

## **Makrolon® DX Sky**

The first transparent Makrolon® refractor (diffuser) with microstructure

# Makrolon® DX Sky

The first transparent Makrolon® refractor<sup>1</sup> (diffuser) with microstructure

Prismatic diffusers are commonly made with fairly big structures (e.g. 5 mm). These structures generally work perfectly with bigger light sources that have a larger light emitting surface (e.g. T8 fluorescent lamps). But do not work correctly for smaller light sources like LED structures. Because of this, Exolon Group has developed the Makrolon® DX Sky sheet for LED based luminaires, so that a homogenous light emitting area with fair glare control can now be obtained for those small light emitting sources.

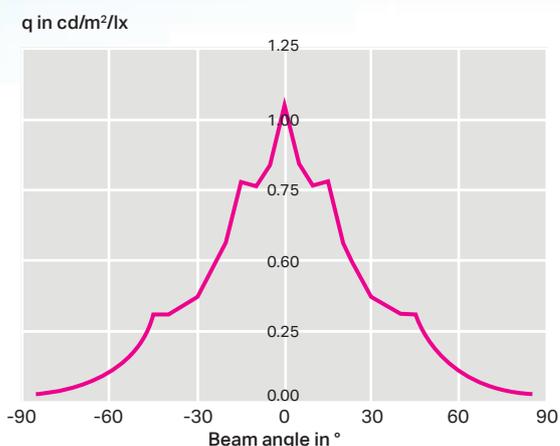
The colourless transparent diffuser sheet Makrolon® DX Sky is designed to distribute the light uniformly with a light intensity distribution curve best suited for most common lighting applications.

The best way to diffuse light is through a micro lens array, or a so called microstructure. This pre-determined geometric shape arranged in a hexagonal grid results in optimized control over the light distribution and an optically better product than one would achieve with a frosted surface or a simple surface pattern. The resultant scattering profile is almost 22° with straight edges and almost no light losses except for Fresnel losses.

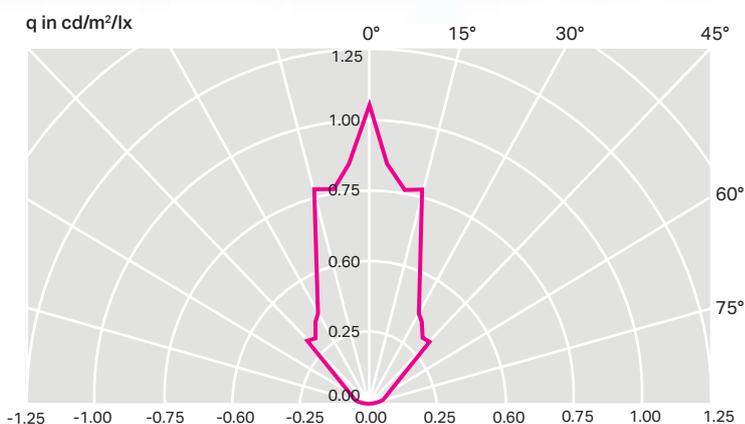
|  | LED     |         | Sample + |         |
|--|---------|---------|----------|---------|
|  | LED (1) | LED (2) | LED (1)  | LED (2) |
| Chromaicity coordination               |         |         |          |         |
| x                                      | 0.439   | 0.322   | 0.438    | 0.322   |
| y                                      | 0.401   | 0.346   | 0.400    | 0.345   |
| u                                      | 0.253   | 0.198   | 0.253    | 0.198   |
| v                                      | 0.347   | 0.319   | 0.347    | 0.319   |
| Correlated colour temperature $T_c/K$  | 2940    | 5940    | 2950     | 5980    |
| Special colour rendering indices $R_i$ |         |         |          |         |
| 1)                                     | 97      | 69      | 97       | 69      |
| 2)                                     | 97      | 73      | 97       | 73      |
| 3)                                     | 99      | 77      | 99       | 77      |
| 4)                                     | 98      | 73      | 97       | 73      |
| 5)                                     | 96      | 71      | 96       | 71      |
| 6)                                     | 94      | 66      | 94       | 66      |
| 7)                                     | 97      | 78      | 97       | 78      |
| 8)                                     | 98      | 61      | 98       | 61      |
| 9)                                     | 97      | -27     | 97       | -26     |
| 10)                                    | 94      | 38      | 94       | 38      |
| 11)                                    | 95      | 72      | 95       | 73      |
| 12)                                    | 91      | 49      | 91       | 49      |
| 13)                                    | 96      | 68      | 96       | 69      |
| 14)                                    | 99      | 87      | 99       | 87      |
| General colour rendering index $R_a$   | 97      | 71      | 97       | 71      |

The results show that the influence of the Makrolon® DX Sky on the colour and colour rendering properties in both LEDs with and without sample is hardly noticeable.

