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EXPERIMENTAL VALIDATION OF A THEORETICAL MODEL FOR THE STUDY OF ATOMIC OXYGEN DEGRADATION OF SPACE SYSTEMS

Abstract

Effects on Atomic Oxygen (AO) on space systems in Low Earth Orbit (LEO)are today not yet completely known. The cause of this uncertainty is due to the many parameters involved in the mechanical and chemical process of AO erosion and corrosion. The first parameter is the variation of Fluence of Oxygen Atoms, depending on the altitude. The second important parameter is the angle of attack of the spacecraft, that affects both the amount of AO atoms hitting the spacecraft surface and their shifting on the spacecraft surface itself, with consequences on the Erosion Yield. In this paper we will study a CC composite based material with a nano-silica protective coating, created for the specific aim to protect spacecraft, instrumentation and electronics from AO effects. Aim of the paper is the validation of a theoretical damage model, using the experimental data taken from the ground simulation facility present in the Aerospace Systems Laboratory of Sapienza University of Rome. The mathematical model is developed in order to predict the erosion of the coating, taking into account the Fluence used for the experimental campaign as the main parameter, and varying the Angle of Attack. The experimental campaign is then carried on in order to verify the reliability of the model. The facility is capable of a vacuum condition of 10-6 mbar, and a RF Plasma Source from Specs is used for creating a 8.7x1020 Atoms/cm2 Fluence. The specimens can be rotated in order to achieve the different Angles of attack that the system shall face.