

A Spectral-Directional Emissometer for Measurements of Thermal Emission from Microstructured Surfaces

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A spectrometric emissometer has been developed for the measurement of polarization-dependent angle-resolved emittance of thin-film and microstructured surfaces. The main components include a heater assembly, blackbody source, optical components, and a Fourier-transform infrared (FTIR) spectrometer, which is used to collect the emission spectra from either the sample or the blackbody. A wire-grid IR polarizer is placed next to an iris to allow either transverse electric (TE) or transverse magnetic (TM) waves to pass through. The emission angle can be varied from 0 to 45°, and the half-cone angle of the collected beam from the sample is approximately 3°. A DTGS detector can be used at temperatures higher than about 700 K in the wavelength region from about 2 to 20 *micrometers*, while a liquid-nitrogen-cooled InSb detector with a higher detectivity can be used at temperatures above 500 K at wavelengths from 2 to 5.5 *micrometers*. The emissometer was calibrated with materials of known emittance such as a SiC wafer. The overall uncertainty of the emittance measurement was estimated to be 0.03. The measured results of coherent thermal emission from multilayered structures, based on Fabry-Perot cavity resonances, and a microfabricated grating structure, based on magnetic resonances, will be presented. The different mechanisms that give rise to the emittance peaks and spectral control of thermal emission will be elucidated.