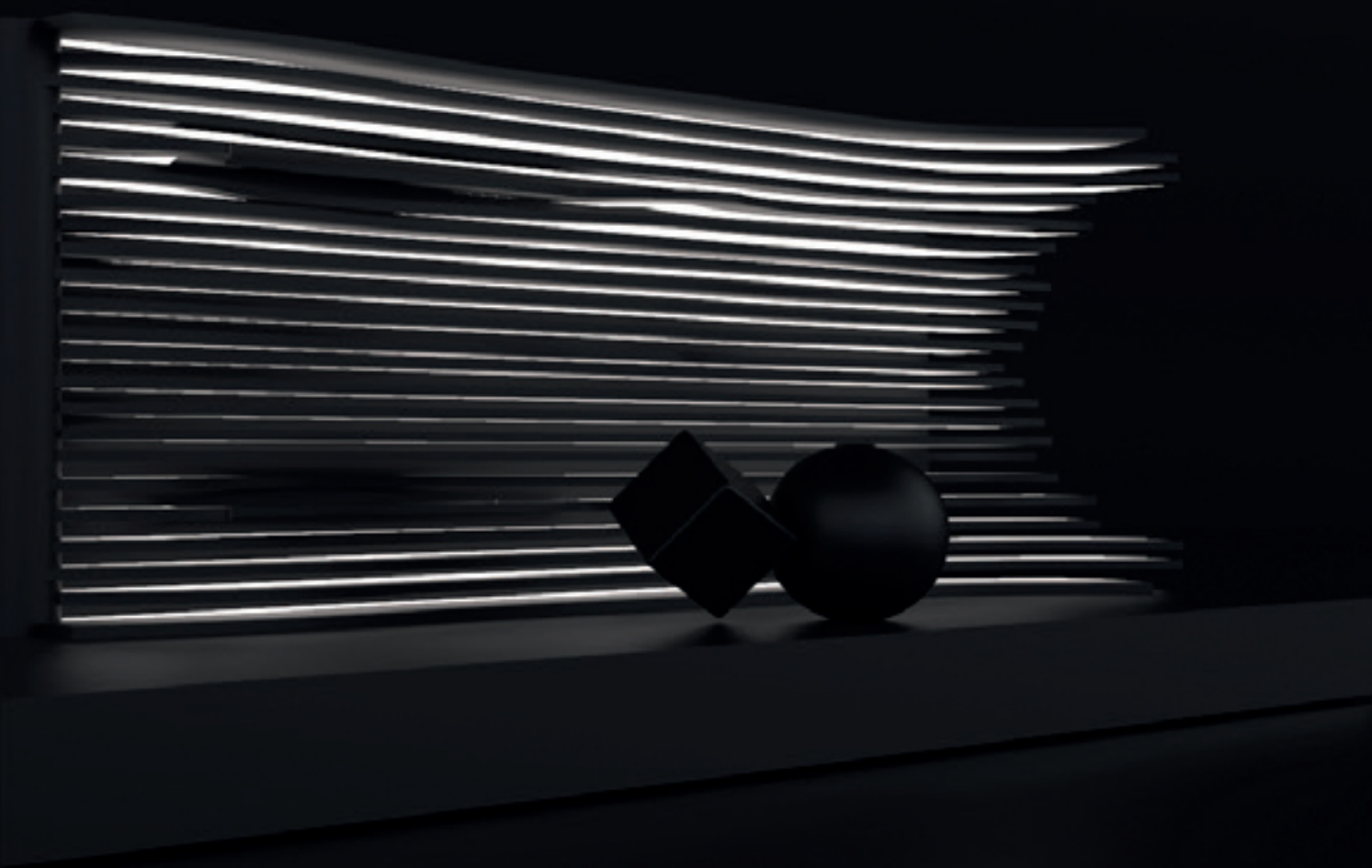
