42nd SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES (D5)
Preventing Spacecraft Failure From Space Environment Effects (3)

Author: Dr. Yugo Kimoto
Japan Aerospace Exploration Agency (JAXA), Japan

PROJECTS FOR SPACECRAFT MATERIALS IN JAXA

Abstract

Space environment effects on materials are very severe and complex because orbital environments include influential factors such as high-energy radiation particles, atomic oxygen (AO), micro-level particles, and UV irradiation. Furthermore, surface degradation associated with contamination can negatively impact optics performance. The space environment and data related to its effects are therefore extremely important for spacecraft design. One approach to solving this problem is ground-based evaluation of materials. Ground simulation technology is therefore a key technology for space exploration. For such evaluations, we utilize our combined space effects test facility, which accommodates the irradiation of independent or coincidental electron beams, ultraviolet (UV) rays, and atomic oxygen. The atomic oxygen source is of laser detonation type. The UV source is a deuterium lamp. A xenon source UV irradiation facility is also available. Research activities of ground evaluation tests are described herein. We also pursue research through spacecraft materials exposure experimentation, which assesses and demonstrates the performance of prospective spacecraft materials. The Micro-Particles Capturer and Space Environment Exposure Device experiments (MPACSEED) were performed on the exterior of the Russian Service Module (SM) of the International Space Station (ISS). Results reveal artificial environment effects such as sample contamination, attitude change effects on AO fluence, and shade effects of UV on ISS. Sample contamination originated from ISS components. Micrometeoroids or debris captured by MPAC might originate from the ISS solar array. Another MPACSEED will be put aboard the Exposed Facility of the Japanese Experiment Module (JEM), the Exposed Facility (EF) on ISS. Results and plans of these experiments are presented. Our group has conducted experiments to evaluate inflammability, off-gassing of equipment, parts and materials used in a manned space environment such as JEM, and “Kibo”, installed in the ISS, to verify the safety of the equipment, parts, and materials. These activities are presented in the final paper.