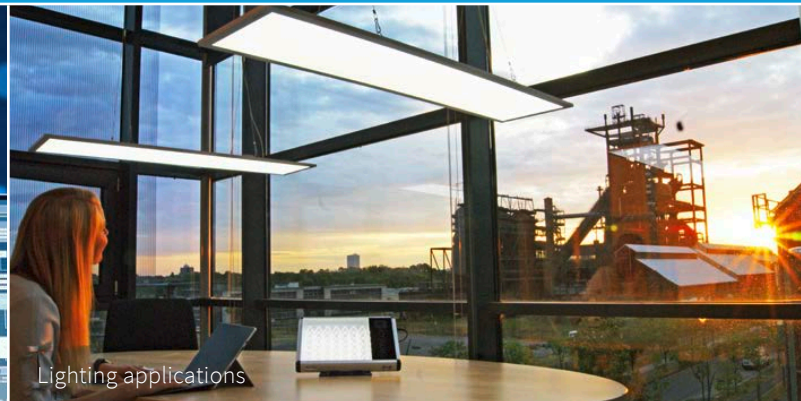
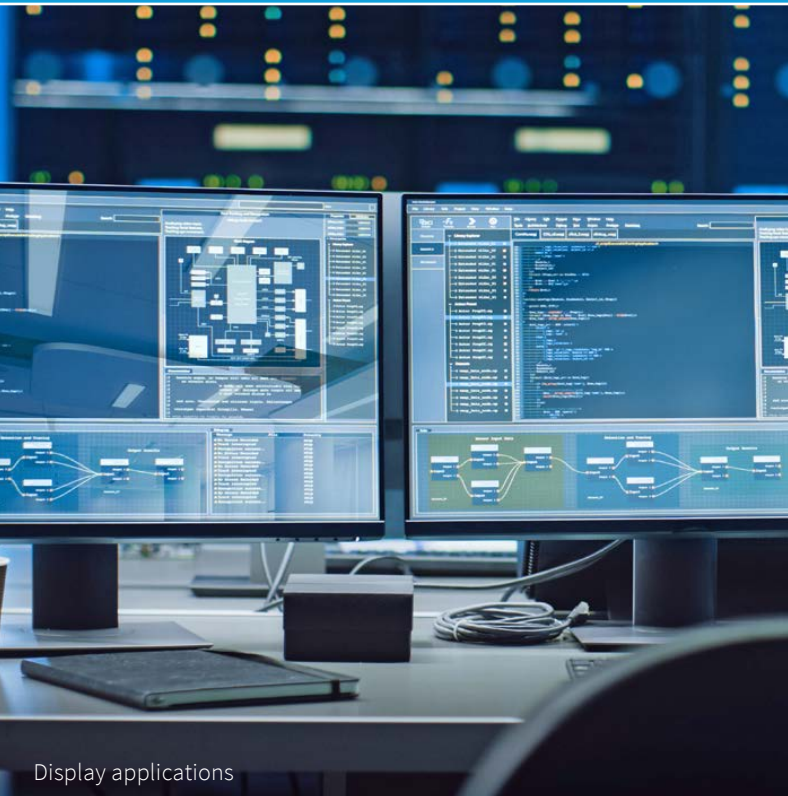


Holographic Surface Diffusers

Features and Specifications

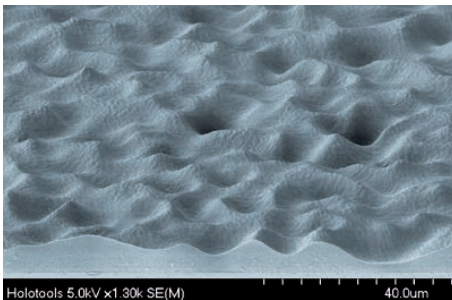


Customized surface diffusers with highest transmission for a wide range of applications