## Distribution of Luminance



Coefficient q in cartesian coordinates



Coefficient q in spherical coordinates

<sup>1</sup> Refractors are transparent optical parts with special 3D geometrical structures which are used to control light.

Makrolon® DX Sky  
1,5 mm  
www.sheets.covestro.com

### Advantage over diffusers made with scattering additives:

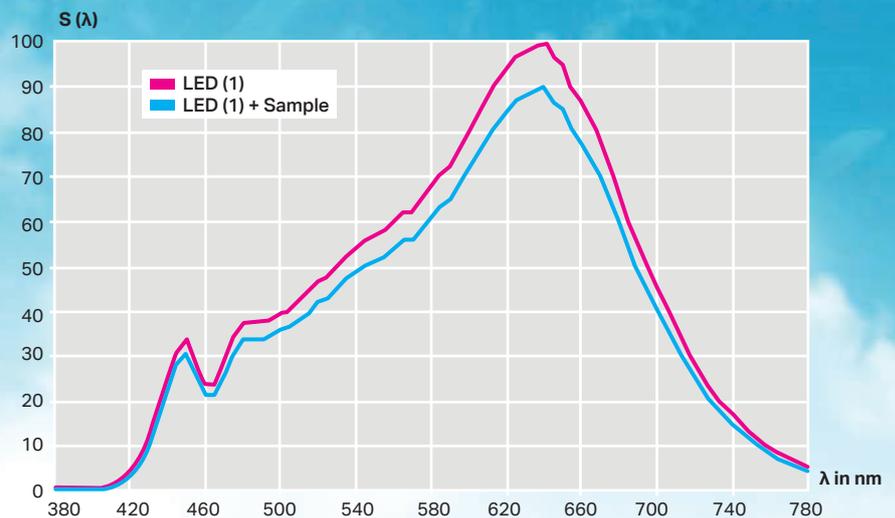
The opto-mechanical structure avoids the need to add scattering additives to the sheet to diffuse the light, which results in a higher light transmission of 90%. The addition of scattering additives introduces photometric losses and the resulting diffusion is not as controllable.

### Advantage over frosted surfaces:

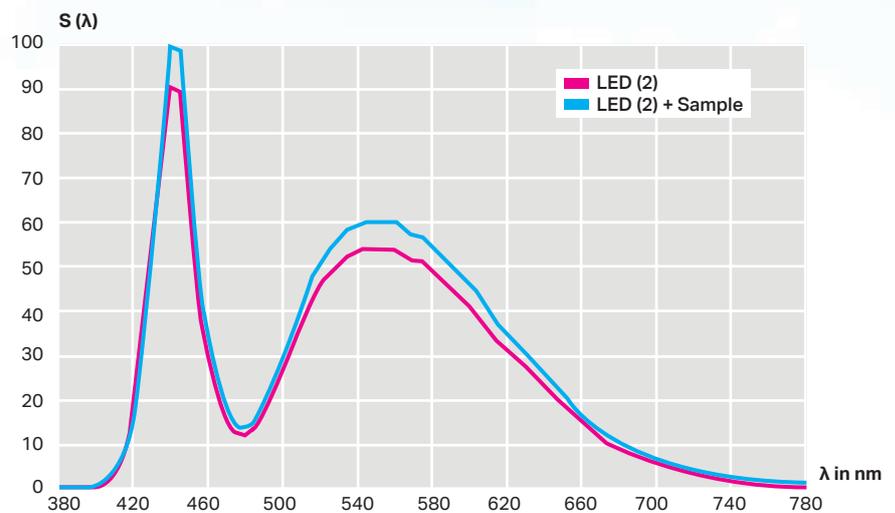
- The use of frosted surfaces for scattering the light limits the scattering profile to just 7° in transmission.
- Intensity distribution edges contain a significant amount of light, which result in light losses.
- Also due to the manufacturing process, no pre-determined surface is possible and the scattering profile is randomised and uncertain.

### Optical data:

- Luminous transmittance  $\tau_A$  for standard illuminant A: 0.90
- Luminous transmittance  $\tau_{D65}$  for standard illuminant D65 (average daylight): 0.90
- Half-value angle  $\gamma$ : 21.5°
- Diffusion factor  $\sigma$ : 0.36
- Volumetric absorption ( $\text{mm}^{-1}$ ): 0.0083
- Abbé number: 30



Light distribution for two types of LEDs with and without Makrolon® DX Sky sample.



The graphs clearly indicate that Makrolon® DX Sky causes limited light loss over the whole visible light spectrum



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