Martin Marietta Atomic Oxygen Low Earth Orbit Simulation

by

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(Poster Abstract)

An atomic oxygen beam apparatus that produces flux levels and atomic kinetic energy similar to that encountered by spacecraft in low earth orbit (LEO) is coming on line at Martin Marietta Denver Aerospace. The beam appratus consists of an electric discharge ion source, mass filter, decelerator, and neutralizer. Specific design goals include a 1.3 cm beam diamter, a 5 eV beam energy, and a flux density on the order of 1.E+15 cm^{-2} s^{-1}. The total fluence will be on the order of 1.E+19 cm^{-2} for an 8 hour test. The neutral oxygen beam will expose various materials contained with a large target chamber. Within the chamber will be a rather complex suite of instrumentation that will allow real-time studies of material mass loss and reactant species spatial distribution. In addition, a UV solar simulator will aid in the understanding of various synergistic effects.

At present, the AO beam appratus has been checked out through the mass filter. Beam currents in excess of 1 mA at 5000 eV have been measured for nitrogen, oxygen, and hydrogen prior to the mass filter; and beam space charge analysis has been confirmed for a hydrogen beam through the mass filter section. Beam uniformity is 8% across a 1.3 cm diameter atomic oxygen beam at 10 microamperes and 3000 eV. The next phases will include decelerator and neutralizer testing.

Material testing and research in this atomic oxygen environment will include all materials of interest for LEO spacecraft including space station. Results of ground based testing will provide input data to computer modeling of long duration mission analyses of atomic oxygen effects. Ground based testing will also be compared with past and future flight test data through a cooperative effort with Dr. J. Gregory of the University of Alabama in Huntsville as part of the Consortium for Materials Development in Space.