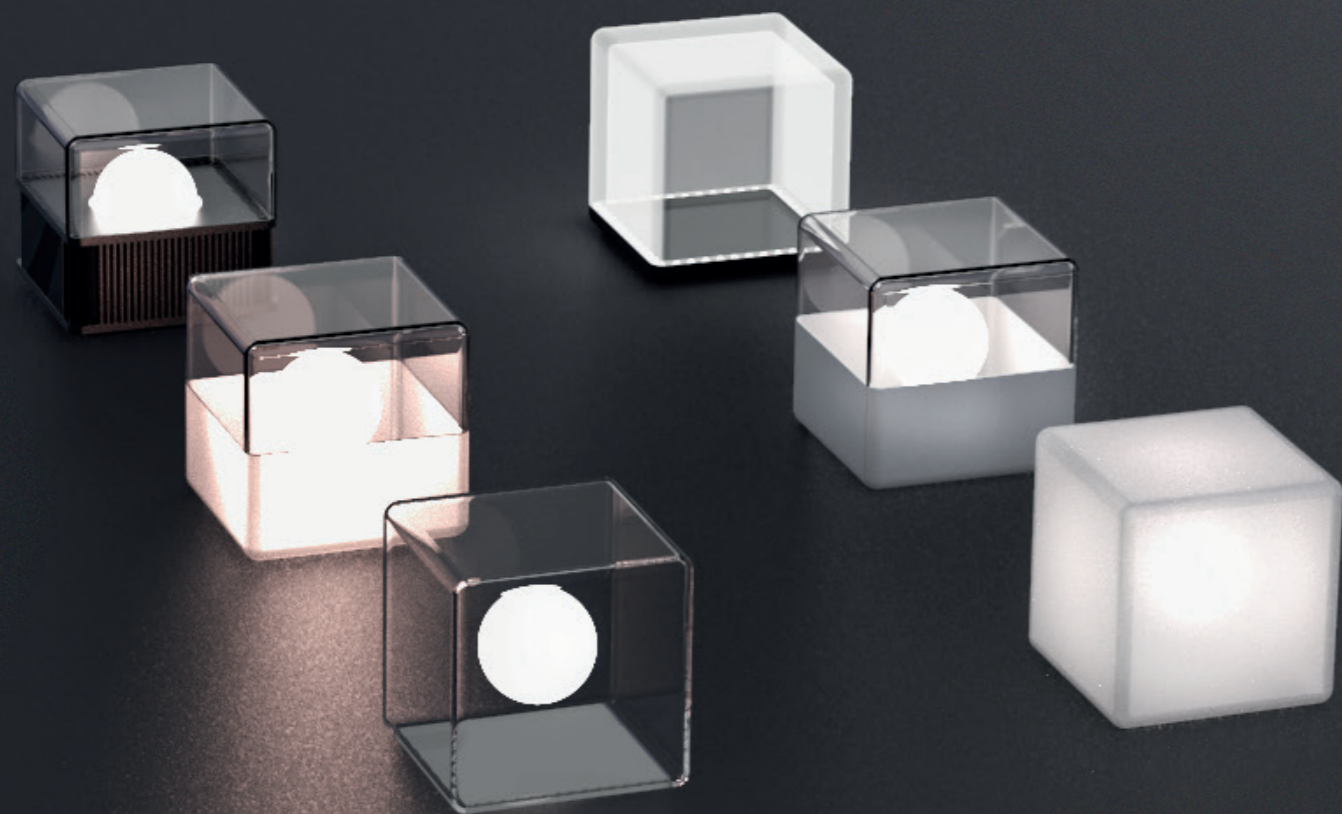


