



## RADIANCE AND EMISSIVITY MEASUREMENTS OF PATCHES AT A TEMPERATURE OF 37°C.



Pursuant to Contract no. 0002874 of 19/06/2015 agreed between D.Fenstec Srl and the CNR Institute of Nanoscience, the following are the results of the optical characterisation measurements for samples received from D.Fenstec Srl in the spectral range between 2 and 24  $\mu\text{m}$ .

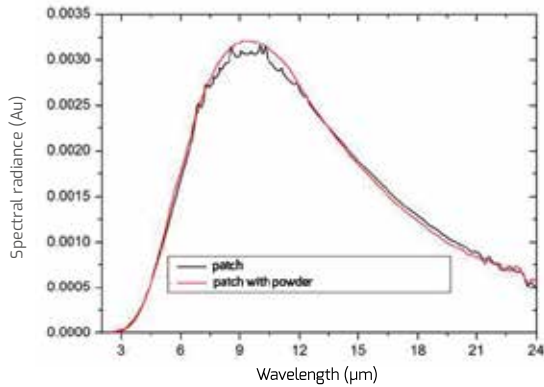
The measuring instrument used consists of a spectrometer, with the relevant control software, equipped with an MCT/A detector, sensitive within the range 0.8 to 35  $\mu\text{m}$ . The equipment was aligned and calibrated using a blackbody source at a temperature of  $T=37^\circ\text{C}$  in the wavelength range 4-14  $\mu\text{m}$ .

A heating element was used as both a reference blackbody source and as an oven for warming the samples.

For the measurements in question, two identical substrates of material opaque to IR radiation were used. Subsequently two samples of untreated patches supplied by D.Fenstec Srl were applied to both substrates. On only one of these a certain quantity of powder was deposited in such a way as to cover the whole surface of the patch. The two substrates obtained in this way were heated and kept at a temperature of  $37^\circ\text{C}$  by means of the heating element with thermostatic control. At this temperature, a spectrum in the wavelength range between 2 and 24  $\mu\text{m}$  was obtained, for the sample with the powder as well as for the one without, and the two spectrums were compared.

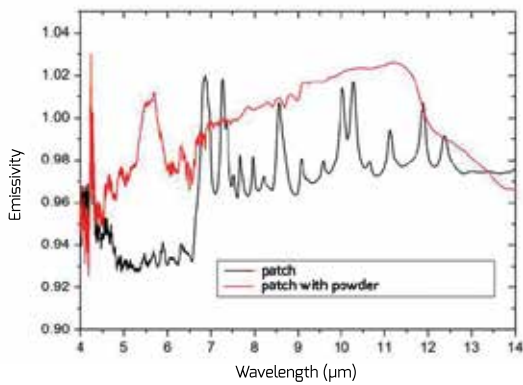
The measurements for each sample were repeated on three different days in order to ascertain the repeatability of the results. The graphs below show the trends, in terms of both spectral radiance (Fig.1) and emissivity (Fig.2), recorded for the two samples.





**Fig. 1**

Spectral radiance at T=37° C: patch without powder (black), patch with powder (red).



**Fig. 2**

Emissivity at T=37° C: patch without powder (black), patch with powder (red). The emissivity values shown refer to measurement with the blackbody source prepared in the laboratory.

The results obtained for the sample patch with powder demonstrate a spectral radiance which, within the spectral range between 7.5 and 13  $\mu\text{m}$ , is higher than the sample patch without powder by  $5 \cdot 10^{-4} \text{ W/cm}^2$ . In addition, in relation to the blackbody prepared by us for this type of measurement, the patch with powder proves to have higher emissivity than the sample without powder over almost all of the wavelength range between 4 and 14  $\mu\text{m}$ , with a deviation of  $(0.05 \pm 0.02)$  at the 10.8  $\mu\text{m}$  wavelength.

Pisa, 07/07/2015

Prof. Mauro Tonelli



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Attn.: Mr. Gaetano Bertinato

**SUBJECT: Clarification on the “Radiance and emissivity measurements of patches at a temperature of 37°C” report dated 07/07/2015.**

In reply to your request, please find below further clarification on the results contained in the “Radiance and emissivity measurements of patches at a temperature of 37°C” report dated 07/07/2015 (Contract No. 0002874 dated 19/06/2015 between D.Fenstec Srl and Istituto Nanoscienze del Consiglio Nazionale delle Ricerche).

1. The full spectral radiance, calculated over the wavelength range between 7.5 and 13  $\mu\text{m}$ , for the sample patch with powder prepared by us proves to be 3% greater than the corresponding full radiance calculated for the sample patch without powder.
2. The emissivity value at the wavelength of 10.8  $\mu\text{m}$  for the sample patch with powder prepared by us proves to be 5% greater than the emissivity value of the patch without powder at the same wavelength. In other words, the energy emitted by the patch with powder at the wavelength of 10.8  $\mu\text{m}$  is 5% higher than that emitted by the patch without powder at the same wavelength.
3. The sample patch with powder prepared by us shows an emissivity of around 100% in the range 7-11  $\mu\text{m}$ .

Pisa, 16/07/2015

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