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RISK ASSESSMENT FOR SPACECRAFT SURFACE DISCHARGING INDUCED BY MICRO SPACE DEBRIS

Abstract

The population of micro space debris is increasing significantly with the rapid development of space technology and increasing launching of space vehicles year by year. The threatening effects of space debris lie not only in its direct damage to exposed spacecraft materials, but also in the dense and rapid spreading plasma cloud generated by hypervelocity impact. In the case of high voltage solar arrays or significant differential surface charging, micro impact induced plasma cloud may trigger transient discharging around the locations where significant voltage gradient exists, e.g. between solar cell strings in high voltage solar arrays. Since the space micro debris population is huge and the high surface spacecraft charging is also frequent, the micro debris induced discharging may occur with high possibility. The ESD may be an important anomaly source that results in malfunctions of electronic systems onboard. Such mechanism of micro debris induced discharging has been basically accepted, but adequate investigation in depth is still lacking. In this article, we present the experimental results of micro impact induced discharging, which is carried out on a plasma drag micro particle accelerator. The characteristics of the discharging and its dependence on the hypervelocity impact parameters are analyzed, furthermore, the mechanism and preconditions for the micro debris induced discharging is discussed in detail.