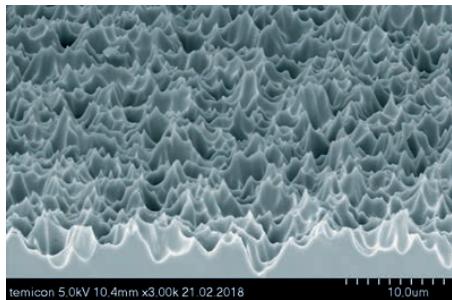
holotools® is a brand of

Features and Applications

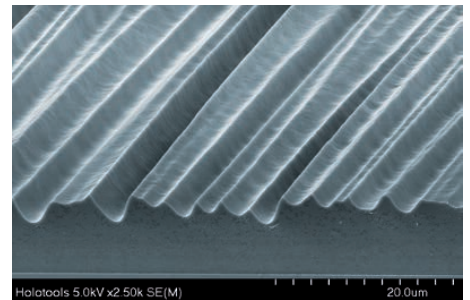
SEM images of diffuser surfaces



Gaussian circular
2D-stochastic surface



Wide angle circular
Surface with reduced grain size.



Gaussian linear
1D-stochastic surface

FEATURES

- **Stochastic surface diffuser**
 - Antiglare
 - Circular
 - Elliptical
 - Linear
- **High transmission**
- **Excellent LED hiding (for WA)**
- **Sparkling effect can be minimized (for AG)**
- **Custom tailored haze value (for AG)**
- **Large, seamless surfaces**
- **Adjustable grain size**

AVAILABLE AS

- Nickel tool
- UV-Rollimprint
- Mold insert
- Injection molded part
- Standard mold
 - Mold size: 100 mm x 100 mm
 - Mold thickness: 300 μm +/-5 %
 - Other sizes and materials on request

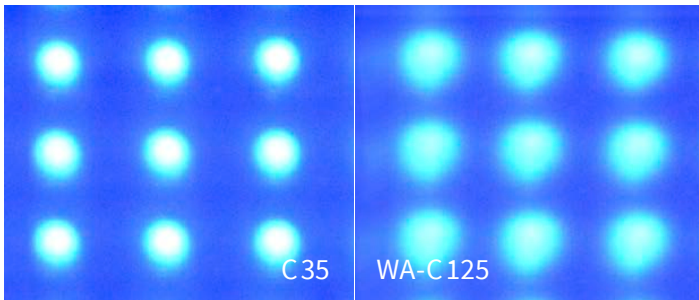
APPLICATIONS

- Automotive
- Backlite
- Illumination
- Imaging
- Sensors
- Haptic
- R&D

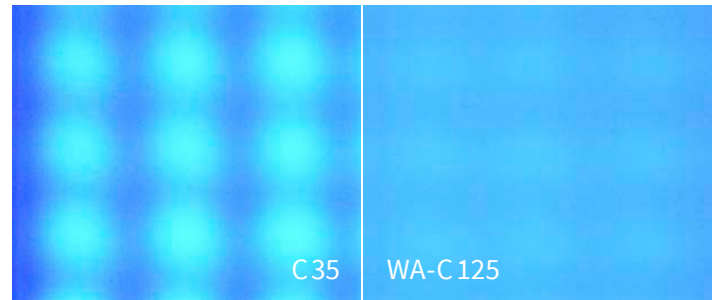
Custom tailored solutions are available on request.

