Emissivity Determination by a Virtual Source Method in Laboratory Applications

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Emissivity as a material property has a high importance for temperature metrology and more specifically for non-contact measurements of temperature. Without the precise and reliable knowledge of material emissivity, it would be difficult to determine the temperature of a surface with low uncertainty. Radiation thermometry techniques are used in multiple industrial applications for temperature determination where contact measurements cannot be used. Non-contact measurements of temperature bring many advantages compared to contact methods, although many issues still remain. Because of these issues, non-contact measurements of temperature have relatively high uncertainty and low repeatability. Two fundamental issues associated with the use of radiometric techniques for temperature measurements occur. First is the imprecise information about the emissivity value of the object which is necessary to subsequently determine the object's true surface temperature, and the second is the influence of background radiation from nearby objects and the emission from and absorption by the environment. These issues significantly influence the radiation reaching the detector and the resulting temperature reading. One of the problematic areas that we are going to concentrate on is the determination of emissivity of a solid material. Commonly used procedures for emissivity determinations are based on knowledge of surface temperature, comparison with a material with a known emissivity, radiometric method and table values for a specific material. This paper is going to present an alternative procedure of emissivity determination of a material that has a low dependence on surface temperature of the sample and its application in a primary laboratory.

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