# Makrolon® for **LED Lighting**



# LED Portfolio Index



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Introducing

# Makrolon® Polycarbonate

## A Building Block for Innovation

A thermoplastic with truly diverse applications, Makrolon® polycarbonate enables efficient design and manufacturing of optical parts for LED powered luminaires. The tailored portfolio of Makrolon® from Covestro for general lighting applications include transparent, translucent, reflective white, thermal conductive and flame retardant grades, which can be used for injection molding and extrusion. Stronger and lighter than glass, polycarbonate also provides energy and CO<sub>2</sub> emission savings. All of which explains why Makrolon® has been trusted for decades and continues to pave the way for tomorrow's lighting innovations.

### Product List



**Makrolon®**  
Transparent Polycarbonate

**LED5102**  
Low viscosity

**LED5202**  
Medium viscosity

**LED5302**  
High viscosity

**LED5402**  
High viscosity



**Makrolon®**  
Diffusion Quality

**DQ5122**  
Low diffusion

**DQ5142**  
Medium diffusion

**DQ5162**  
High diffusion

**DQ5622 ET**  
Extrusion  
Low diffusion

**DQ5652 ET**  
Extrusion  
Medium diffusion

**DQ5662 ET**  
Extrusion  
High diffusion



**Makrolon®**  
Flame Retardant

**LED5902 FR**  
High transmission

**DQ5922 FR**  
Low diffusion

**DQ5942 FR**  
Medium diffusion

**DQ5962 FR**  
High diffusion



**Makrolon®**  
Reflective White

**RW5181 019900**  
Excellent reflection

**RW2407 012363**  
High reflection

**RW6267X 012363**  
High reflection  
Flame retardant

**RW2407 012612**  
Light blocking

**RW6267X 010083**  
Light blocking  
Flame Retardant

**RW3137 ET 010083**  
Light blocking  
Extrusion



**Makrolon®**  
Thermal Conductive

**TC629**  
Excellent thermal conductivity  