LED Illumination

Homogenization and blurring

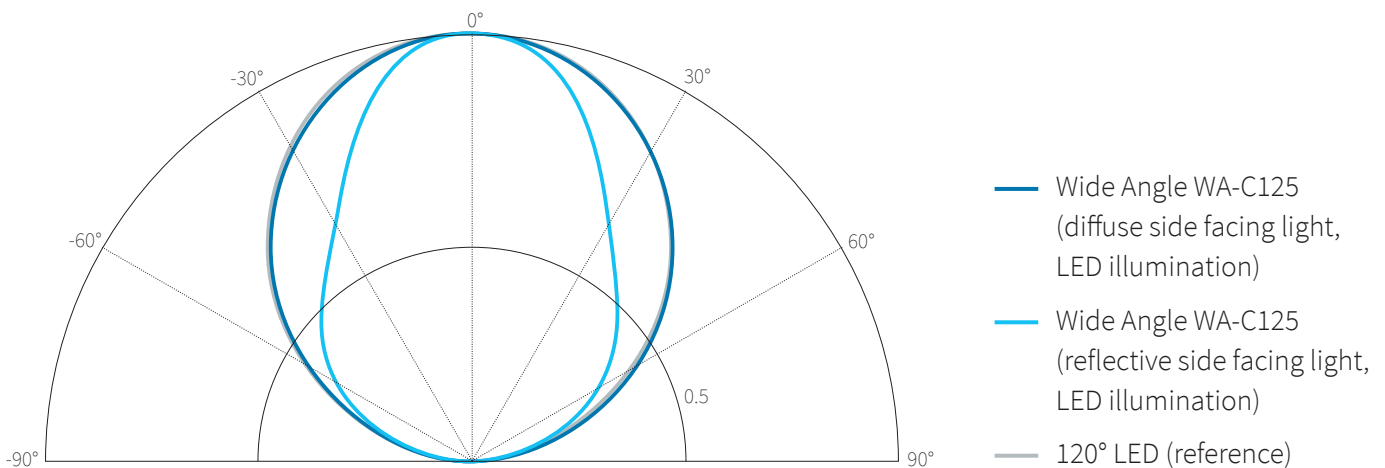


Distance to LED matrix: 0 mm
Almost no hiding for both diffuser types



Distance to LED matrix: 15 mm
Strong hiding for WA-C125 diffuser (right),
less hiding for C35 diffuser (left)

Measurement using LED illumination

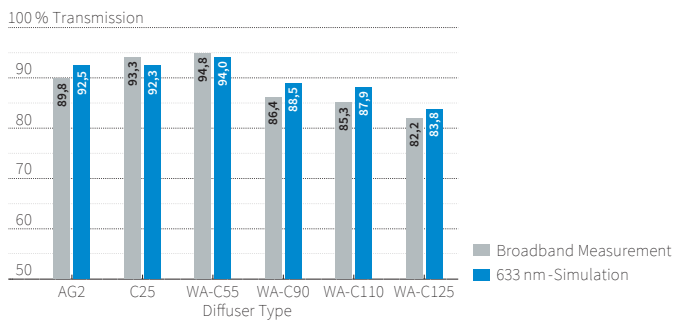


LED luminaires often suffer from strong glaring effects due to the small size of single LED sources and their broad emission angles. By utilizing the WA-series diffusers, one can narrow down the emission angle due to internal reflection (refer to light blue measurement curve above). Additionally, an increase of the light emitting surface can be achieved. Both effects reduce unwanted glaring issues.

If an even broader emission pattern is requested, the diffuser can also be utilized to widen the LED emission (dark blue curve). Another goal is the homogenization of a discrete LED matrix (refer to photographs below). The WA-series diffusers allow to minimize the distance between light source and diffuser, while maintaining an uniform and homogeneous appearance.

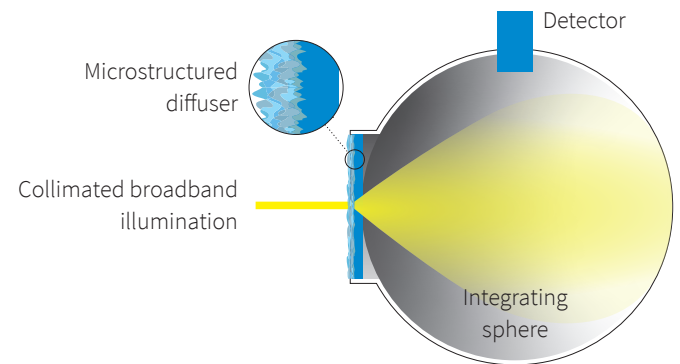
Transmission and Optical Modeling

Transmission Properties



Measured and simulated transmission of different diffusers with structured side facing the collimated light source.

