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LEO ATOMIC OXYGEN INTERACTION EXPERIMENTS AT THE ANU NATIONAL SPACE TEST FACILITY

Abstract

In Low Earth Orbit (LEO), at altitudes ranging from 200 to 1000 km, the space environment consists of a variety of hazards including atomic oxygen (AO). Since the interaction of atomic oxygen with materials may result in surface erosion, materials for potential use on spacecraft external surfaces must be carefully assessed with respect to the AO threat. For materials with volatile erosion, like polymers, it can result in serious structural and/or optical degradation. Our work will present the details of the experiments performed at the LEO Atomic Oxygen Interaction Facility recently developed at the ANU (Australian National University) National Space Test Facility (NSTF) in Canberra. During these experiments, Kapton-HN material samples were used as a reference to determine equivalence between exposure to atomic oxygen in ground testing and in LEO conditions, where its erosion is well characterized. The erosion of Kapton-HN samples exposed to AO was evaluated based on mass loss measurement using high-precision weighing devices after vacuum dehydration. The mass loss of the Kapton samples was used to derive the effective atomic oxygen fluence and hence the equivalent time in LEO. Finally, silicone material samples protected by a silicone-metal oxide composite coating were exposed to the same calibrated atomic oxygen conditions to study their erosion in LEO conditions.