Portable Infrared Reflectometer Designed and Manufactured for Evaluating Emittance in the Laboratory or in the Field

The optical properties of materials play a key role in spacecraft thermal control. In space, radiant heat transfer is the only mode of heat transfer that can reject heat from a spacecraft. One of the key properties for defining radiant heat transfer is emittance, a measure of how efficiently a surface can reject heat in comparison to a perfect black body emitter. Heat rejection occurs in the infrared region of the spectrum, nominally in the range of 2 to 25 μm. To calculate emittance, one obtains the reflectance over this spectral range, calculates spectral absorptance by difference, and then uses Kirchhoff's Law and the Stefan-Boltzmann equation to calculate emittance.

Portable infrared reflectometer for evaluating emittance.

A new portable infrared reflectometer, the SOC–400t, was designed and manufactured to evaluate the emittance of surfaces and coatings in the laboratory or in the field. It was developed by Surface Optics Corporation under a contract with the NASA Glenn Research Center at Lewis Field to replace the Center's aging Gier-Dunkle DB–100 infrared reflectometer. The specifications for the new instrument include a wavelength range of 2 to 25 μm; reflectance repeatability of ±1 percent; self-calibrating, near-normal spectral reflectance measurements; a full scan measurement time of 3.5 min, a sample size of 1.27 cm (0.5 in.); a spectral resolution selectable from 4, 8, 16, or 32 cm^{-1}; and optical property characterization utilizing an automatic integration to calculate total emittance in a selectable temperature range.

The computer specified to drive the software is a laptop with a menu-driven operating system for setup and operation, a full data base manager, and a full data analysis capability through MIDAC Grams/32 software (MIDAC Corporation, Irvine, California). Spectral

scanning is achieved through the use of a Fourier Transform Infrared Michelson interferometer. In addition, the reflectometer's size and weight make it conducive to portable operation. Although most of the planned uses for the instrument are expected to be in the laboratory, some field operations are anticipated. The only requirement for field operation is a source of power (115 V alternating current).

Glenn took delivery of this world-unique, portable infrared reflectometer in January 1999. It is a resounding success, and an evaluation of thermal control materials for NASA and aerospace customers is currently underway.

Find out more about this research
http://www.grc.nasa.gov/WWW/epbranch/ephome.htm.

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