

Use of a High Temperature Reflectometer for Surface Temperature Measurements

L.M. Hanssen,^{C,S} M. Noorma, A.V. Prokhorov, S.N. Mekhontsev, V.B. Khromachenko, and Cagran
NIST, Gaithersburg, MD, USA
hanssen@nist.gov

NIST has developed a new facility for the characterization of the infrared spectral emissivity of samples between ambient and 1000 °C. For accurate measurement of the sample surface temperatures above 200 °C, the system employs a high temperature reflectometer to obtain the surface temperature of the sample. This technique is especially useful for samples that have significant temperature gradients due to the thermal conductivity of the sample and the heating mechanism used. The sample temperature is obtained through two measurements: (1) an indirect sample emissivity measurement with an integrating sphere reflectometer and (2) a radiance measurement (at the same wavelengths as in (1)) of the sample compared to that of a blackbody source. The results are combined with knowledge of the blackbody temperature and Planck's law, to obtain the sample temperature. The reflectometer's integrating sphere is a custom design that accommodates the sample and heater to allow reflectance measurements at temperature. The sphere measures the hemispherical-near-normal (11°) reflectance factor of the sample compared relative to a previously calibrated room temperature reference sample. The accuracy of the reflectance measurement is tested by means of a set of calibrated samples, both specular and diffuse, and with high and low reflectance values. The reflectometer technique of sample temperature measurement is also evaluated for several types of samples. Temperature results are compared with values simultaneously obtained from embedded thermometers and temperature drop calculations using knowledge of the sample's thermal conductivity.