Holographic Surface Diffusers

Features of temicon’s holographic diffusers
→ Surface diffuser
→ High transmission
→ Custom tailored haze value (for AG)
→ Adjustable grain size
→ Sparkling effect can be minimized (for AG)
→ Excellent LED hiding (for WA)
→ Large, seamless surfaces
→ Seamless sleeve tooling on request

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

Diffuser categories

Antiglare

Gaussian circular

Wide Angle circular

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

Custom tailored solutions are available on request.
SEM images of diffuser surfaces

- **Gaussian circular**
  SEM image showing a 2D-stochastical surface.

- **Gaussian linear**
  SEM image showing a 1D-stochastical surface.

- **Wide Angle circular**
  SEM image showing a surface with reduced grain size.

Measurements using LED illumination

- **Wide Angle WA-C110**
  (diffuse side facing light, LED illumination)

- **Wide Angle WA-C110**
  (reflective side facing light, LED illumination)

- **120° LED** (reference)

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.

- **Distance to LED Matrix: 0 mm**
  Almost no hiding for both diffuser types

- **Distance to LED Matrix: 15 mm**
  Strong hiding for WA-C 110 diffuser (right), less hiding for C.35 diffuser (left)
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.

Optical modelling

The usage of Laser Interference Lithography to generate holographic diffusers enables feature sizes of statistical surface topographies which are in the micro- or even nanometer range. However, such dimensions require ray- and wave-optical models in order to describe the system in a proper way. Therefore temicon’s engineers use a library of different software tools and models. For example Zemax, rigorous coupled wave analysis (RCWA) or own codes (mainly based on Huygen’s principle) are used in order to simulate optical effects caused by various surface topographies accurately. Furthermore we can quantify the statistical surface properties of temicon’s diffusers using various methods. Subsequently, this information can be used for the modelling of the optical behaviour under realistic conditions like oblique incidence and divergent illumination in order to offer the best solution for the requirements of our customers.
Specifications and availability

Available diffuser types

<table>
<thead>
<tr>
<th>Type</th>
<th>Denotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiglare</td>
<td>HF-AG1</td>
<td>Low sparkling due to small grain size; Low haze 25.9%</td>
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<tr>
<td></td>
<td>HF-AG2</td>
<td>Low sparkling due to small grain size; High haze 81.5%</td>
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<tr>
<td></td>
<td>AG1</td>
<td>AG with larger grain size; Very low haze 1.65%</td>
</tr>
<tr>
<td></td>
<td>AG2</td>
<td>AG with larger grain size; Low haze 11.2%</td>
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<tr>
<td>Gaussian</td>
<td>C15</td>
<td>FWHM = 15°; Gaussian</td>
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<tr>
<td>Circular</td>
<td>C25</td>
<td>FWHM = 25°; Gaussian</td>
</tr>
<tr>
<td></td>
<td>C35</td>
<td>FWHM = 35°; Gaussian</td>
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<tr>
<td></td>
<td>C40</td>
<td>FWHM = 40°; Gaussian</td>
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<tr>
<td></td>
<td>C50</td>
<td>FWHM = 50°; Gaussian</td>
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<td>Wide Angle</td>
<td>WA-C55</td>
<td>Non-Gaussian</td>
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<tr>
<td>Circular</td>
<td>WA-C90</td>
<td>Non-Gaussian</td>
</tr>
<tr>
<td></td>
<td>WA-C100</td>
<td>Non-Gaussian</td>
</tr>
<tr>
<td></td>
<td>WA-C110</td>
<td>Non-Gaussian</td>
</tr>
<tr>
<td>Gaussian</td>
<td>L80</td>
<td>FWHM = 1°/80°; Gaussian</td>
</tr>
<tr>
<td>Linear</td>
<td>L90</td>
<td>FWHM = 1°/90°; Gaussian</td>
</tr>
</tbody>
</table>

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

- Scattering angle
- Scattering profile (circular, linear, elliptical)
- Grain size
- Depth of profile
- Haze value
- Sparkling reduction
- Mold size
- Seamless sleeve

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