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

Author: Mr. Martin Rudolph
Fraunhofer - Institute for High-Speed Dynamics, Germany, mjbrudolph@gmail.com

Mr. Martin Schimmerohn
Fraunhofer EMI, Germany, martin.schimmerohn@emi.fraunhofer.de
Dr. Jens Osterholz
Fraunhofer EMI, Germany, jens.osterholz@emi.fraunhofer.de
Dr. Frank Schäfer
Fraunhofer EMI, Germany, frank.schaefer@emi.fraunhofer.de

ELECTRICAL SIGNATURES OF HYPERVELOCITY IMPACT PLASMAS WITH APPLICATIONS IN IN-SITU PARTICLE DETECTION

Abstract

Highly transient plasma is observed in impacts of particles at hypervelocity. This type of plasma shows a range of distinct electrical phenomena which allow to deduce impact parameters. The effects range from charge production to electrostatic and electromagnetic wave generation. In the past, some detectors based on electric coupling to impact plasmas were deliberately designed, such as a long heritage of charge collection detectors. Other effects revealed themselves as anomalies on instruments dedicated to tasks other than particle detection. These effects showed up as impact-correlated voltage spikes on radio astronomy and ambient plasma instruments. In all cases, the instruments were on board interplanetary mission and thus measured the natural dust population. Up to today, electrical coupling mechanisms are rarely exploited for in-situ detection of man-made space debris particles. Although differences between interplanetary dust and debris exists, e.g. in chemical composition, size and velocity, there is no apparent reason for not doing so. The paper at hand provides a tentative evaluation of detection principles in view of typical requirements on impactor parameters to be extracted such as size, velocity and direction.