14TH IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Measurements (1)

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MEASUREMENTS OF ABSORPTION CROSS SECTION FOR SPACE DEBRIS IDENTIFICATION BY USING REVERBERATION CHAMBER

Abstract

The identification of space debris based on radar measurements strongly depends on the ability of the orbiting object to reflect the electromagnetic waves irradiated by the transmitting station. A critical parameter describing the object electromagnetic behavior in a frequency band is the electromagnetic absorption cross section (ACS). At University "Sapienza" of Rome, a facility was established for space debris ACS measurements, by adapting the large Space Simulator once used for the San Marco satellites and available at the DIAEE (Department of Astronautics, Electrical and Energetics Engineering). The Space Simulator is a metallic cylinder of 3.5 meter diameter and 3.5 meter length, which is very well suited to obtain a large reverberation chamber (RC). This work presents measurements of electromagnetic absorption cross section (ACS) of space debris samples in the frequency range 500 MHz-6 GHz by using the DIAEE reverberation chamber. The use of RC and vector network analyzer (VNA) allows to compute the ACS thanks to an homogeneous distribution of the electromagnetic field within the RC environment, where a mechanical rotating stirrer is also placed and tuned to increase the waves random propagation. Several materials have been characterized and compared, by analyzing samples of approximately same shape and dimensions. The obtained results show that the materials under test behave quite differently at these frequencies in terms of electromagnetic waves absorption, depending on both the density and the material's nature itself. Furthermore, the ACS of pure ice and water, as well as that of and aluminum, have been also measured and compared to the former results in order to evaluate the measurement set-up

dynamic range when different materials scenarios are analyzed. This type of measurements could allow to improve the detectability of space debris or non-operational spacecraft by radar techniques. In fact, once the ACS of an object is known, it will be easier to establish its radar detection possibility, allowing to recognize the space debris.