Report TLSF-2501-015
Classification of polymer films according to EN 14501:2021 for RHODETEC GmbH

For
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The results in this report refer to the tested sample. Fraunhofer ISE did not have any influence on the selection of samples.

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1 Summary of classification of glare control and visual contact with the outside according to EN 14501:2021

The optical data of two solar-shading polymer films from RHODETEC GmbH, Chemnitz, Germany were determined according to EN 410:2011 and
EN 14500:2021. On this basis, their performance with regard to glare control and visual contact with the outside was classified according to EN 14501:2021 as presented in Table 1.

Table 1 Summary of the performance classes according to EN 14501:2021 with respect to glare and visual contact with the outside.

Fraunhofer ISE ID	Sample	Glare control class	Class for visual contact with the outside
TLSF6095	Shade Film SiGr01	4	2
TLSF6096	Shade Film SiGr02	3	2

Product SiGr01

The tested product achieves the highest possible rating in the "Glare control" category, being classified as Class 4 according to EN 14501:2021, meaning that its influence on controlling glare is very good.
Its effect on an unobstructed view to the outside is moderate, being classified as Class 2 in the category "Visual contact with the outside" of EN 14501:2021.

Product SiGr02

The tested product achieves the second highest possible rating in the "Glare control" category, being classified as Class 3 according to EN 14501:2021, meaning that its influence on controlling glare is good.
Its effect on an unobstructed view to the outside is moderate, being classified as Class 2 in the category "Visual contact with the outside" of EN 14501:2021.

The classification of these solar-shading polymer films is based on optical spectra that have been measured at the TestLab Solar Facades laboratory of Fraunhofer ISE, that is certified according to DIN EN ISO/IEC 17025:2018, an international standard specification.

2 Sample description

The test samples used for this report are shown in the following list.
Samples of two different polymer films were supplied by RHODETEC GmbH and delivered on 13th January 2025 to Fraunhofer ISE.

Table 2 Sample descriptions.

Fraunhofer ISE ID	Descriptions as confirmed by RHODETEC GmbH	Thickness (mm)	Dimensions (mm)
TLSF6095	Shade Film SiGr01	0.075	238 mm x 210 mm
TLSF6096	Shade Film SiGr02	0.075	238 mm x 210 mm

3 Description of methods

TestLab Solar Façades is accredited for thermal-optical testing of windows, façades and other products according to DIN EN ISO/IEC 17025:2018. The initial accreditation was in 2006. The accreditation encompasses the determination by measurement and calculation of the g value, transmittance, reflectance and U value. The flexible accreditation also includes procedures developed at Fraunhofer ISE which go beyond the state of the art as documented in standards.

The DAkkS registration number for the accreditation is **D-PL-11140-03-00**.

The spectral measurements in the medium infrared range for wavelengths longer than 3.2 µm are not included among the accredited services offered by the TestLab Solar Façades. However, the measurement instruments are included in the quality management system of Fraunhofer ISE, which is certified according to ISO 9001:2015. The instruments are calibrated regularly against traceable standards.

3.1 Description of spectral transmittance and reflectance measurements in the solar spectral range

The spectral normal-hemispherical and normal-diffuse transmittance and the spectral near-normal-hemispherical and near-normal-diffuse reflectance of the samples were measured in the range from 280 nm to 2500 nm using a Perkin-Elmer Lambda-900 spectrometer and a 220 mm integrating sphere coated with sintered PTFE.
The reference used for the reflectance measurements with the Lambda-900 spectrometer is a mirror reflectance standard that is traceable to reflectance standards calibrated externally by RI.SE, the Swedish national metrological institute (calibration certificate number: 105105-2P02127-K03rev1 of 2020-04-06).
For normal-diffuse measurements, the relevant "gloss trap" is removed, allowing the normal-normal component to leave the sphere undetected.
The angle of incidence was 0° for the transmittance measurements and 8° for the reflectance measurements.
Calculation of the light and solar energy characteristics
The light and solar energy properties of the samples in Table 2 were calculated from the spectra measured in the solar spectral range according to
EN 410:2011 and EN 14500:2021. A program which was written and validated at Fraunhofer ISE was used for these calculations.
The normal-normal (or "direct") transmittance τnn was determined by calculating the difference between the normal-hemispherical transmittance τnh and normal-diffuse transmittance τndif that had been determined from the Lambda-900 measurements.

