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CHARACTERISATION OF ORBITAL AERODYNAMIC PROPERTIES OF NEW MATERIALS: GROUND-BASED AND ON-ORBIT EXPERIMENTS

Abstract

The DISCOVERER project is a European-funded project that aims to develop new materials and technologies for satellite operations to become more sustainable at very low Earth orbit (VLEO). The benefits of orbiting nearer the surface of the Earth are counterbalanced by the challenges of operating in an atmosphere of greater density and is mainly composed of highly reactive neutral oxygen atoms. For a spacecraft, the combination of these features results in more damage to the external surfaces and generation of drag, both consequences from the interactions with the atomic oxygen (AO). To improve satellite operation at these altitudes, it is therefore necessary to develop new materials that are better suited to the demanding conditions of VLEO. These materials must be resistant to the erosion induced by AO, whilst also minimising drag. We at The University of Manchester have been working on the task of developing new coatings that meet these requirements. We are also building an experimental facility to perform ground-based tests that characterise the gas-surface interactions, the Rarefied Orbital Aerodynamics Research (ROAR) facility, which is currently being commissioned. On a different front, also as part of the development of these materials, samples were sent to the International Space Station as part of the Materials International Space Station Experiment (MISSE) to be exposed to the real space environment. These samples have recently returned, and they are going to be analysed via different surface characterisation techniques like atomic force microscopy (AFM), scanning electron microscopy (SEM), Raman spectroscopy and X-ray photoelectron spectroscopy (XPS). The results are going to be presented and discussed as well. While the experiments performed on ROAR aim to characterise the orbital aerodynamic properties of the materials, the results from MISSE will provide validation on the material's resistance to space, complementing the data acquired in the lab. In this talk we will present and discuss the most recent developments on both fronts, thus providing a complete description of the

performance of the materials.

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