test results Liquisol 4ever blue

BAU 2011

WERELD PREMIERE
PREMIÈRE MONDIALE
WORLDWIDE RELEASE
WELTNEUHEIT

17-22 JAN 2011
MÜNCHEN

Fraunhofer IPA	**Fraunhofer Institut für Produktionstechnik und Automatisierung (IPA)** **Abteilung Lacke und Pigmente** Allmandring 37, D-70569 Stuttgart Tel.: +49 711 68780-0, Fax: +49 711 68780-79	
Bericht – Nr.: PH031/10	Gruppe Physik	*Seite 1 von 5*

Test report

Client:
Liquisol
Mr. Tom Huymans
Lindberg 52
2520 Oelegem
BELGIUM

Order No.:

Subject of testing:
3 panels
- A: PMMA glass without coating
- B: PMMA glass with „Liquisol 4everBlue“ single layer coating
- C: PMMA glass with „Liquisol 4everBlue“ double layer coating

We received the samples on Monday, 23th August 2010

Objective of testing:
Measurement of transmission and reflection
Calculation of TSR, TSA, TST and VLT using solar irradiance data according ASTM G173-03 “Reference Spectra Derived from SMARTS v. 2.9.2”

Start of tests:
06.09.2010

End of tests:
11.09.2010

Investigation method
UV-VIS-NIR- Spectrometer Lambda 900 (Perkin Elmer)
Spectral range: 250 to 2200 nm
Data interval: 1 nm
Slit 3 nm
Calibration (base line): 0% and 100% reflection (white standard)

Samples

The area covered by the measurement is about 4 x 11 mm² in transmission and 5 x 12 mm² in reflection, therefore a statistically relevant area is covered by the measurements.

Sample thickness was measured by scratching away the coating and measuring the step height with a profilometer.

Sample B (1 layer) was 13 ± 0.9 µm thick, sample C (2 layer) 25 ± 2.2 µm.

Reflectance and Transmittance Spectra

Reflectance and Transmittance Spectra are shown in Fig. 1 and 2. The coated side was directed towards the incident beam.