High softening temperature

**TC621**  
Excellent thermal conductivity

**TC421**  
High thermal conductivity

**TC210**  
Electrically insulating  
Increased thermal conductivity

**TC110**  
Electrically insulating



# Makrolon® LED Transparent

High light transmission across  
the visual spectrum

Good life time performance

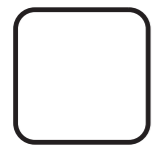
High mechanical stability



## Form Your Future

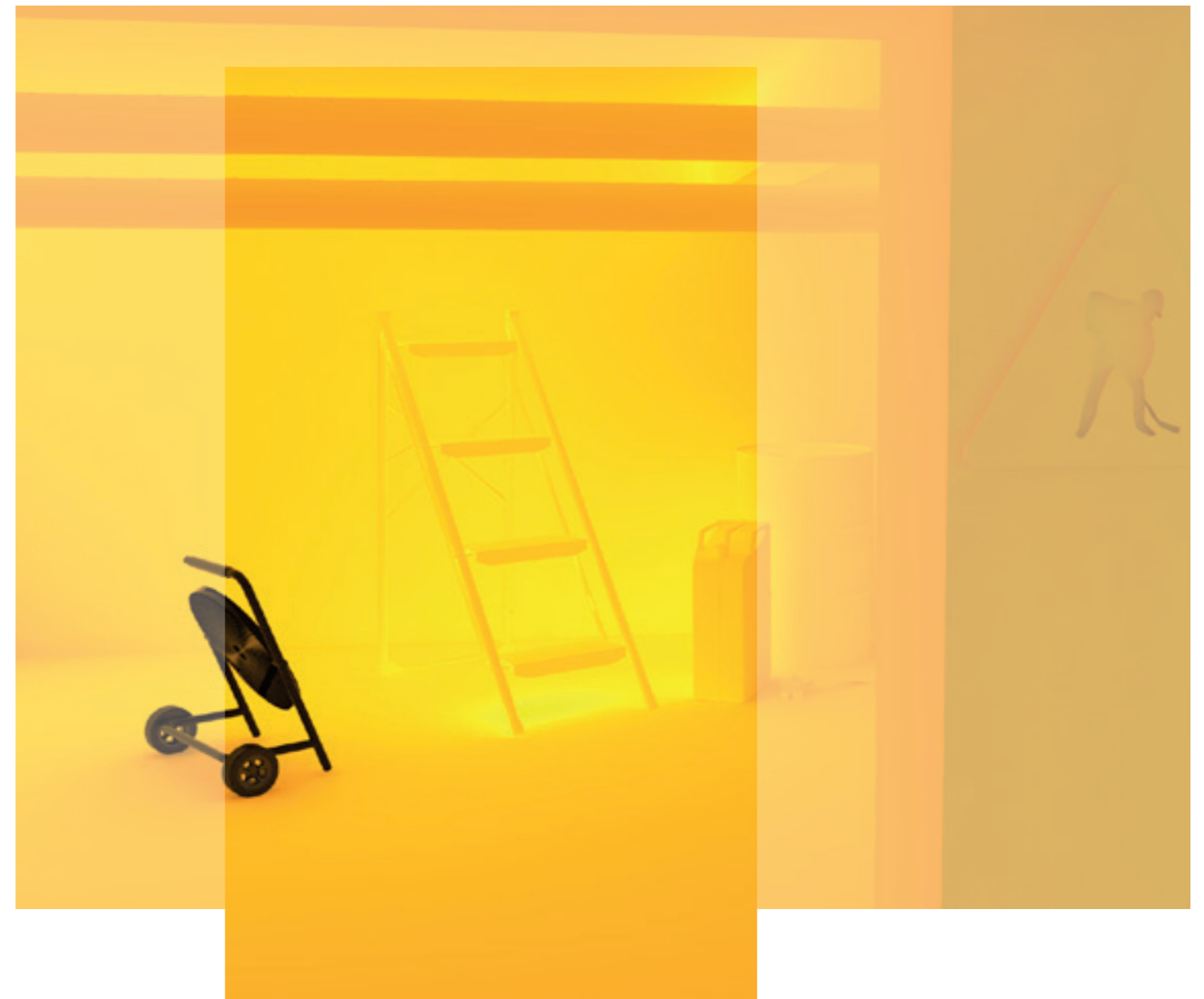
The modern design possibilities for luminaires powered by LEDs are endless. Makrolon® LED5102 provides good flowability, allowing you to injection mold complex geometrics while maintaining high mechanical stability. In case you need additional mechanical performance Makrolon® LED5302 or LED5402 have you covered.





# Makrolon® LED Transparent

Material Properties	Makrolon® LED5102	Makrolon® LED5202	Makrolon® LED5302	Makrolon® LED5402
MVR [cm³/10 min]	34	19	13	9.5
Transmission @ 2 mm	90%	90%	90%	89%
UV stabilized	✓	✓	✓	✓
Yellowness Index @ 2 mm	1	1	1	<0.8
Haze @ 2 mm	<0.5%	<0.5%	<0.5%	<1.0%
Izod notched impact 23 °C [kJ/m²]	55	69	72	71
RTI listed 125°C/115°C/125°C	✓	✓	✓	✓
f1 listed	✓	✓	✓	✓
Process	Injection molding	Injection molding	Injection molding	Injection molding & Extrusion



## Shine Brighter

The incredible transparent properties of Makrolon® LED5102, Makrolon® LED5202, Makrolon® LED5302 and Makrolon® LED5402 let your light shine brighter through both quality and longevity.



# Makrolon® DQ Diffusion Quality

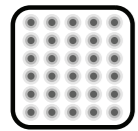


For luminaires with superior lumen output

Customized levels of hiding power

## Transmission is our Vision

With up to 10% more light transmission, Makrolon® DQ improves your luminaire efficacy, allowing you to make more powerful luminaires with the same ability to diffuse light.



