

GAS DISCHARGE PHENOMENA IN SPACECRAFT DISCHARGE PULSES

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ABSTRACT

Various experiments are performed to determine that the typical pulsed discharge current is controlled by a low-pressure gas discharge. Although not broadly accepted, this has been mentioned often by previous investigators. The phenomenon has important technical implications that are only now being investigated. We find that both the spatial arrangement of the vacuum chamber grounds and the divergence of the space-charge electric fields strongly modify the pulsed-current waveform. The results are consistent with the interpretation that the pulse of current is carried by a Townsend gas discharge, and not by electrons emitted from the insulator. The amplitude, duration, slew-rate, polarity and total charge in the pulse can be dramatically changed by changing the spatial arrangement of grounded surfaces in the vacuum chamber. As a result, the pulsed energy delivered to a threatened circuit element is varied by an order of magnitude or more by seemingly unimportant parameters such as the "geometry" of the discharge space. Useful quantitative distinctions can now be made.