IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

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EFFECTS OF SPACE THERMAL-VACUUM CONDITIONS ON THE ELECTROMAGNETIC REFLECTIVITY OF SMALL SATELLITES STRUCTURAL PLATES

Abstract

In recent years, the development of a new class of small satellites, such as cube-sat or nano-satellites, have attracted the interest of aerospace industry both for the need of space mission cost lowering as well as for the emerging service capabilities envisaged by the constellations of such objects. In this scenario, one of the most important feature to be taken into account is the satellites detectability, which may represent a severe task since the low radar cross section of such small orbiting items. Moreover, the influence of the space environment on the electromagnetic properties of the satellite exposed surfaces should be carefully assessed, with the aim to preserve the full operability of the spacecraft components as long as it is required. This work presents the microwave free-space characterization of structural plates made of different materials subjected to thermal-vacuum conditioning treatment, in order to establish how harsh space aging factors such as heating-induced thermo-mechanical stress and ultra-low pressure outgassing may affect the original electromagnetic signature. Advanced metallic and ceramic structures, such as titanium- and carbon/carbon-based tiles, were considered in the test campaign; the influence of a novel hybrid nano-coating treatment was also investigated. Preliminary findings showed that an addressed prototypal design of small satellite structural plates is due in order to mitigate the space environment detrimental effects on the surfaces microwave reflectivity, thus avoiding systems weakening in terms of monitoring, tracking and surveillance effectiveness.