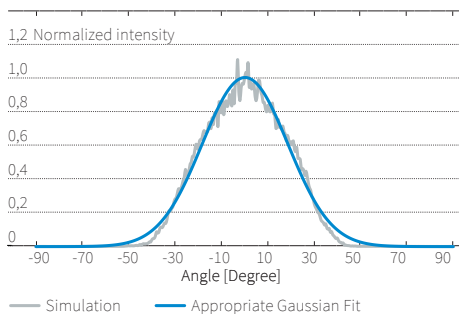
Values closely matching the maximum theoretical transmission efficiency calculated by raytracing can be observed in temicon's surface diffusers. The simulations include a wide range of ray-optical effects. Transmission measurements



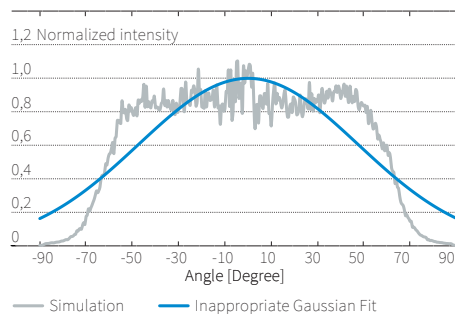
Measurement principle based on an integrating Ulbricht sphere for transmission characterization.

of the diffusers were carried out according to ISO 9050. Light recycling happening in luminaires was not taken into account. Utilizing light recycling, transmission values of 95% are possible with our diffusers.

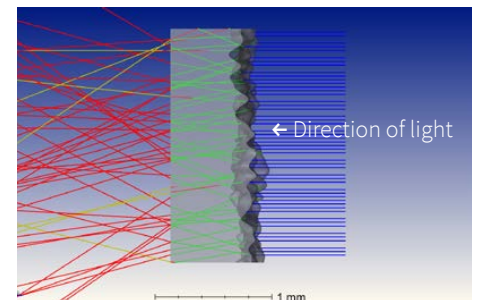
Modeling of diffusers



Simulated gaussian behavior of diffusers with FWHM < 55°. Here a C50 diffuser is shown.



Simulated wide angle behavior of diffusers with FWHM > 55°. Here a WA-C125 is shown.



Simulation for diffuse side facing light source

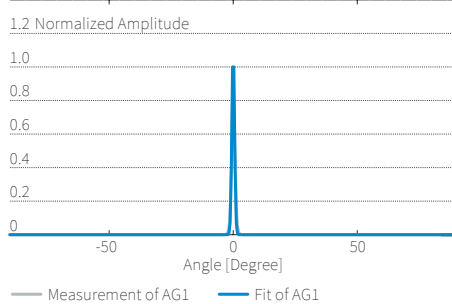
Non-approximated raytracing of stochastically micro-structured surfaces is used to gain insight into important optical effects. This approach leads to correct modeling of transmission and total internal reflection under any AOI.

As a result, even complex, non-gaussian scattering patterns can be modeled in order to design an appropriate diffuser for a wide range of applications.

Scattering Characterization

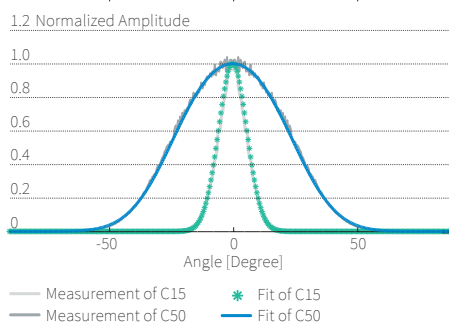
Categories

Antiglare



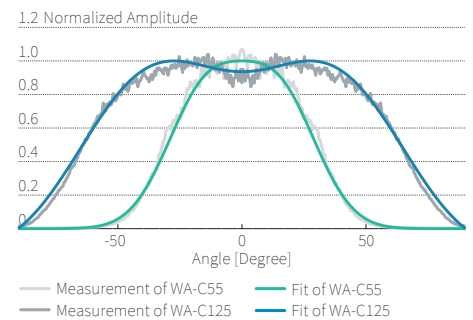
It is possible to vary parameters like haze, grain size and sparkling in a wide range.