3.2 Classification of glare control and visual contact properties

The values of the normal-normal transmittance τnn and the normal-diffuse transmittance τndif as described in Section 0 were used to classify the glare control properties according to Table 7 and the visual contact with the outside according to Table 9 of EN 14501:2021.

4 Results

The measurements were carried out between 16.01.2025 and 30.01.2025.

4.1 Calculated technical values for measured samples according to EN 410:2011 and EN 14500:2021

The technical values calculated according to EN 410:2011 and EN 14500:2021 from the normal-hemispherical and normal-diffuse spectra for the samples are presented in Table 3.

Table 3 Summary of normal-hemispherical, normal-diffuse and normal-normal transmittance values and near-normal-hemispherical reflectance values according to EN 410:2011 and EN 14500:2021 for the samples described in Table 2. The uncertainty for transmittance is ±0.01, the uncertainty for reflectance is ±0.02. These uncertainty values do not take the uncertainty of the wavelength calibration into account. With these spectral distributions, we do not expect that the measurement uncertainty would be significantly larger if the wavelength calibration were taken into account.
τ = transmittance with light incident on the labelled surface, ρ= reflectance with light incident on the labelled surface, ρ' = reflectance with light incident on the unlabelled surface, UV = ultraviolet, L = light, e = (solar) energy, nh = normal-hemispherical, nn = normal-normal, ndif = normal-diffuse.
The values are given to three decimal places to identify small differences or trends.

Fraunhofer ISE ID	Sample	τ_{UV} [-]	$\tau_{L,nh}$ [-]	$\tau_{L,nn}$ [-]	$\tau_{L,ndif}$ [-]	$\tau_{e,nh}$ [-]	$\rho_{L,nh}$ [-]	$\rho_{e,nh}$ [-]	$\rho'_{L,nh}$ [-]	$\rho'_{e,nh}$ [-]
TLSF6095	Shade Film SiGr01	0.007	0.007	0.007	0.000	0.008	0.199	0.313	0.830	0.825
TLSF6096	Shade Film SiGr02	0.016	0.018	0.017	0.001	0.020	0.187	0.295	0.715	0.723

4.2 Classification of glare control and visual contact with the outside according to EN 14501:2021

The glare control and visual contact classes according to EN 14501:2021, Tables 7 and 9 respectively, based on the normal-normal and normal-diffuse light transmittance values of Table 3, are presented in Table 4.

Table 4 Summary of normal-normal and normal-diffuse transmittance according to EN 410:2011 and EN 14500:2021 for the samples described in Table 2 and the resulting classification of glare control and visual contact with the outside according to EN 14501:2021, Tables 7 and 9, respectively.
The uncertainty for transmittance is ±0.01. These uncertainty values do not take the uncertainty of the wavelength calibration into account. With these spectral distributions, we do not expect that the measurement uncertainty would be significantly larger if the wavelength calibration were taken into account.
τ = transmittance with light incident on the labelled surface, L = light, nn = normal-normal, nn = normal-diffuse.
The values are given to three decimal places to identify small differences or trends.

Fraunhofer ISE ID	Sample	$\tau_{L,nn}$ [-]	$\tau_{L,ndif}$ [-]	Glare control class	Effect on glare control	Class for visual contact with the outside	Effect on visual contact with the outside
TLSF6095	Shade Film SiGr01	0.007	0.000	4	very good	2	moderate
TLSF6096	Shade Film SiGr02	0.017	0.001	3	good	2	moderate

