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DESIGNING A SPACE SIMULATOR FOR TESTING FUNCTIONAL COATINGS THAT CONTROL THE TEMPERATURE OF SATELLITE COMPONENTS.

Abstract

Our goal was to design, build, and validate a prototype space simulator capable of performing ionic damage tests under real-life conditions, including thermal cycling and ion bombardment, on functional coatings used to control the temperature of satellite components. The ion damage considered is that resulting from an ion thruster. The high vacuum chamber developed simulates the thermal and atmospheric conditions to which the satellite is subjected, as specified in the ECSS-Q-ST-70-02C standard. This includes a 90-minute heating/cooling cycle, consisting of two stages: first, a temperature change from -50C to +100C over 60 minutes, followed by a change from 100C to -50C over 30 minutes. A cryogenic pump reduces pumping times by eliminating a large portion of the water vapour present in the vacuum chamber. This allows for the reproduction of an atmosphere in the chamber with a composition similar to that of VLEO orbiters. During the experimental phase, the requirements of ECSS-Q-ST-70-04C were met. As an initial step, the atmosphere of the vacuum chamber was characterized with the ion cannon switched off using both the RGA and PMP (Test 0, Pcamera =10-7 mbar). Tests can be conducted using either the ion cannon supplied with O2 gas or the gas mixture consisting of 56