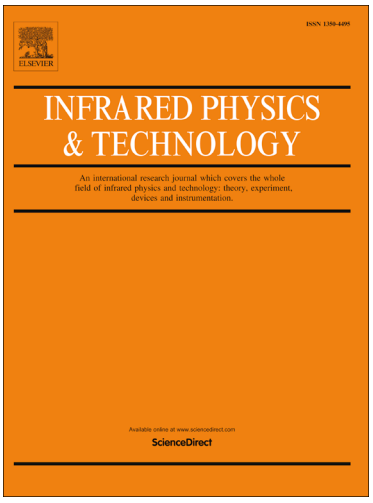

Simple method for calculating the local effective emissivity of the blackbody cavity as a temperature sensor

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PII: S1350-4495(17)30174-3
DOI: http://dx.doi.org/10.1016/j.infrared.2017.07.019
Reference: INFPHY 2342

To appear in: *Infrared Physics & Technology*

Received Date: 5 April 2017
Revised Date: 12 July 2017
Accepted Date: 18 July 2017

Please cite this article as: G. Mei, J. Zhang, S. Zhao, Z. Xie, Simple method for calculating the local effective emissivity of the blackbody cavity as a temperature sensor, *Infrared Physics & Technology* (2017), doi: http://dx.doi.org/10.1016/j.infrared.2017.07.019

Simple method for calculating the local effective emissivity of the blackbody cavity as a temperature sensor

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ABSTRACT: A blackbody cavity is used as a temperature sensor for measuring the average temperature of the molten liquid. Due to the deviation of fabrication and installation, the detector usually receives the radiation from the different regions of the measuring cavity, so the local effective emissivity distribution is an important parameter to evaluate the measuring temperature discrepancy of a blackbody cavity sensor. We introduced the net-radiation method into the finite element method and extended it to calculate the local effective emissivity of blackbody cavities. It was applied to three typical cavities, and the calculated results are in very well agreement with those in references. This method is simple, easy to use, replicable, and very suitable to evaluate and design a novel cavity.

Keywords: Radiation temperature measurement; Blackbody cavity; Local effective emissivity.

1. Introduction

Blackbody cavities are widely applied as standard sources in radiation thermometry and optical radiometry. They also can be used as a measuring cavity of a temperature sensor [1,2] immersed into liquid for measuring the average temperature, especially for molten liquid which has erosive characteristic. In practice, it can sometimes be observed that the indicated temperature is below the real temperature of the molten steel, one of the main reasons is the lower effective emissivity of the cavity. It is due to the deviation of fabrication and installation, which cause that the detector receives the radiation from the