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Space Environment Degradation of LDEF Thermal Control Paints TRACE TAYLOR, BEN BRADSHAW, JR DENNISON, Utah State University Materials Physics Group — Space environmental degradation of Long Duration Exposure Facility (LDEF) white thermal control coatings was studied. Prolonged exposure modified properties of these spacecraft materials, such as optical reflectivity and emissivity, which regulate satellite thermal control and electron emission and conductivity which determine spacecraft charging and electrostatic discharge. Tests of 1980s vintage LDEF samples are still relevant, as few long-exposed materials are available for study due to the expense of their launch and retrieval. LDEF panels coated with white A276 TiO₂ epoxy-based paint turned, in varying degrees, to yellow or dull brown and showed up to ~2X increase in electron emission. Changes were likely due to UV and atomic oxygen degradation of the epoxy or contamination from outgassing of adjacent materials. Electron emission and optical reflectivity are both affected by surface roughness, oxidation, chemical decomposition, and contamination, all of which evolved for these LDEF samples subjected to electron, ion, and photon radiation, atomic oxygen, and small orbital debris for 69 months. To better understand the nature, composition, and sources of degradation and contamination, measurements of exposed panels, flight control samples, and potential outgassing sources were compared, including: electron yields; scanning electron microscopy and energy-dispersive x-ray spectroscopy; diffuse/specular UV-Vis-NIR reflectivity; and Fourier transform IR spectroscopy.

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