Electron Emission Yield (TEEY) and Photoelectron Emission Yield (PEY) are required. My research purpose is to measure charging properties to make a data base and to evaluate space material. Space materials are Black Kapton and Teflon which are thermal control film.

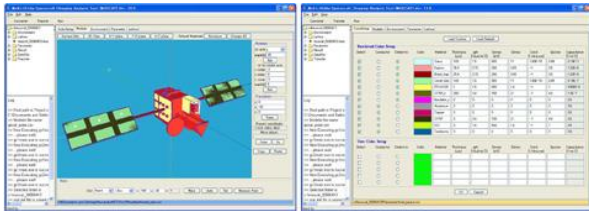


Figure 1. Charging analysis tool “MUSCAT”

2. Total Electron Emission Yield

The total electron emission yield is defined as the number ratio of emitted electron and injected electrons. Spacecraft is exposed to plasma and sub-storm in space, so surface charging is influenced there.

The result of TEEY virgin and exposed Atomic Oxygen value as shown in Figure 2. TEEY is decreased by AO.

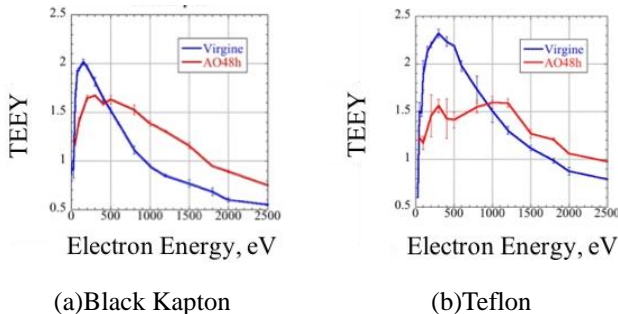


Figure 2. Difference of TEEY virgin and AO

3. Photoelectron Emission yield

The photoelectron emission yield is defined as the number ratio of emitted electron and injected photon. Photoelectron

current is calculated by PEY and photon flux in space. Current of Black Kapton and Teflon changed after AO exposing.

Table1 .Difference of Photoelectron current virgin and AO

	virgin	AO
Black Kapton[$\mu\text{A}/\text{m}^2$]	6.14	13.1
Teflon[$\mu\text{A}/\text{m}^2$]	0.77	0.64

4. JAXA samples

As a joint research, JAXA asked us to measure charging properties of AO tolerance coating material (SQ). The results are shown in Fig3.

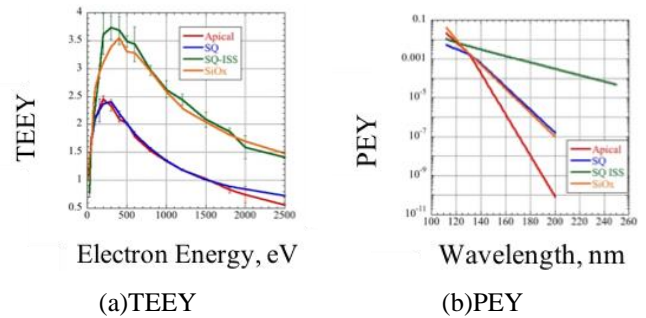


Figure 3 Charging properties of SQ

5. Summary

Black Kapton and Teflon are measured TEEY and PEY in various space environments. Also Atomic Oxygen tolerance materials are measured charging properties (TEEY, PEY, and Resistivity). So many databases are constructed. Future task is charging analysis in any other environment and measurement of charging properties for new space material.