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Hypervelocity Impacts and Protection (3)

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RISK ASSESSMENT OF SUSTAINED DISCHARGE ON SATELLITE'S POWER HARNESSES CAUSED BY SPACE DEBRIS IMPACTS

Abstract

Hypervelocity impacts of space debris pose not only mechanical failures like breakup of satellite main body but also electric failures resulting in the loss of power supply from solar arrays. The past hypervelocity impact experiments suggest that the sustained discharge and subsequent ground/short fault on power harnesses could be caused by impacts of space debris smaller than 1 mm. This presentation reports the risk assessment of impact-induced sustained discharge on satellite's power harnesses based on the more realistic configuration of the satellite's circuit and impact condition than the past. The submillimeter spheres made of aluminum oxide and stainless steel were impacted on the simulated power harness attached on the aluminum substrate plate at 4–7 km/s. In addition to the measurement of discharge duration, impact-induced plasma density was measured simultaneously by double-probe method. The results suggest that the mechanical damage of the power harness, which determines the distance of electrodes (cable cores and aluminum plate), plays a key role in the sustained discharge on the satellite power harness.