Fraunhofer ISE

Report TAG3-UA-1212-E08

Testing of the transmission and the g-value of a polycarbonate multiwall panel AKYVER 16/7 IR Control White

for:
Kaysersberg Plastics
BP 27 – 77 route de Lapoutroie
68240 Kaysersberg
France

prepared by:
Ulrich Amann
Dr Helen Rose Wilson
Johannes Hanek

18th December, 2012

Address:
Fraunhofer Institute
for Solar Energy Systems
TAG Division
Heidenhofstraße 2
79110 Freiburg
Germany

Contents

This report consists of 8 pages. The results may not be published incompletely or in a misleading context. The measurement report may not be duplicated in extracts without the permission of Fraunhofer ISE in written form.
The report is the property of Kaysersberg Plastics, Kaysersberg. It may not be passed on to third parties without written permission from Kaysersberg Plastics.
The results in this report refer to the tested samples. Fraunhofer ISE did not have any influence on the selection of samples.

Fraunhofer Institute for Solar Energy Systems ISE
Division of Thermal Systems and Buildings (TAG)
Group Solar Façades
TestLab Solar Façades

Freiburg, 18th December, 2012

Dipl. Ing. (FH) Ulrich Amann
Manager of TestLab Solar Façades

Dr Helen Rose Wilson
TestLab Solar Façades

1 Description of samples

The following sample was supplied for testing by the client, Kaysersberg Plastics, Kaysersberg:

AKYVER 16/7 IR Control White
7-layer grey polycarbonate multiwall panel with external IR-protective layer
Area (external dimensions): 1000 mm x 1002 mm
Total thickness: 16 mm
Date of delivery: 19th October, 2012
Fraunhofer ISE sample ID: KS308003

2 Description of measurement methods

The TestLab Solar Façades has been accredited for testing windows, façades and other products according to DIN EN ISO/IEC 17025:2005 since 2006. The accreditation encompasses the determination of the g value (total solar energy transmittance), transmittance, reflectance and U value by measurement and calculation. The flexible accreditation also includes procedures developed at Fraunhofer ISE which go beyond the state of the art documented in standards. The DAkkS registration number for the accreditation is D-PL-11140-03-01.

2.1 Description of spectral transmittance measurements for multiwall polycarbonate sample

The spectral normal-hemispherical transmittance of the multiwall polycarbonate panels was measured for near-normal incidence over the spectral range from app. 370 nm to app. 1980 nm with a Tec5 diode array spectrometer and an integrating sphere. The integrating sphere has a diameter of 650 mm and is coated with PTFE.
The spectral normal-hemispherical transmittance of all samples was also measured using a Perkin-Elmer Lambda-900 spectrometer and a 220 mm integrating sphere also coated with PTFE. These spectra were used to complete the spectra described above to cover the range from 280 nm to 2500 nm.

The angle of incidence was 0 ° for the transmittance measurements.

The samples were mounted with the outside layer oriented toward the lamp.

2.2 Description of the calculation procedure

The light and (solar) energy values for the samples were calculated according to EN 410 on the basis of the measured normal-hemispherical transmittance using an EXCEL table which has been validated in house.

2.3 Description of the total solar energy transmittance measurement

The total solar energy transmittance g (solar factor) was determined for the sample with the calorimetric measurement facility GKAL3 with a solar simulator (see Figure 1). The sample was mounted with air-tight sealing material in front of the absorber of the calorimeter. Lateral heat losses were minimised with an insulating frame of polystyrene. The sample was mounted with the partitions oriented vertically.
With a cross-flow ventilator, wind conditions were established on the outer surface of the sample with a wind speed of 3-4 m/s. This corresponds to an external heat coefficient of $h_e = 25 \pm 3$ W/(m^2K), according to the standard conditions of DIN EN 410.
The distance between the inner surface of the sample and the absorber was chosen such that the internal heat transfer coefficient was $h_i = 7.7 \pm 1$ W/m^2K. This corresponds to the standard conditions according to DIN EN 410.
The absorber surface temperature (internal temperature for the measurement) and the air temperature in the measurement chamber (external temperature) was about 25 °C.
The measurement was done with normally incident radiation (angle of incidence 0°). The irradiance level on the sample was about 530 W/m².
Depending on the position of the lamps, the light from our solar simulator has a divergence of 3°-12°. The lamps were set up such that the resulting divergence was as small as possible in the plane in which the tested sample in question would react sensitively to divergent radiation. In the case of venetian blinds, for example, this is the direction perpendicular to the plane which is defined by the incident radiation direction and the axis of the slats.
The spectrum of the incident light – generated by the solar simulator with HMI 4000 lamps – is practically identical to the standard spectrum specified in EN 410. However, the slight mismatch between the two spectra results in a small difference in the solar transmittance of the sample. The measured g value was corrected spectrally by adding this difference in transmittance to the g value (based on the assumption of a small secondary heat gain value).