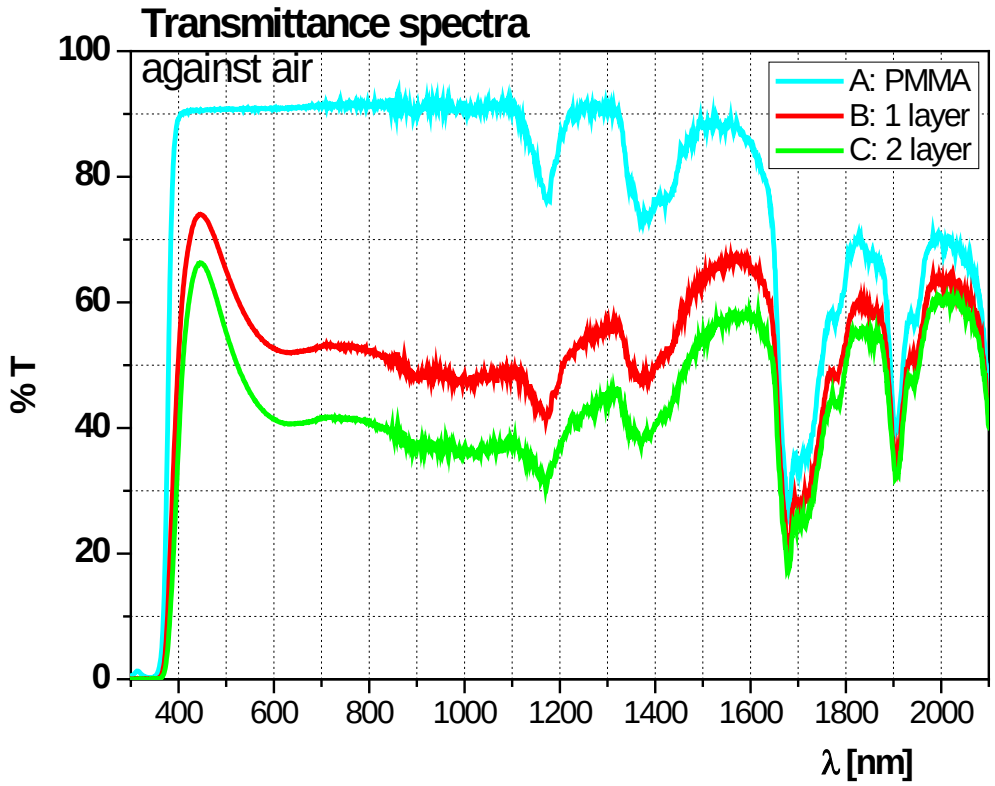

Fig. 1: Transmittance spectra against air

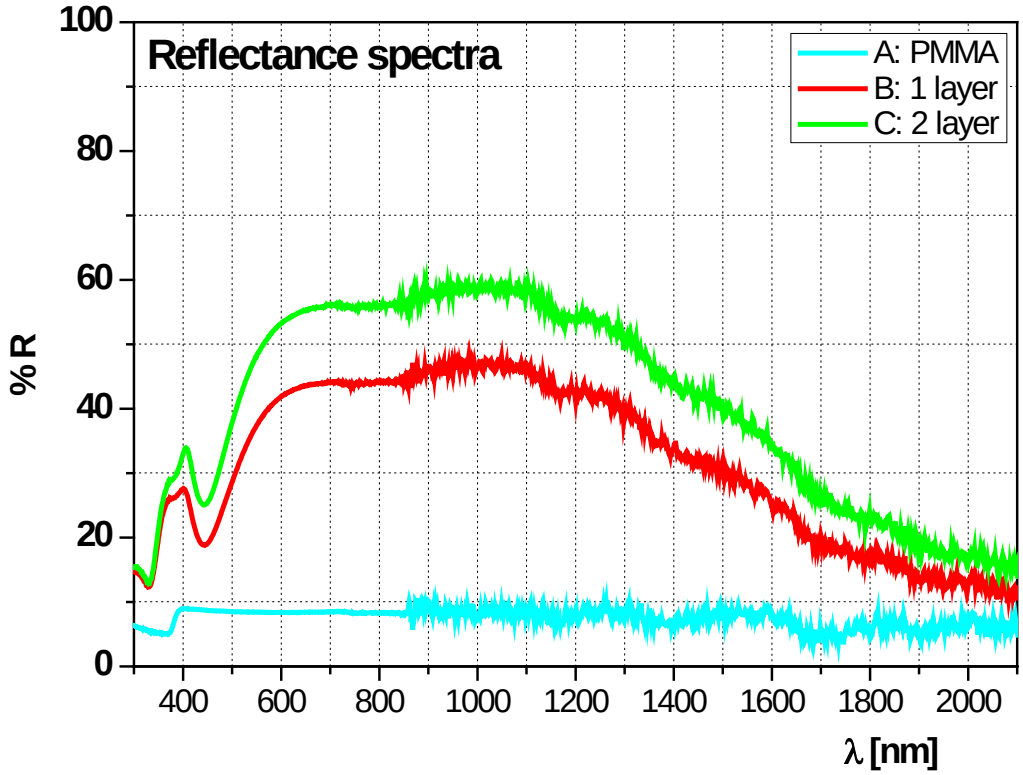

Fig. 2: Reflectance spectra

Calculations

Multiplying the solar irradiance data from “ASTM G173-03 Reference Spectra Derived from SMARTS v. 2.9.2” (Direct+circumsolar) with the measured transmittance (against air) and reflectance spectra, power spectra of the reflected and transmitted radiation can be calculated (Fig. 3 and 4). These spectra were integrated in the full range (300 to 2100 nm) and in the visible light region (380 to 780 nm, shown by the blue dashed lines). Results are listed in table 1 and plotted in Fig. 5.

