Vipac Engineers & Scientists Ltd

Brandy Pines Pty Ltd

Insultec Coatings

Measurement of Solar Heat Gain Properties

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INSULTEC COATINGS MEASUREMENT OF SOLAR HEAT GAIN PROPERTIES	
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1.0 INTRODUCTION

Vipac Engineers and Scientists Ltd. was commissioned by Brandy Pines Pty Ltd. to measure the solar heat gain properties of Insultec Coatings to compare with those properties for commercially available roofing material. The absorbance of several samples of Insultec coatings and commercially available metal roofing materials were measured using a UV/IR Spectrophotometer. These measurements were then used to calculate the Solar Heat Gain (SHG), Solar Heat Gain Factor (SHGF), Shading Coefficient (SC), Overall Heat Transfer Coefficient (U-Value), and Maximum Surface Temperature, according to methods described in ASHRAE handbook 1993, Chapter 27.

The types of samples used for the test are;

Colorbond – Heritage Red

Colorbond – Off White

Colorbond – Mist Green

Galvanised Steel

Insultec – sample 1 - ≅0.01 mm thick coating

Insultec – sample 2 - ≅0.05 mm thick coating

Insultec – sample 3 - ≅0.01 mm thick coating

Insultec – sample 4 - ≅0.05 mm thick coating

Since only a flat sample was used for each test as per ASTM E903-82 the measured absorptance is diffused absorptance for normal incidence of the solar beam. The effect of Greco or Roma profile is not included in this procedure.

2.0 METHODOLOGY

One test piece of dimension 13 mm x 50 mm was cut from each type of sheeting. The test piece was then placed in a GBC 916 UV-Visible Spectrophotometer and a PE-IR infra red spectrophotometer. The absolute diffused absorbance of each sample was measured for wavelengths 190 nm to 2500 nm (Figure 1) using Integrating Sphere attachment. The solar absorptance for the total solar spectrum was evaluated using the Air Mass 1 Spectrum (Figure 2)

The solar absorptance of the samples were calculated using the following formula in the wavelength range 190 nm – 2500nm.

$$\% \text{ Absorptance} = \frac{\Sigma a(\lambda) \times S(\lambda)}{\Sigma S(\lambda)} \times 100$$

where, $S(\lambda)$ is the Air Mass 1 solar spectrum and $a(\lambda)$ is the absorptance of the sample.

The above measurements were used with the typical properties of Galvanised steel to evaluate the Solar Heat Gain (SHG), Solar Heat Gain Factor (SHGF), Shading Coefficient (SC), Overall Heat Transfer Coefficient (U-Value), and Maximum Surface Temperature, using the methodology described in ASHRAE Fundamentals Handbook, Chapter 27

3.0 RESULTS

The measured absorbance spectra were identical for the four Insultec Coated samples with different thicknesses. This implies that the solar heat transfer properties of the coatings do not depend on the coating thickness when the thickness is greater than ≅0.01mm. In the results shown in Figure 1 only one curve is used to represent all Insultec samples.

The following standard conditions were assumed for the calculation of Solar Heat Gain Properties.

Solar Bean Intensity	782	W/m^2.
Outside Temperature	32	^0C
Inside Temperature	24	^0C
Outside Wind Velocity	3.3	m/s
Inside Wind Velocity	0	m/s
Thermal Conductivity	50.5	W/m/K
Emissivity of Air	0.93	

The results obtained are shown in Table 1.

Table 1: Solar Heat Transfer Properties of the Samples Tested

Sample	Solar Absorbance %	Overall Heat Transfer Coefficient (U) [W/m2/K}	Maximum Surface Temp [C]	Solar Heat Gain (W/m2)	Solar Heat Gain Factor (SHGF)	Shading Co efficient (SC)
Heritage Red	80.2	5.64	49.9	152.0	0.19	0.22
Off White	24.7	5.42	36.8	52.4	0.07	0.08
Mist Green	54.2	5.55	44.2	108.3	0.14	0.16
Galv. Steel	29.3	5.44	38.0	61.6	0.08	0.09
Insultec	**15.1**	**5.38**	**34.2**	**32.7**	**0.04**	**0.05**

The errors associated with the measurement and calculation of the above results are less than ± 3%.

Based on the above results Insultec Coatings have the best solar insulation properties. In terms of Solar Heat Gain, Insultec Coated sample is 38% better than the Off White – Colorbond sample and 47% better than the Galvanised Steel sample. The maximum surface temperature of the Insultec sample is only 2.2 ^0C higher than the ambient temperature whereas the corresponding temperature difference for Colorbond- Heritage Red sample is 17.9 ^0C. The Colorbond- Heritage Red sample show the worst solar insulation properties.

Based on the above test results and analysis it can be concluded that the Insultec Coatings provide a significant benefit in solar insulation when compared to the commonly used commercial metallic roofing materials.

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For
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By
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Figure 1: Absolute Diffused Absorption of the Samples Tested

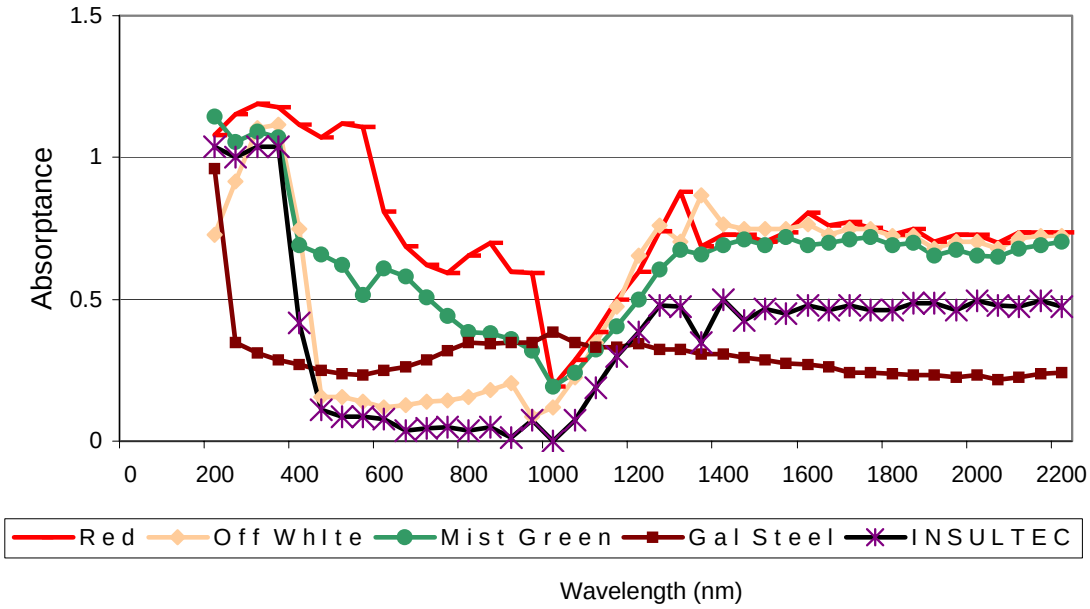

Figure 2: Solar Radiation Spectra (Air Mass)