SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

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ELECTRICAL BREAKDOWNS ON SC SURFACES DUE TO MICROPARTICLES IMPACTS

Abstract

Between a spacecraft hull and its plasma environment there is a significant voltage generated by space fluxes of charged particles and space power systems. Electrical charged are created on dielectric coverings. Such capacities could store rather large charges and energy. When the dielectric layer is punctured by a hypervelocity microparticle an electrical breakdown is initiated because the melted crater surface could be an ideal cathode spot. The main part of the capacity charge could leak through the created plasma channel and the released energy could essentially exceed the kinetic energy of the micro-particle. First of all, this phenomenon could be dangerous for the International Space Station (ISS) because there are high voltage sun arrays (SP) (the voltage up to 160 V, the negative terminal connected to the hull) and there are large metal surfaces with thin dielectric covering. Such are anti meteoroid protection constructions of USA's segment, EVA suits, etc. The dielectric surfaces accumulated electrical charges from an ambient plasma and such structures lead to creation the system of parallel plasma capacitors. The model estimations are following: the total surface having the thin dielectric covering is 100 m2, the thickness of dielectric is 1 m, the plasma capacity is 67.10-3F, the electrical charge is Q 1 C, and energy is ¿ 10 J. 1 m microparticles puncture the dielectric covering and create power electrical impulses up to I 102103A. This paper is concerned the microparticle fluxes on different on ISS segments, Calculations are made using MASTER-2005 model. Usually the impacts of such small particles (d=110m) mean to be not dangerous, but the number of such impacts are much greater then impacts of the larger particles. The estimates made using some plasma generation and electrical circuit models show that the electrical discharges lead to essentially increase surface erosion. Generated electromagnetic impulses could have essential interference and damage effects for the electro physical systems and ESA suits.