

Design and construction of an InGaAs transfer standard for absolute calibration of radiation thermometers

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The Centro Español de Metrología (CEM) in collaboration with the Instituto de Óptica of the Consejo Superior de Investigaciones Científicas (IO-CSIC) are able to calibrate filter radiometers/radiation thermometers with direct traceability to the radiant watt at 650 nm wavelength. This allows CEM to measure thermodynamic temperature in the range from 900 °C to 2500 °C. Currently, some modifications in the calibration set-up have been done to measure at infrared wavelengths (1.6 μm), in order to extend the thermodynamic temperatures measuring range down to 400 °C. In this case, the radiance/irradiance standards are based in InGaAs detectors, instead of the Si ones used in the visible range set-up. The design, construction and characterization of these standards will be described in this work.

INTRODUCTION

The CEM visible calibration set-up has been fully described in [1] and it is based in a supercontinuum laser, a monochromator, an integrating sphere and a Si trap detector. The calibration method is based on the radiance comparison between the Si trap detector and the filter radiometer/radiance thermometer. The signal of the trap is measured with a Keithley 6480 subfemto-amperimeter (with the preamplifier unit close to the detector).

The main modifications needed for using this set-up at 1.6 μm wavelength are: the use of a new grating at the monochromator and a new radiance standard based in InGaAs detectors.

DESIGN OF THE InGaAs STANDARD

The InGaAs standard is based in Hamamatsu G8370-10NA detectors (10 mm in diameter and windowless). The standard main body is cooled with water and it

has a precision aperture 5 mm of diameter at the entrance. It is made on aluminium. Nextel® coating has been used to cover all the parts reachable by infrared radiation. The design of the transfer standard can be seen in figure 1.

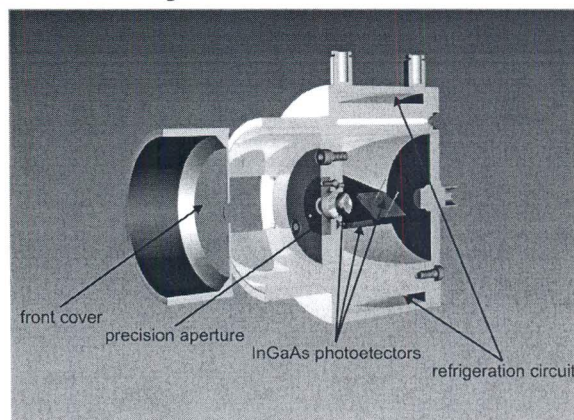


Figure 1. InGaAs transfer standard overview

The instrument allows different configurations:

- one single detector at normal incidence to the incoming light, see figure 2
- three detectors in a trap configuration, see figure 3
- one detector + an interference filter (in the case it is used as a standard filter radiometer), see figure 4

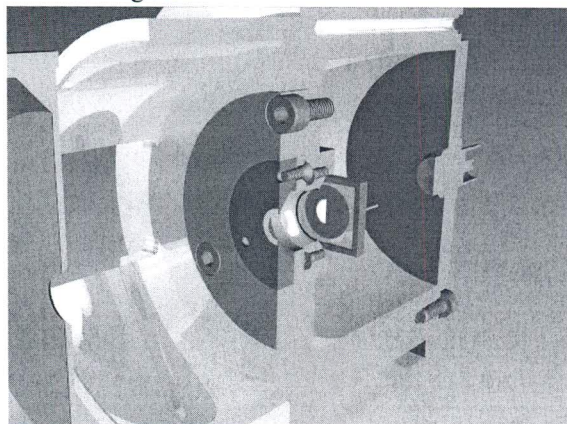


Figure 2. Single detector configuration

