Comparison of Flight and Ground Tests of Environmental Degradation of MISSE-6 SUSpECS Materials

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Comparison of Flight and Ground Tests of Environmental Degradation of MISSE-6 SUSpECS Materials

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Abstract

The effects of prolonged exposure to the LEO space environment and charge-enhanced contamination on optical, thermal, and electron emission and transport properties of common spacecraft materials has been investigated by comparing pre- and post-flight characterization measurements. The State of Utah Space Environment & Contamination Study (SUSpECS) deployed in March 2008 on board the Materials International Space Station Experiment (MISSE-6) payload, was exposed for ~18 months on the exterior of the International Space Station (ISS), before retrieval in September 2009. A total of 165 samples were mounted on three separate SUSpECS panels on the ram and wake sides of the ISS. Electron-, ion-, and photon-induced electron emission yield curves, crossover energies and emission spectra, resistivity, dielectric strength, optical and electron microscopy, UV/Vis/NIR reflectance spectroscopy, and emissivity were tested for pre-flight SUSpECS samples in their pristine conditions.

The purpose of MISSE is to characterize the performance of new prospective spacecraft materials when exposed to the synergistic effects of the space environment.

The second comparison reported here focused on four materials [carbon-loaded polyimide, polyester (Dupont Mylar), Al2O3 (sapphire), and SiO2 (quartz)] that showed some of the most prominent effects of the complex space environment. Samples of each material were mounted on three separate SUSpECS panels on the ram and wake sides of the ISS. Electron-, ion-, and photon-induced electron emission yield curves, crossover energies and emission spectra, resistivity, dielectric strength, optical and electron microscopy, UV/Vis/NIR reflectance spectroscopy, and emissivity were tested for pre-flight SUSpECS samples in their pristine conditions.

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