Final Results of an Inter-Laboratory Comparison of Infrared Emittance Scales

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We report the final results of an international inter-laboratory comparison of their infrared spectral emittance scales. The National Measurement Institutes of 5 countries participated: NIST, PTB, LNE, INRIM and NMIJ. This comparison was initiated through the Consultative Committee on Thermometry – Thermophysical Properties Working Group 9 in order to strengthen the major operative NMI infrared spectral emittance scales and consequently the consistency of radiative properties measurements carried out worldwide. The comparison has been performed over a spectral range of 1 µm to 12 µm, and a temperature range from 23 °C to 800 °C. Samples included in the comparison are potential standards: oxidized inconel, boron nitride, and silicon carbide.The measurement instrumentation and techniques used for emittance scales varied for each NMI, including the temperature ranges, sample sizes, and spectral instrument types (dispersive grating monochromator, Fourier transform infrared, and filter-based, spectrometers). As a result of the difference in temperature ranges, not all NMI scales are compared at all temperatures. However, the overlap of temperature ranges enables at least an indirect comparison between all NMIs. In the conduct of the comparison and in the processing of the results, a number of difficulties needed to be overcome. These will be briefly described and discussed. An analysis of the measurement results has produced comparison reference values (CRV) for each combination of sample, temperature and filter wavelength. The unilateral degrees of equivalence, with reference to the CRV are then determined for each participant, as well as the bilateral degrees of equivalence between each pair of participants. These results are presented and discussed.