# Makrolon® DQ

## Diffusion Quality

Material Properties	Makrolon® DQ5122	Makrolon® DQ5142	Makrolon® DQ5162	Makrolon® DQ5622 ET	Makrolon® DQ5652 ET	Makrolon® DQ5662 ET
MVR (cm³/10min)	34	34	34	6	6	6
HPA* @ 2 mm	19°	43°	56°	19°	49°	54°
Transmission @ 2 mm	85%	65%	57%	83%	58%	54%
UV stabilized	✓	✓	✓	✓	✓	✓
RTI listed 125 °C/115 °C/125 °C	✓	✓	✓	✓	✓	✓
f1 listed	✓	✓	✓	✓	✓	✓
Process	Injection molding	Injection molding	Injection molding	Extrusion	Extrusion	Extrusion

\* Half power angle



## Three Grades – Tailored Power

Makrolon® DQ comprises 3 products for each processing method with tailored half power angles, offering you the right hiding power for your luminaires. Optimized by data science, we can push light transmission to be best in class.



# Makrolon® FR Flame Retardant

Excellent optical performance

Available in transparent and translucent

Strong flame retardance V0 / 5VA

## “Hot” Topic in LED

Trends in LED powered luminaries like miniaturization and functional integration drive the need for flame retardant optics that fulfill demanding flame classifications. Makrolon® LED5902 FR and Makrolon® DQ FR help you to meet these requirements without making compromises in optical performance.