Gaussian circular



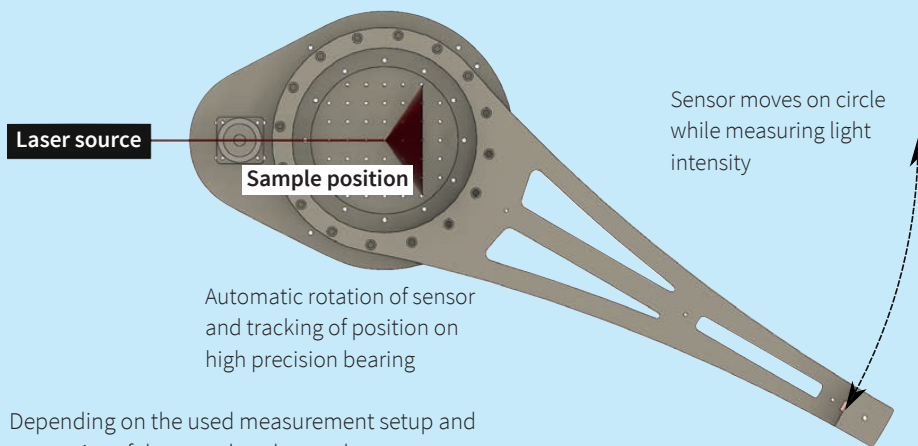
Diffusers with angles from 15° - 50° (FWHM) are available.

Wide angle circular



Diffusers with angles from 55° - 125° are available.

MEASUREMENT SETUP



Depending on the used measurement setup and properties of the samples, the results may vary.

MEASUREMENT CONDITIONS

- 633nm Diode Laser
- Expanded beam (1/e² diameter approx. 8mm)
- Collimated, coherent illumination
- Distance adjustable at 25cm, 50cm, 75cm
- Mounted on optical table
- Normal incidence on structured side
- 125µm PET Foil
- LED as lightsource can be used
- Automatic data acquisition and postprocessing
- Tilt and pitch manually adjustable

For characterization of diffuse surfaces temicon uses the setup as sketched above/below. A monochromatic, collimated laser source is used for illumination, its beam is slightly expanded in order to average speckle effects. By default, a wavelength of 633nm is used, other wavelengths are available on request. The usage of a LED as light source is possible as well. With an increment of up to 0.045°, the diffusing properties of the surface can be analyzed in transmission as well as in reflection.

Typically, a polymer replica consisting of a PET base film with an imprinted UV-lacquer on top is measured. Besides the illumination conditions, sample properties such as refractive index, single- or multilayer design as well as the orientation of the diffuse surface (diffuser towards or diffuser averted to the incident beam) strongly influence the optical behaviour. Therefore, different measurement and material parameters may show deviating results.

Technical Features

Available diffuser types

Type	Denotation	Description
Antiglare	HF-AG1	Low sparkling due to small grain size; Low haze 25,9%
	HF-AG2	Low sparkling due to small grain size; High haze 81,5%
	AG1	AG with larger grain size; Very low haze 1,65%
	AG2	AG with larger grain size; Low haze 11,2%
Gaussian Circular	C15	FWHM = 15°; Gaussian
	C25	FWHM = 25°; Gaussian
	C35	FWHM = 35°; Gaussian
	C40	FWHM = 40°; Gaussian
	C50	FWHM = 50°; Gaussian
Wide Angle Circular	WA-C55	Non-Gaussian
	WA-C90	Non-Gaussian
	WA-C100	Non-Gaussian
	WA-C110	Non-Gaussian
	WA-C125	Non-Gaussian
Gaussian Elliptical	E28-14	X-Axis FWHM = 28°; Gaussian Y-Axis FWHM = 14°; Gaussian
Gaussian Linear	L80	FWHM = 1°/80°; Gaussian
	L90	FWHM = 1°/90°; Gaussian

Available as

Nickel mold	Mold size: 100mm x 100mm Active size: 80mm x 80mm Thickness: 300µm (other thicknesses on request)
Film sample	Substrate: 125µm PET Size: approx. 100mm x 100mm
Injection molding	Tools and parts (detailed specifications on request)
Custom tailored solutions are available on request	
<ul style="list-style-type: none"> • Scattering angle • Scattering profile (circular, linear, elliptical) • Grain size • Depth of profile 	<ul style="list-style-type: none"> • Haze value • Sparkling reduction • Mold size • Seamless sleeve



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