EXPERIMENTAL PLASMA LEAKAGE CURRENTS TO INSULATED AND UNINSULATED 10 m^2 HIGH-VOLTAGE PANELS

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ABSTRACT

Recent plasma tests in the large chamber at the NASA Johnson Space Center have measured plasma leakage currents to a completely conductive 1- by 10-meter panel biased at voltages up to 3 kV, in an argon plasma at densities from 10^4 to 10^6 per cm^3 with $T_e < 0.2$ eV. The same panel was then insulated by applying Mylar tape to 90-99 percent of its surface and retested in the same plasma conditions. Leakage currents below 40 V were reduced by the insulation but increased rapidly between 50 and 150 V to equal or exceed the currents observed for the uninsulated panel. Plasma current at -200 V to the insulated panel was triple that obtained with no insulation at all. In addition, the insulated panel began to "arc" discharge to the plasma at applied voltages above 200 V. Similar results were obtained with other configurations of conductive, partially conductive, and mostly dielectric panels. Increasing the amounts of surface insulation not only was ineffective in reducing plasma current leakage at voltages above 100 V, but it also reduced the threshold voltage observed for the onset of large transient current increases due to "arcing" to the plasma.