# Makrolon® FR

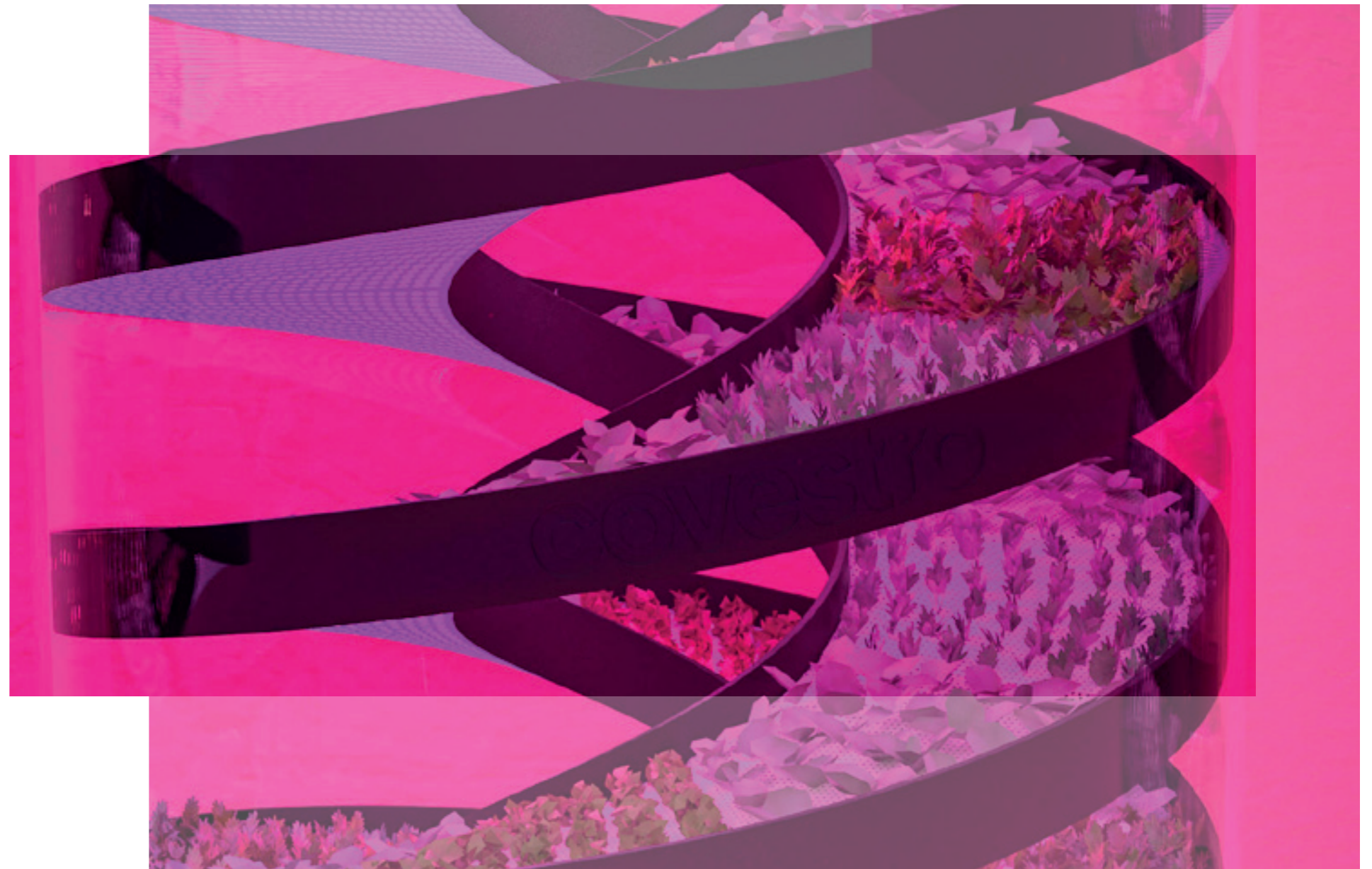
## Flame Retardant

Material Properties	Makrolon® LED5902 FR	Makrolon® DQ5922 FR	Makrolon® DQ5942 FR	Makrolon® DQ5962 FR
UL94 Classification	V-0 @ 1 mm 5VA @ 3 mm	V-0 @ 0.8 mm 5VA @ 3 mm	V-0 @ 0.8 mm 5VA @ 3 mm	V-0 @ 0.8 mm 5VA @ 3 mm
Transmission @ 2 mm	89%	77%	64%	55%
HPA* @ 2 mm		19°	43°	56°
UV stabilized	✓	✓	✓	✓
Yellowness Index	1.2			
f1 listed	✓	✓	✓	✓
Haze @ 2 mm	<1%			
Process	Injection molding & Extrusion	Injection molding & Extrusion	Injection molding & Extrusion	Injection molding & Extrusion

\*Half power angle

## Don't Learn Safety by Accident.

Being both temperature resistant and capable of high impact strength, Flame Retardant Makrolon® is a perfect option for light and safety in enclosed spaces with strict safety regulations.





# Makrolon® RW Reflective White



**High light reflection**

**Exceptional mechanical performance**

**Optimized processability**

## Human Centric Lighting

Makrolon® RW provides an ideal reflective surface in an aesthetic white appearance, spreading light homogeneously in all directions. Making the light easy for the eyes, without glare.



# Makrolon® RW Reflective White

Material Properties	Makrolon® RW5181 019900	Makrolon® RW2407 012363**	Makrolon® RW6267X 012363**	Makrolon® RW2407 012612	Makrolon® RW6267X 010083	Makrolon® RW3137 ET 010083
Total light reflection @ 2 mm	97%	96%	96%	86%	92%	92%
MVR [cm³/10 min]	26	19	19	19	19	6
UV stabilized	-	✓*	✓*	✓*	✓*	✓
Light blocking Transmission @ 1 mm <0.01%	-	-	-	✓	✓	✓
UL94 Classification	V-2 @ 1.5 mm	V-2 @ 1.5 mm	V-0 @ 1.5 mm	V-2 @ 1.5 mm	V-0 @ 1.5 mm	HB
Process	Injection molding	Injection molding	Injection molding	Injection molding	Injection molding	Extrusion

\* Also available as non UV stabilized version (Makrolon® RW2405; Makrolon® RW6265X)

\*\* Also available with colder white impression (Color code: 010226)



## Wide Variety for Specific Needs

Makrolon® RW grades are optimized to achieve excellent optical performance without compromise in processability, flame retardance and mechanical performance. The effect of light leakage in reflectors with thin wall thicknesses can be managed by dedicated light blocking products.



