Grenoble 14th May 1996
N/REF Gm/96-279/FO/Sn

(this report is also in French in the source doc.pdf file – ed)

REPORT OF TEST No. CM/96-30
OPTICAL AND THERMAL CHACTERISATION OF A PAINT (INSULTEC)

This report of tests vouches for the characteristics of samples supplied for the tests but does not prejudge the characteristics of similar products. Therefore it does not constitute a certificate of description in the sense of the law of 10th January 1978

The beneficiary of the report of test will have to make it's true range very clear if it is being used for commercial ends. The sanctions article 24 makes provisions for can be taken against the offending beneficiary.

At the request of: SDCBP1018 97247 FORT DE FRANCE CEDEX

This report of tests includes 5 pages numbered 1/5 to 5/5

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CSTB
LE FUTURE EN CONSTRUCTION

OBJECT

On a painted steel sheet, it is a matter of:

- Measuring the factor of reflection of solar energy
- Measuring the factor of reflection of ultra violet rays
- Comparing the temperature of 2 samples (one with paint & the other without paint) under exposure and controlled atmosphere

SAMPLES:

The samples are made up of galvanized steel sheet coloured again with a paint called Insultec. The 3 samples have been supplied by S. Le Coq, dela Societe, S.D.C.

TESTING METHOD:

The factors of transmission and of refraction are measured by using the method of Spectrophotometre. The calculations of optical factors is stemmed from the Standard plan for pr EN 410 of the European Committee of Standardisation " Glass in Construction – determination of the luminous transmission of the direct Solar transmission of Ultra Violet Rays and of the factors derived from the windows".

The temperature is measured according to the method described in Paragraph 2.

Done at St. Martin d'Heres, 14th May 1996

Francois OLIVE Ingenieur Responsible des Essais

Robert COPE Chef du Service Materioux

1 - METHOD USING THE SPECTROPHOTOMETRE

The measurement is achieved with the Spectrophotometre PERKIN ELMER type Lambda 19 equipped with light sources permitting to cover the spectral range from 0.280 to 2.5 μm and equipped with an incorporated sphere permitting to stop in the spectral domain, all of the radiance transmitted (direct and diffused).

1.2 Measurement and calculations of the factors of reflection.

Fig.1 shows how the sample is placed in relation to the sphere and the incident radiance. You obtain therefore, with means of a monochrometer, the spectrum P nh (λ) that is to say, the normal/hemispheric reflection according to the wavelength.

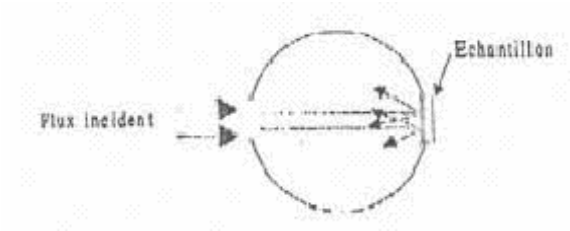

Figure 1: Measured normal hemispheric reflection

In order to calculate the factor of reflection of Ultra Violet Rays P^{nh}_{uv}, you use the formula:

$$\rho^{nh}_{uv} = \frac{\sum_{\lambda_1}^{\lambda_2} \rho^{nh}_{\lambda} U_{\lambda} \Delta\lambda}{\sum_{\lambda_1}^{\lambda_2} U_{\lambda} \Delta\lambda}$$

U is the relative distribution of the ultra violet part of the solar spectrum
<λ is the distance of the wavelength
the field of balance is λ_1 = 282.5 nm
the field of balance is λ_2 = 377.5 nm

In order to calculate the factor of reflection of solar energy P^{nh}_{e}, you use the formula:

$$\rho^{nh}_{e} = \frac{\sum_{\lambda 1}^{\lambda 2} \rho^{nh}_{(\lambda)} S_{(\lambda)} \Delta\lambda}{\sum_{\lambda 1}^{\lambda 2} S_{(\lambda)} \Delta\lambda}$$

S (λ) is the efficiency of the Solar spectrum.
<λ is the distance of wavelength
the field of balance is λ_1 = 300 nm
the field of balance is λ_2 = 300 nm

2 - Measurement of the temperature under exposure and controlled atmosphere

2.1 The source of radiance

The radiance is stemmed from an opening of 500mm diameter carried out on a sphere of integration of 3m diameter in which is placed a halogen lamp of 2kw with a tungsten filament. A screen prevents all radiation from the lamp directly reaching the opening.

The opening defines thus a source of about 1,000 W/m^2 whose radiance is homogenous and perfectly diffused (coming from all directions) the luminous flux is controlled with the help of 2 Pyranometers .

2.2 - Measurement of temperature

The temperature on the back of the samples, (side not exposed to the radiance) is measured with the help of thermo probes with platinum resistance type P-100-DIN43760. The temperatures are measured simultaneously on both samples. The samples are placed vertically to 50mm of the source defined in para. 2.1. The measurements are carried out in a room air conditioned to 23^0C. No forced convection is applied.

2.3 - Preparation of samples,

Two samples of 120 x 120 mm are cut up from the same painted steel sheet. The samples are fixed in a wooden frame. The painted side of the first sample is exposed to the radiance, through an aperture of 100mm diam., the second is cleaned in order to suppress all traces of paint, then exposed through an aperture of 100mm diam.

3 - RESULTS.

3.1 - Factors of reflection

The values of the factors of reflection of the ultraviolet ray and of the solar energy are given in the table below. The accuracy given by the spectrophotometer on the factors is 1%.

	P^{nh}_{UV}	P^{nh}_{E}
Sample with Insultec paint	9.4%	83.2%

3.2 Thermal tests

The value of the temperatures as well as of the energy of the incident radiance are given in the table below. The accuracy on the measurement of temperature is plus or minus 1.5%, the accuracy on the measurement of flux is plus or minus 2%.

	Without radiance		With radiance	
	Temp ^{0}C	Flux W/m^2	Temp ^{0}C	Flux W/m^2
Sample with Insultec paint	22.9	7	41.5	1270
Sample without paint	23.0	7	56.8	1270