

SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

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AN OPEN-ACCESS VISIBLE NEAR-INFRARED SPECTRAL REFLECTANCE LIBRARY OF
SPACECRAFT MATERIALS

Abstract

The task of identifying specific material types in reflectance spectra of artificial Earth-orbiting objects is difficult in part because there are no open-access spectral reflectance libraries of spacecraft materials. Moreover, the limited number of published spectra of some spacecraft materials provide limited information as to the illumination and observational geometry that was used to acquire the presented measurements which severely limits their utility when attempting to compare these with reflectance spectra of artificial Earth-orbiting objects. In response to this problem, a research project was initiated at the Royal Military College of Canada (RMCC) to develop a preliminary open-access database of spectral reflectance measurements of spacecraft materials over a wavelength region between 350 and 1100 nm. A critical requirement of this effort was to obtain, for a specific material sample, spectral reflectance measurements over a wide range of illumination and observational geometries such as are typically encountered by geostationary satellites. With this in mind, a goniospectrometer was designed and built to measure the spectral scattering characteristics of materials that are commonly found on the surfaces of spacecraft. In addition, by collecting spectral reflectance measurements over a wide range of illumination and observational geometries, this instrument provided an opportunity to gain a better understanding of how the spectral energy distribution (SED) of light reflected from such materials behaves as the observational geometry is varied. For this preliminary project spectral scattering characteristics were collected for four types of material samples, namely triple-junction photovoltaic cells, aluminum surfaces, white-coated metallic surfaces and aluminum-coated polyimide films. This paper begins with an overview of the problem that led to this experiment and a description of the goniospectrometer that was built for this research project. The second part of the paper presents initial measurements that were collected with the instrument as well as data products derived from these that may eventually become useful to interpret time-resolved reflectance spectra and colour photometric light curves of artificial Earth-orbiting objects. The paper will conclude with final thoughts on the work that will be required to establish a widely accepted open-access spectral library of spacecraft material.