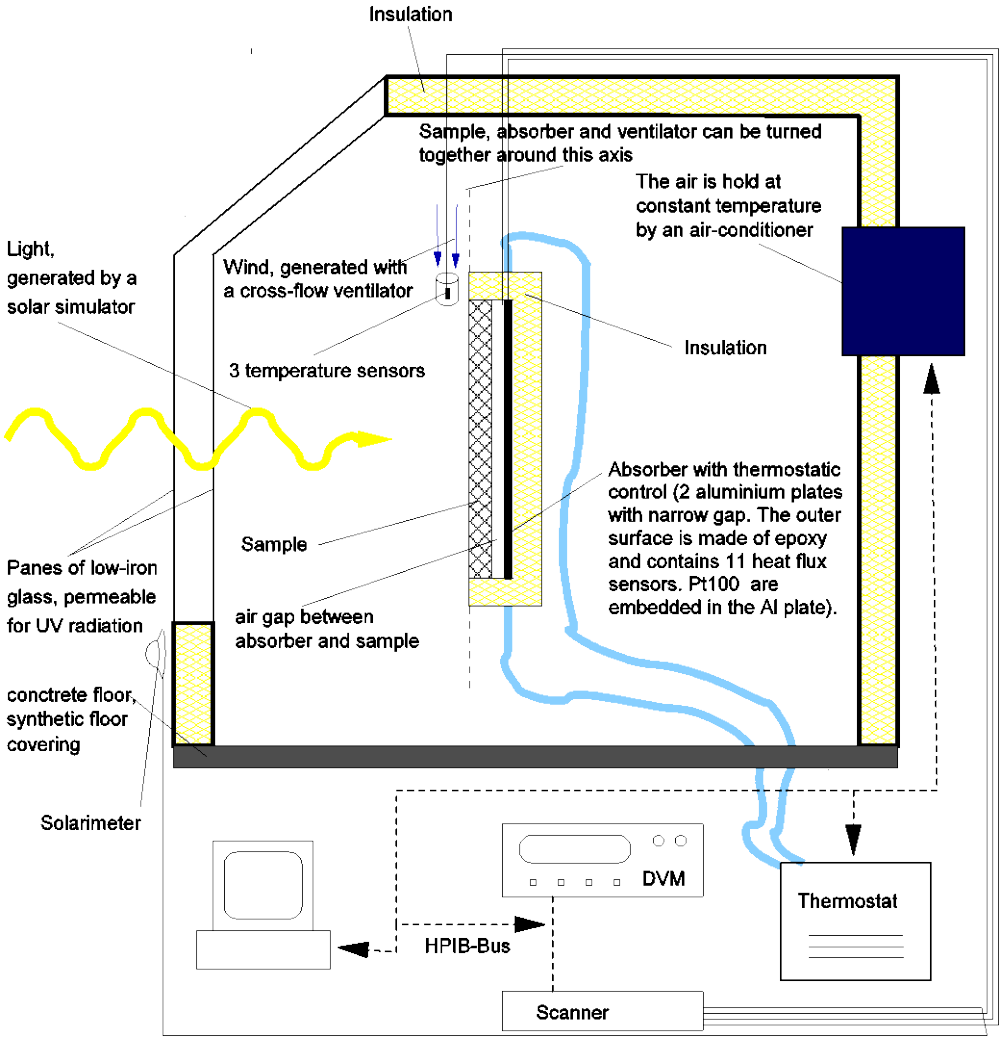

Figure 1 Cross-section through the measurement chamber and the calorimeter.

3 Results

3.1 Results of the transmission measurement

Table 1 Results for normal-hemispherical transmittance according to EN 410. The results apply for normally incident radiation. Three decimal places are used only to indicate small differences between similar values. Only two decimal places are significant.
Sample: Multiwall panel AKYVER 16/7 IR Control White (Fraunhofer ISE sample ID: KS308003).
Date of measurements: 25th – 30th October, 2012.

	normal-hemispherical transmittance according to EN 410 [-]	
sample ID	light	direct (solar) radiation
KS308003	0.225	0.242

The total measurement uncertainty for the transmittance measurements without consideration of uncertainty in the wavelength calibration is an absolute value of 0.01. The spectra of these samples is such that we do not expect the measurement uncertainty to be significantly increased if the wavelength calibration is taken into account.

3.2 Spectrum

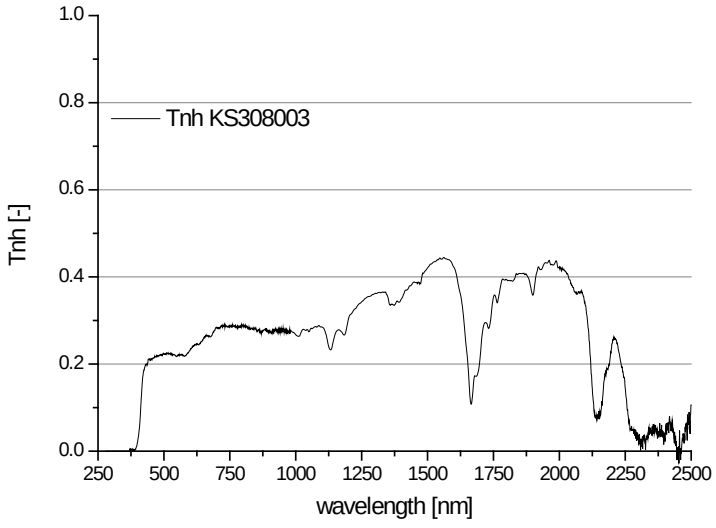

Figure 2 Normal-hemispherical transmittance spectrum of the sample KS308003.

3.3 Results of the g-value measurement

Table 2 Measurement results of the g-value test of the multiwall panel AKYVER 16/7 IR Control White (Fraunhofer ISE sample ID: KS308003).
Date of measurements: 21st – 22nd November, 2012.

angle of incidence	irradiance level on the sample	internal temperature	external temperature	g value
0°	ca. 530 W/m²	25 °C	25 °C	0.31 ± 0.03