

Random Errors in Direct Emissivity Measurements

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In direct emissivity measurements, the radiation emitted by a sample is compared to the radiation emitted by a blackbody at the same temperature and wavelength, and equal geometrical conditions. In order to design a device to carry out this kind of measurements, a key point is the analysis of both the systematic and random error sources. This will permit the choice of the most appropriate measurement method, which minimizes the uncertainty, and also to identify the sources of the largest errors. If the experimental device is already in use, the complete error characterization, in addition to the emissivity error calculation, will permit the improvement of the device capabilities. Thus, a guideline to the experimentalists working in this subject is provided. In this work, a complete study of the random error sources in direct emissivity determination is carried out (the analysis of the systematic errors is performed in Ref.[1]). First of all, the emissivity measurement method and the error estimation methodology are introduced. After that, the influence of the uncertainties of each of the magnitudes used to obtain the emissivity is analyzed theoretically. The most important error sources depending on the measuring parameters have been identified. Finally, as a practical example, the error sources on a low emissivity sample are experimentally studied. In this case, it has been found that, at intermediate temperatures and short wavelength, the emissivity uncertainty is determined by the uncertainty in the sample temperature, whereas at long wavelength, the factor determining the emissivity uncertainty is the temperature error of the surroundings.

[1] R.B. Pérez-Sáez, L. del Campo, M.J. Tello; “Analysis of the accuracy of the methods for the direct emissivity measurements”; *International Journal of Thermophysics* **29** (2008) 1141-1155.