Direct Emissivity Measurements at UPV/EHU: Updated Methods and Uncertainty Budget

Telmo Echániz [C, S]
Department of Applied Mathematics, University of the Basque Country, Bilbao, Basque Country, Spain
telmo.echaniz@ehu.es

Iñigo González de Arrieta
CEMHTI UPR3079, CNRS, Orléans, Centre-Val de Loire, France
Department of Physics, University of the Basque Country, Leioa, Basque Country, Spain

Raquel Fuente
Department of Applied Mathematics, University of the Basque Country, Bilbao, Basque Country, Spain

Gabriel Alejandro López
Department of Physics, University of the Basque Country, Leioa, Basque Country, Spain

A revision and improvement of the experimental device and method for direct emissivity measurements at UPV/EHU are reported. A systematic uncertainty budget compliant with the *Guide to the Expression of Uncertainty in Measurement* (GUM) is also provided in this work. The measurement setup is improved with a better vacuum system and a wider temperature range (300-1273 K). Diffuse and specular infrared reflectance setups for room-temperature measurements are also available. The emissivity measurement equation is modified to take into account the different emissivities of the reference sources, corrections for systematic effects, and a revised radiance factor to avoid correlations between calibration parameters. The uncertainty analysis, which is exemplified for both metallic and ceramic materials, is expanded to account for effects such as thermal gradients, thermocouple accuracies, temperature measurement in ceramics, and uncertainties of the emissivity references. Total emissivities are obtained from directional spectral data by numerical integration, where values outside the measurement range are extrapolated. The uncertainty propagation of the integrated data is made using a Monte Carlo method due to the complexity of the analytical expression and the non-linearity of the parameters. The results obtained in this work are applicable to similar experimental devices built for direct emissivity characterization.