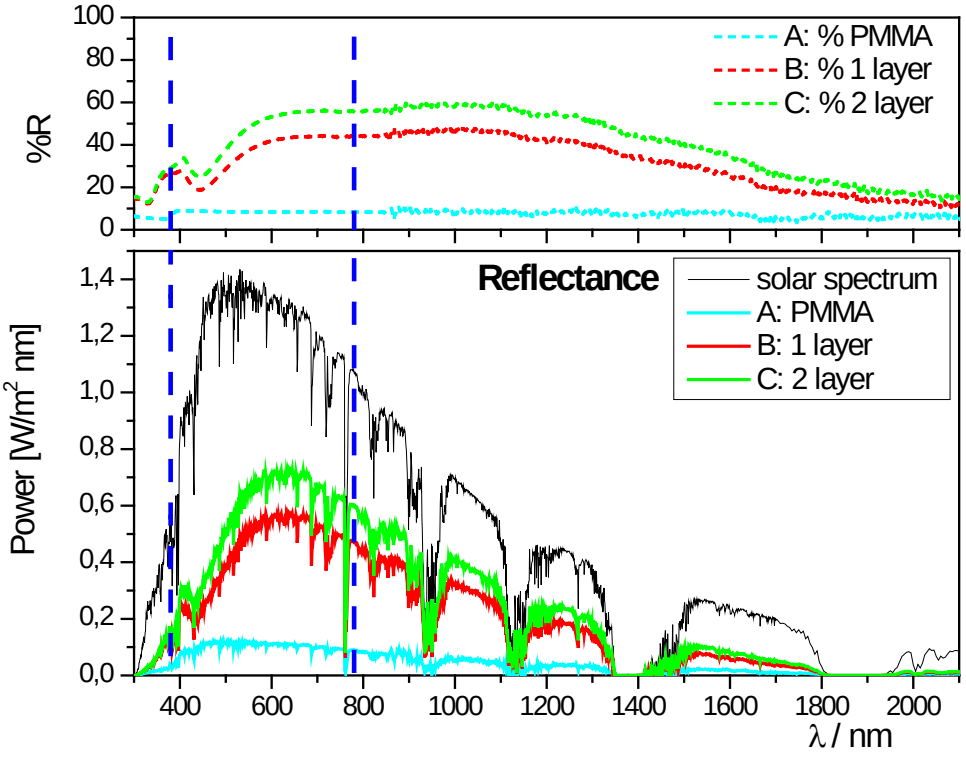

Fig. 3: Power spectrum of reflected radiation

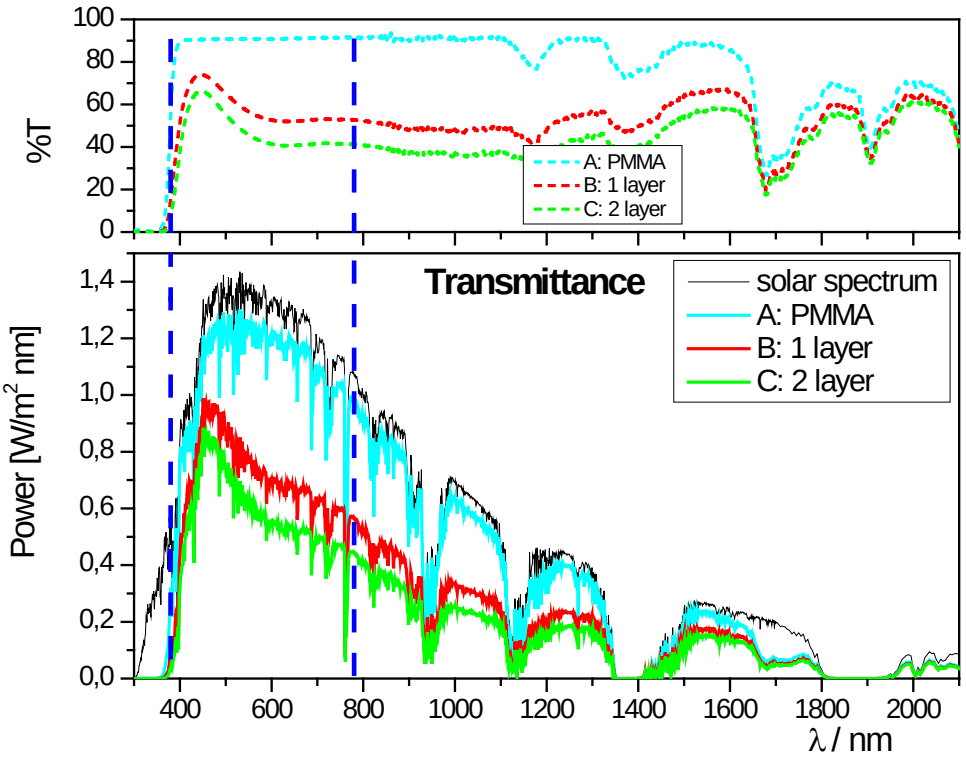

Fig. 4: Power spectrum of transmitted radiation

Table 1: TST, TSR, TSA and VLT

	Trans	Refl	Abs		Trans	Refl	Abs
	[W / m²]				[%]		
total spectrum (300 to 2100 nm)					respect. solar: 870 W/m²		
PMMA	754	71	44		86,7%	8,2%	5,1%
1 layer	464	326	79		53,3%	37,6%	9,1%
2 layer	374	417	79		43,0%	47,9%	9,0%
vis. spectrum (380 to 780 nm)					respect. solar: 467,8 W/m²		
PMMA	86,7	8,2	5,1		90,7%	8,5%	0,8%
