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THE STUDY OF INTERNAL CHARGING AND DISCHARGING EFFECTS ON SOLAR ARRAY DRIVE MECHANISM

Abstract

The Spacecraft internal charging and subsequent discharging, caused by high-energy particles of the space, is one of the main causes of spacecraft abnormity and malfunction.

Solar Array Drive Mechanism (SADM) is a crucial component of the electrical transfer system of the modern long life and large power satellite, which is used to rotate the solar array to follow sunlight for maximum energy acquisition, as well as transfer power and signals from the solar array to satellite main structure through the sliprings inside SADM. Installed at the interface of spacecraft body and outer space, SADM is directly exposed to the space environment, so the energetic particles may penetrate its exterior cover and interfere the normal functioning of its sliprings.

In order to test the influence of internal charging and the subsequent discharging by the space environment on SADM, especially on its electrical transfer sliprings, a "Space Electron Charging Effects Simulation Device" simulating the space radiation environment of the Geosynchronous orbit, was utilized to conduct internal charging tests on SADMs. A number of SADMs utilizing different dielectrics were tested.

The test results demonstrated that: 1) The internal charging and discharging would not influence the normal functionality of SADM with proper design. 2) The dielectrics with lower resistivity would lower the accumulated voltage on the sliprings, and thus improve their reliability in space environment.

The test results will serve as a good foundation for the design of future space mechanisms like SADM for better safety in space environment, which will enhance the long life reliability of satellites equipped with these mechanisms.