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A METHOD OF CONTROLLING FLOATING POTENTIAL FOR SPACE STATION BASED ON ION CURRENT MAGNIFICATION

Abstract

The charging events of the International Space Station have been a focus of concerns in the recent years. The hollow cathod plasma contactor was applied to control the floating potential due to its high emession current of amps order. The in situ measurements show that the floating potential is much smaller than predicted previously, and the actual contactor emission currents are far less than amps level. In such case, a simpler method is possible to control the floating potential. In this paper, a new method of controlling floating potential for space station is provided. By application of a metal spherical surface, which is negatively biased relative to the structure, as an ion current collector, the ion current can be magnified at high biased voltage and the structure floating potential can be controlled to zero. The dependence of the sphere radius on the biased voltage is calculated based on the Potential Control Unit measurements of electron emission current on the ISS. Typically, for a 100V high voltage solar array design, a sphere of r=0.3m 0.7m biased at -500V -200V accordingly is enough. The engineering feasibility of the method is also analyzed. Besides its simplicity, the method has obvious advantages, such as without requirement of working gas, high reliability and long life, etc.