

## **Makrolon<sup>®</sup> DX Sky**

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

**makrolon<sup>®</sup>**

# 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, Covestro 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.

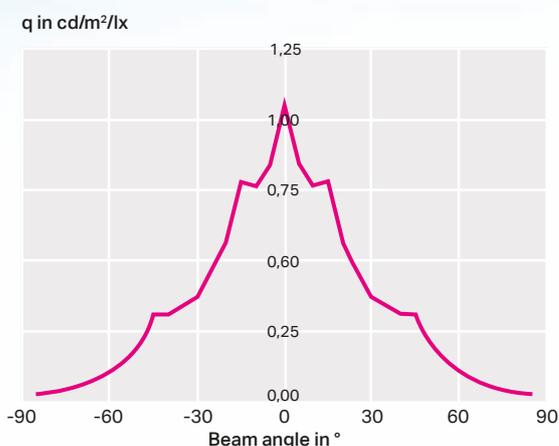
The colourless transparent diffuser sheet Makrolon® DX Sky is designed to distribute the light uniformly with a light intensity distribution curve best suited for most common lighting applications.

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.

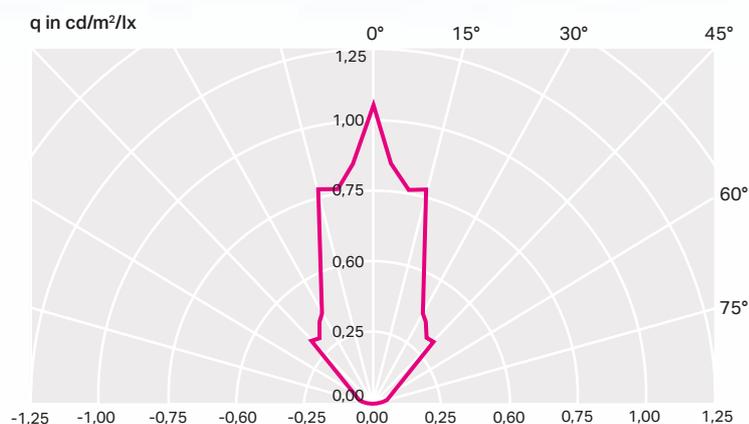
	LED		Sample +	
	LED (1)	LED (2)	LED (1)	LED (2)
Chromaicity coordination				
x	0,439	0,322	0,438	0,322
y	0,401	0,346	0,400	0,345
u	0,253	0,198	0,253	0,198
v	0,347	0,319	0,347	0,319
Correlated colour temperature $T_c$ /K	2940	5940	2950	5980
Special colour rendering indices $R_i$				
1)	97	69	97	69
2)	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.

### Advantage over diffusers made with scattering additives:

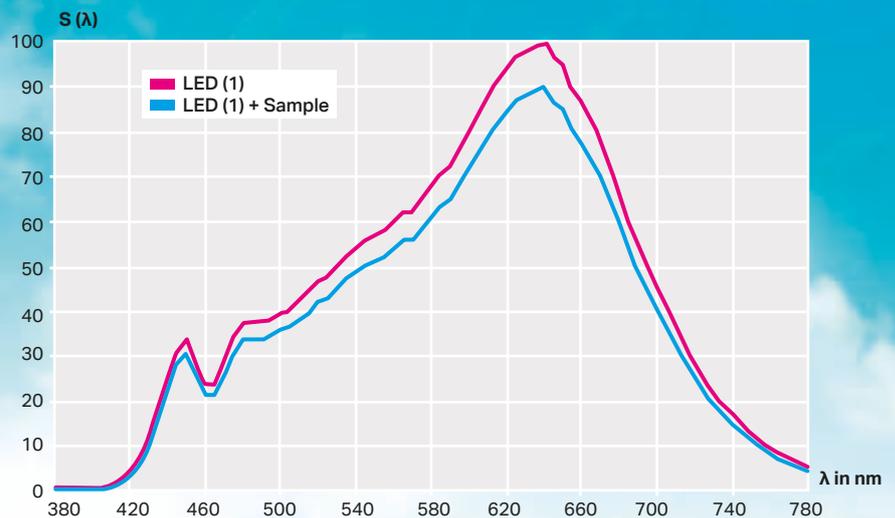
The opto-mechanical structure avoids the need to add scattering additives to the sheet to diffuse the light, which results in a higher light transmission of 90%. The addition of scattering additives introduces photometric losses and the resulting diffusion is not as controllable.

### Advantage over frosted surfaces:

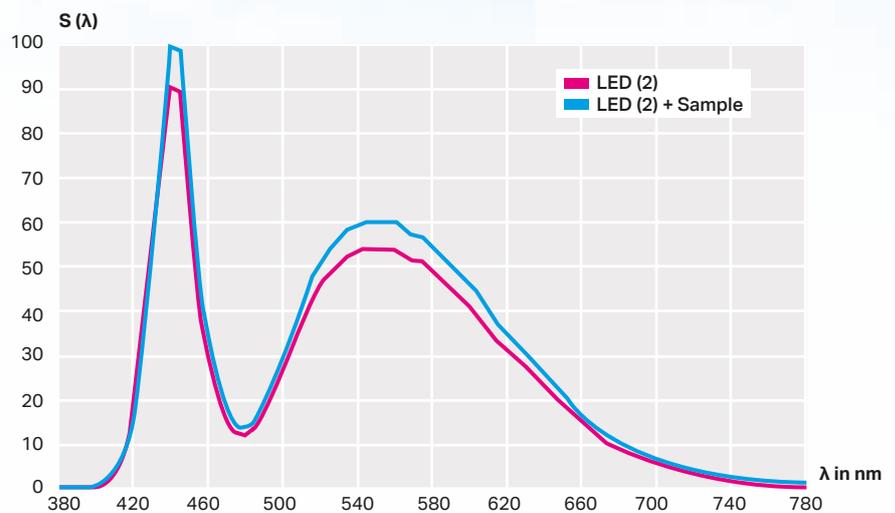
- The use of frosted surfaces for scattering the light limits the scattering profile to just 7° in transmission.
- Intensity distribution edges contain a significant amount of light, which result in light losses.
- Also due to the manufacturing process, no pre-determined surface is possible and the scattering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

### Optical data:

- Luminous transmittance  $\sigma_A$  for standard illuminant A: 0.90
- Luminous transmittance  $\sigma_{D65}$  for standard illuminant D65 (average daylight) : 0.90
- Half-value angle  $\lambda$ : 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



**Covestro  
Deutschland AG**  
Business Unit  
Polycarbonates  
51365 Leverkusen  
Germany

**www.sheets.  
covestro.com**  
sales.sheetsEMEA@  
covestro.com

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations, are beyond our control. Therefore, it is imperative that you test our products, technical assistance, information and recommendations to determine to your own satisfaction whether our products, technical assistance and information are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by Covestro. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale which are available upon request. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with any claim of any patent relative to any material or its use. No license is implied or in fact granted under the claims of any patent. Makrolon® is a registered trademark of Covestro AG.  
Edition: 2018 · Order-No.: MF0360 · Printed in Germany