4.3 Spectra of the samples

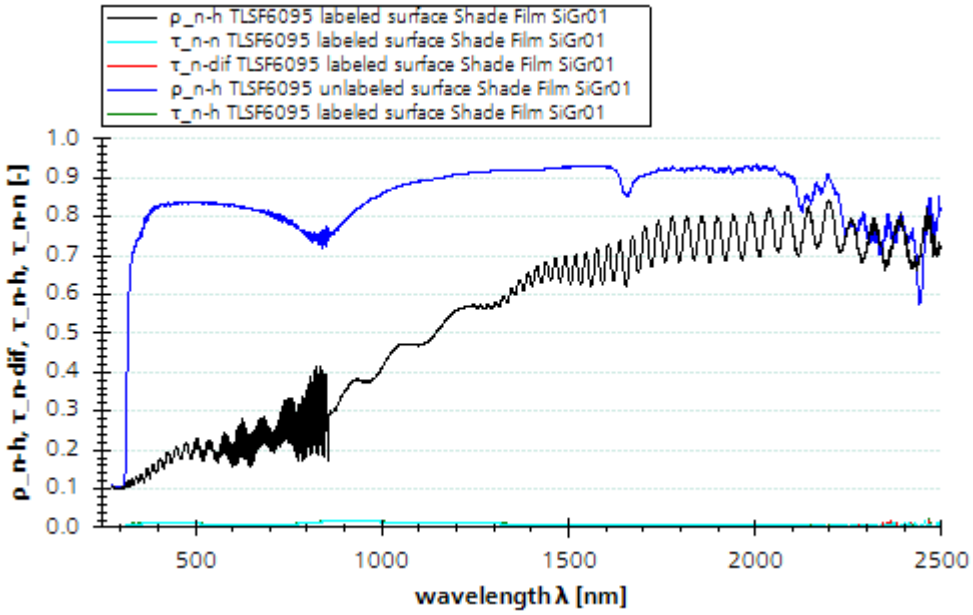

Figure 1 Normal-hemispherical (Tnh), normal-normal (Tnn) and normal-diffuse transmittance (Tndif) and near-normal-hemispherical reflectance (Rnh) spectra for the sample TLSF6095 (Shade Film SiGr01).

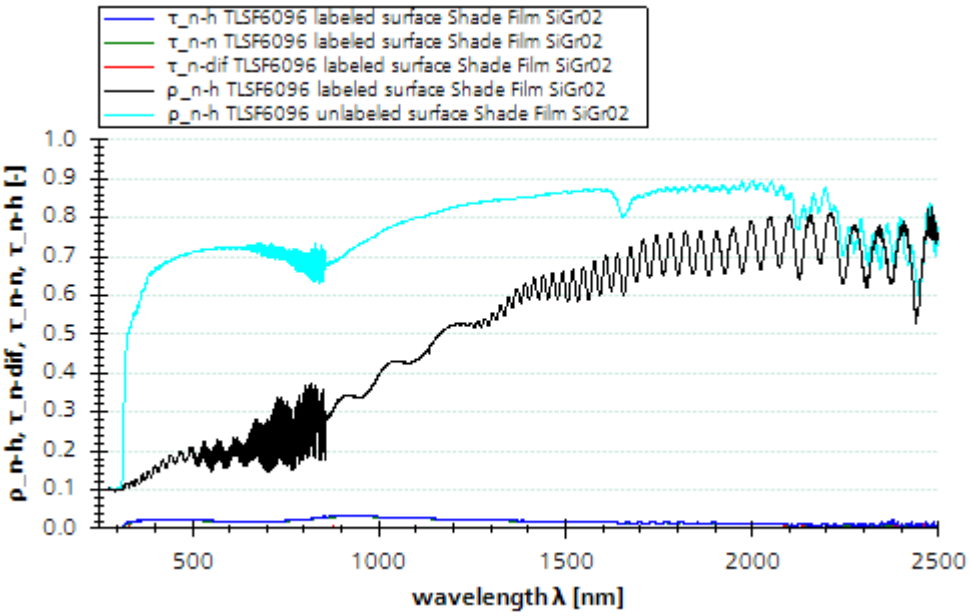

Figure 2 Normal-hemispherical (Tnh), normal-normal (Tnn) and normal-diffuse transmittance (Tndif) and near-normal-hemispherical reflectance (Rnh) spectra for the sample TLSF6096 (Shade Film SiGr02).

5 References

EN 410:2011 (E) Glass in building – Determination of luminous and solar characteristics of glazing, 2011.

EN 14500:2021 Blinds and shutters – Thermal and visual comfort – Test and calculation methods, 2021.

EN 14501:2021 Blinds and shutters – Thermal and visual comfort – Performance characteristics and classification, 2021.