

## **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.

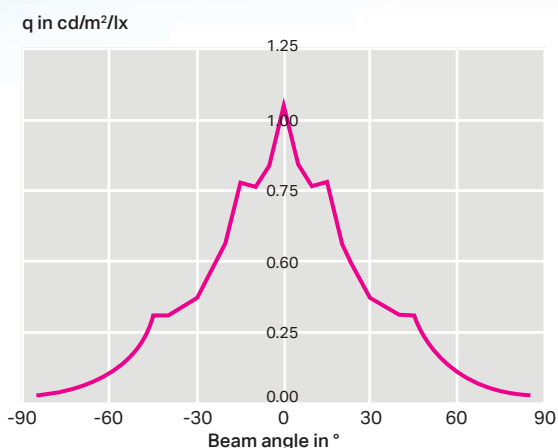
The colourless transparent diffuser sheet Makrolon® DX Sky is designed to distribute the light uniformly with a light intensity distribution curve best suited for most common lighting applications.

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.

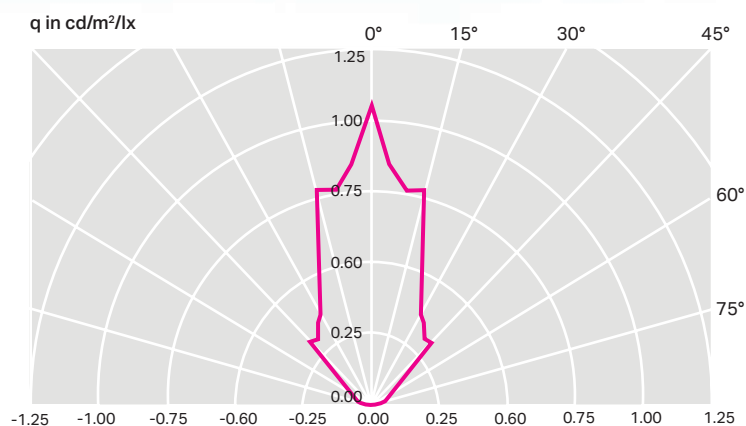
	LED		Sample +	
	LED (1)	LED (2)	LED (1)	LED (2)
Chromaicity coordination				
x	0.439	0.322	0.438	0.322
y	0.401	0.346	0.400	0.345
u	0.253	0.198	0.253	0.198
v	0.347	0.319	0.347	0.319
Correlated colour temperature $T_c/K$	2940	5940	2950	5980
Special colour rendering indices $R_i$				
1)	97	69	97	69
2)	97	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:

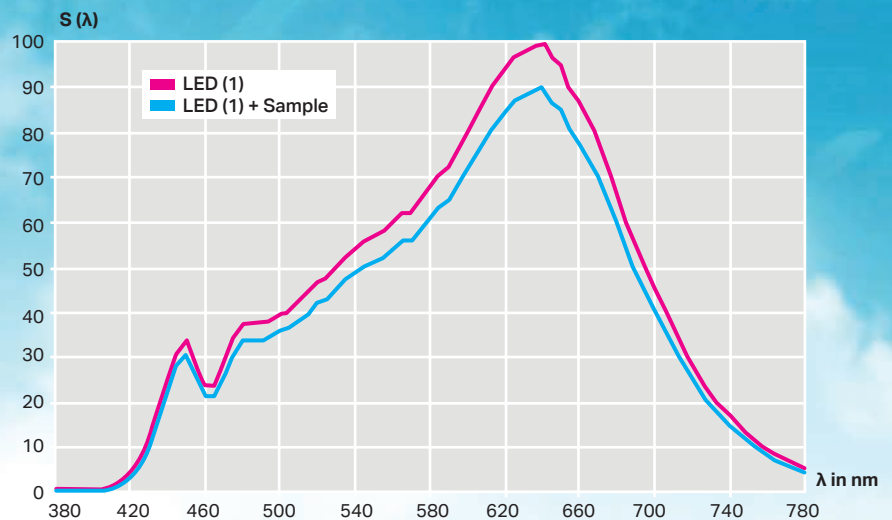
The opto-mechanical structure avoids the need to add scattering additives to the sheet to diffuse the light, which results in a higher light transmission of 90%. The addition of scattering additives introduces photometric losses and the resulting diffusion is not as controllable.

### Advantage over frosted surfaces:

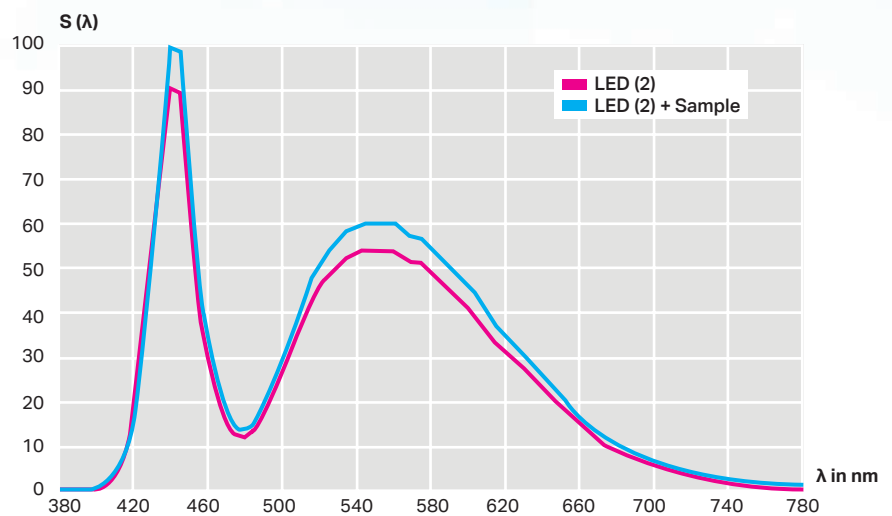
- The use of frosted surfaces for scattering the light limits the scattering profile to just 7° in transmission.
- Intensity distribution edges contain a significant amount of light, which result in light losses.
- Also due to the manufacturing process, no pre-determined surface is possible and the scattering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