1 layer	53,3	37,6	9,1		57,7%	36,1%	6,2%
2 layer	43,0	47,9	9,0		47,1%	46,3%	6,7%

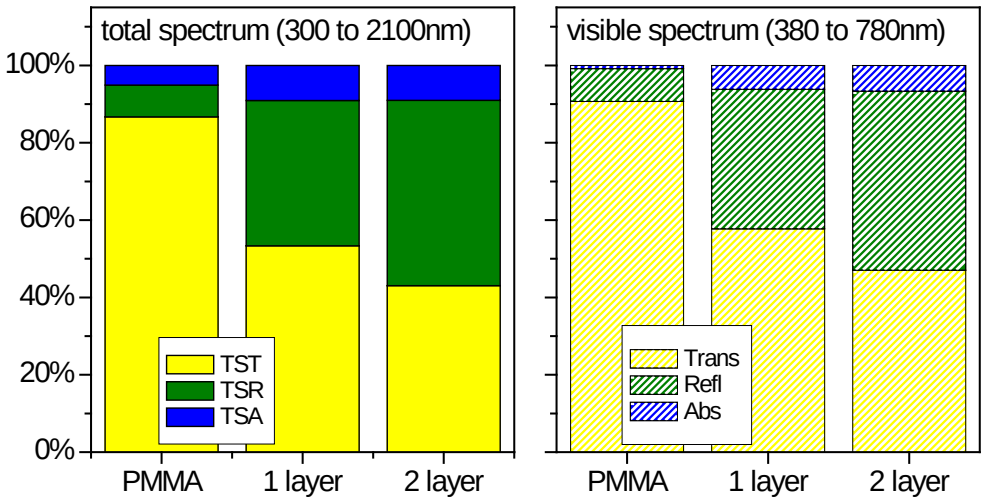

Fig. 5: Reflected, absorbed and transmitted part in percent of the radiation of the whole spectrum (300 to 2100 nm) and in the visual range (380 to 780 nm)

The test results reference to the subjects tested only. Without permission of the IPA the test report may not be published in whole or in extracts.

Stuttgart, 13.09.2010

i. A.
Dr. Rolf Nothhelfer-Richter
Group manager Physics

i.A.
Gabriel Kunz
Tester Physics