Application Note
UV-0011

Evaluation of a Solar Reflective Paint Material using the V-670

Introduction

In recent years, solar reflective paints have attracted attention as a way to combat the 'heat island' phenomenon and as a sustainable household building material. Heat islands are urban areas where the temperature is significantly hotter than the surrounding rural areas and occur where buildings, roads, and infrastructure have replaced a majority of the natural landscape and vegetation.

V-670
UV-Vis Spectrophotometer

As shown in Figure 1, solar radiation has significant energy in the near IR region. Solar reflective paints are specifically designed to reflect NIR light with higher efficiency than general usage paints. Therefore, these materials can be used to reflect the heat from the surface of a building, reducing the thermal energy, and cooling the coated object.

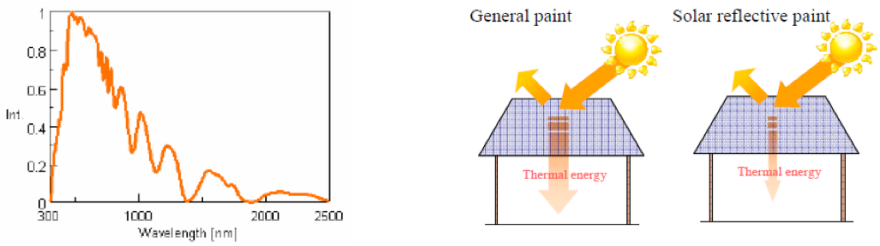

Figure 1. A standard solar intensity spectrum (left) and thermal energy reduction using solar reflective materials (right).

This application note evaluates solar reflective paints using a V-670 UV-Visible/NIR spectrophotometer with integrating sphere.

Keywords

V-670 uv-visible/nir spectrophotometer, UV-Visible/NIR, Materials, Near-infrared, ISN-723 Integrating sphere, VWCD-790 Color diagnosis, VWST-774 Solar/visible light measurement

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Experimental

Two aluminum plates were painted with both a general water-based paint and a solar reflective paint in two different colors and dried completely for 7 days.

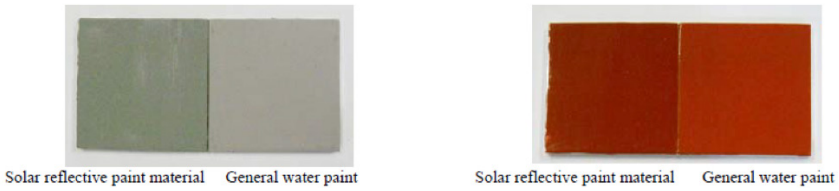

Figure 2. Grey and red samples painted with reflective and general paint.

Measurement Conditions			
Measurement Range	300-2500 nm	Data Interval	1 nm
UV-Vis Bandwidth	4.0 nm	NIR Bandwidth	2.0 nm
Scan speed	1000 nm/min	Response	Fast

Results

The diffuse reflectance of the four samples was measured and the spectra are shown in Figure 3. The data illustrate that samples with the solar reflective material paint have higher reflectance in the NIR region than the general water-based paint.

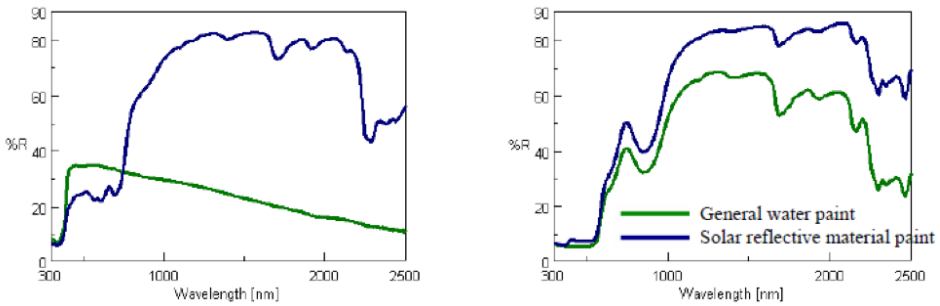

Figure 3. Diffuse reflectance spectra of grey (left) and red (right) samples with the general water-based paint (green) and solar reflective material paint (blue).

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Using the diffuse reflectance spectra, the color analysis of both paint materials was performed with the Color Analysis Program and the results are shown in Figure 4. The data illustrate very similar color positions for both the different grey and red paint samples on the chromaticity diagram, even though the paints have very different reflectance characteristics.

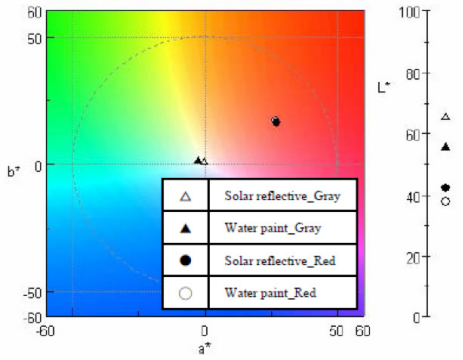

Figure 4. Chromaticity diagram.

The reflectance values of solar light at three different wavelength ranges was also calculated for the paint samples using the Solar/visible light measurement program. The results are shown in Table 1 and indicate that the solar reflective paint material has higher reflectance values in all wavelength regions, as well as the NIR region.

Table 1. Calculated values of reflected solar light.

	Gray		Red	
	Solar Reflective	**Water Paint**	**Solar Reflective**	**Water Paint**
UV-Vis	24.09	32.19	21.67	17.60
NIR	70.39	26.68	64.98	50.61
UV-Vis/NIR	44.30	29.75	40.53	31.95

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