

Space Weathering Experiments on Spacecraft Materials

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A project to investigate space environment effects on specific materials with interest to remote sensing was initiated in 2016. The goal of the project is to better characterize changes in the optical properties of polymers and Mylar, specifically those found in multi-layered spacecraft insulation, due to electron bombardment. Previous analysis shows that chemical bonds break and potentially reform when exposed to high energy electrons. Among other properties these chemical changes altered the optical reflectance as documented in laboratory analysis. This paper presents results of the initial experiment results focused on the exposure of materials to various fluences of high energy electrons, used to simulate a portion of the geosynchronous space environment. The paper illustrates how the spectral reflectance changes as a function of time on orbit with respect to GEO environmental factors and investigates the survivability of the material after multiple electron doses. These results provide a baseline for analysis of aging effects on satellite systems used for remote sensing. They also provide preliminary analysis on what materials are most likely to encompass the high area-to-mass population of space debris in the geosynchronous environment. Lastly, the paper provides the results of the initial experimentation as a proof of concept for space aging on polymers and Mylar for conducting more experiments with a larger subset of spacecraft materials.