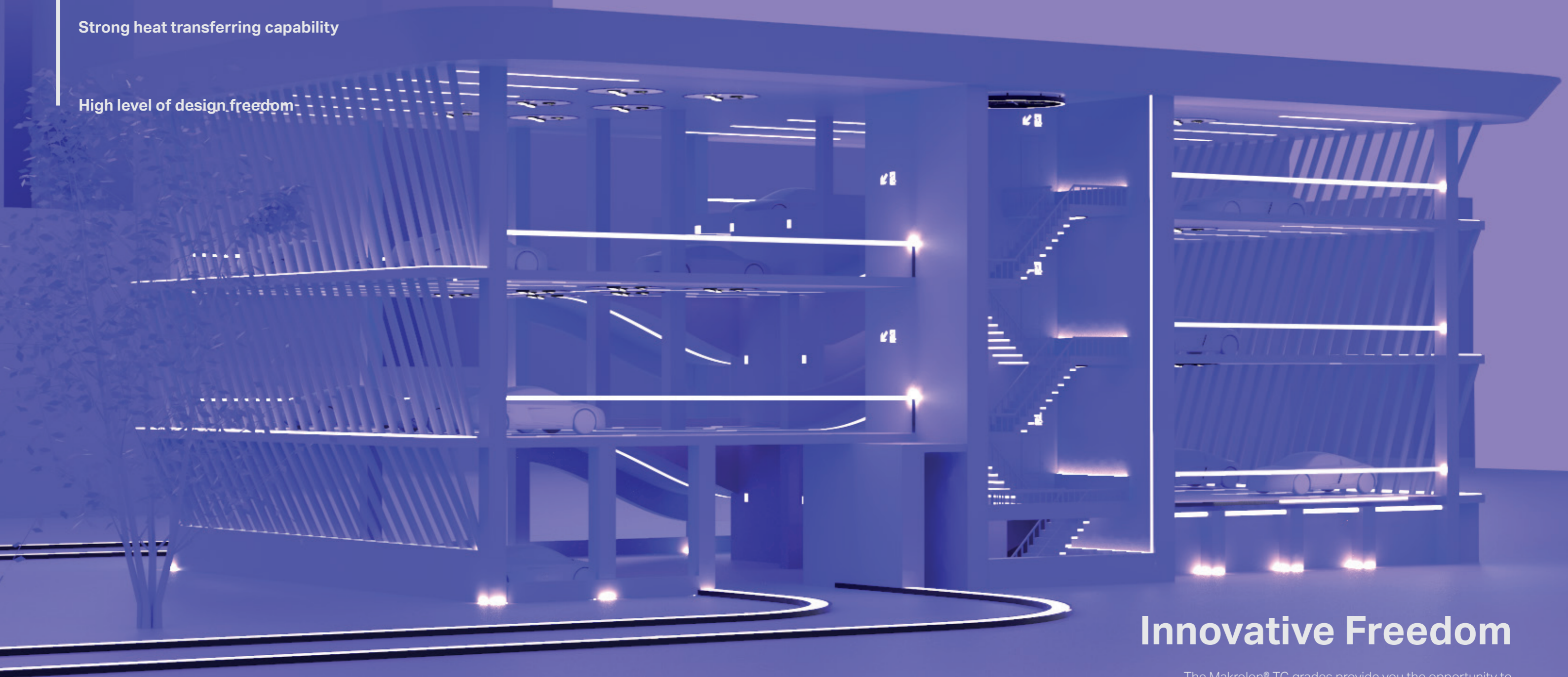
Makrolon® TC

# Thermal Conductive

Reduces weight

Strong heat transferring capability

High level of design freedom



## Innovative Freedom

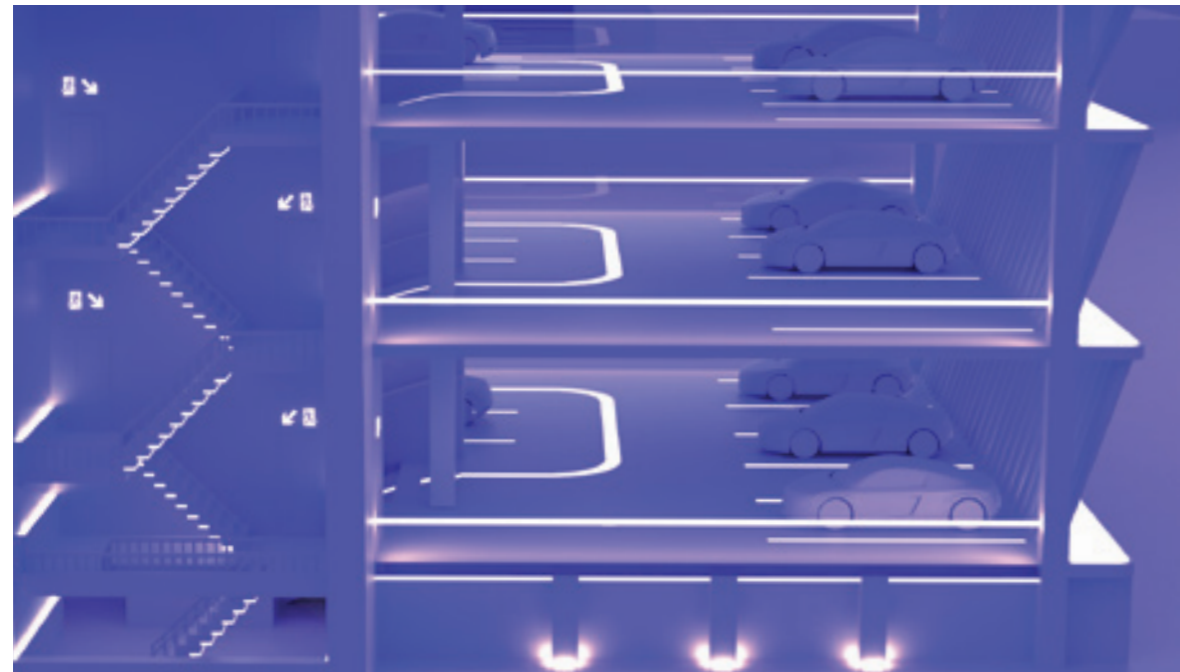
The Makrolon® TC grades provide you the opportunity to replace metals in heat sink applications, opening up incredible design opportunities while still keeping high dimensional stability.



# Makrolon® TC

## Thermal Conductive

Material Properties	Makrolon® TC629	Makrolon® TC621	Makrolon® TC421	Makrolon® TC210	Makrolon® TC110
Thermal conductivity in plane [W/(m·K)]	15	16	8	1.4	1
Thermal conductivity through plane [W/(m·K)]	1.2	1.4	0.9	0.3	0.3
Vicat softening temperature	144 °C	128 °C	131 °C	146 °C	145 °C
Electrical properties	Cond.	Cond.	Cond.	Insul.	Insul.
Color appearance	●	●	●	○	○
UL94 Classification	V-0 @ 2 mm	V-0 @ 2 mm	V-0 @ 3 mm	-	-
Charpy unnotched impact 23 °C [kJ/m²]	<10	<10	<10	12	70



## Lighten Your Experience

Makrolon® TC helps you achieve weight savings while meeting service life requirements and high efficiency. Improve time, ergonomics and costs.



# Makrolon® Edge Light Technology

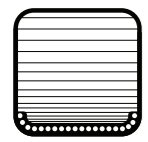
**Unlock new designs**

**Well-defined light distribution**

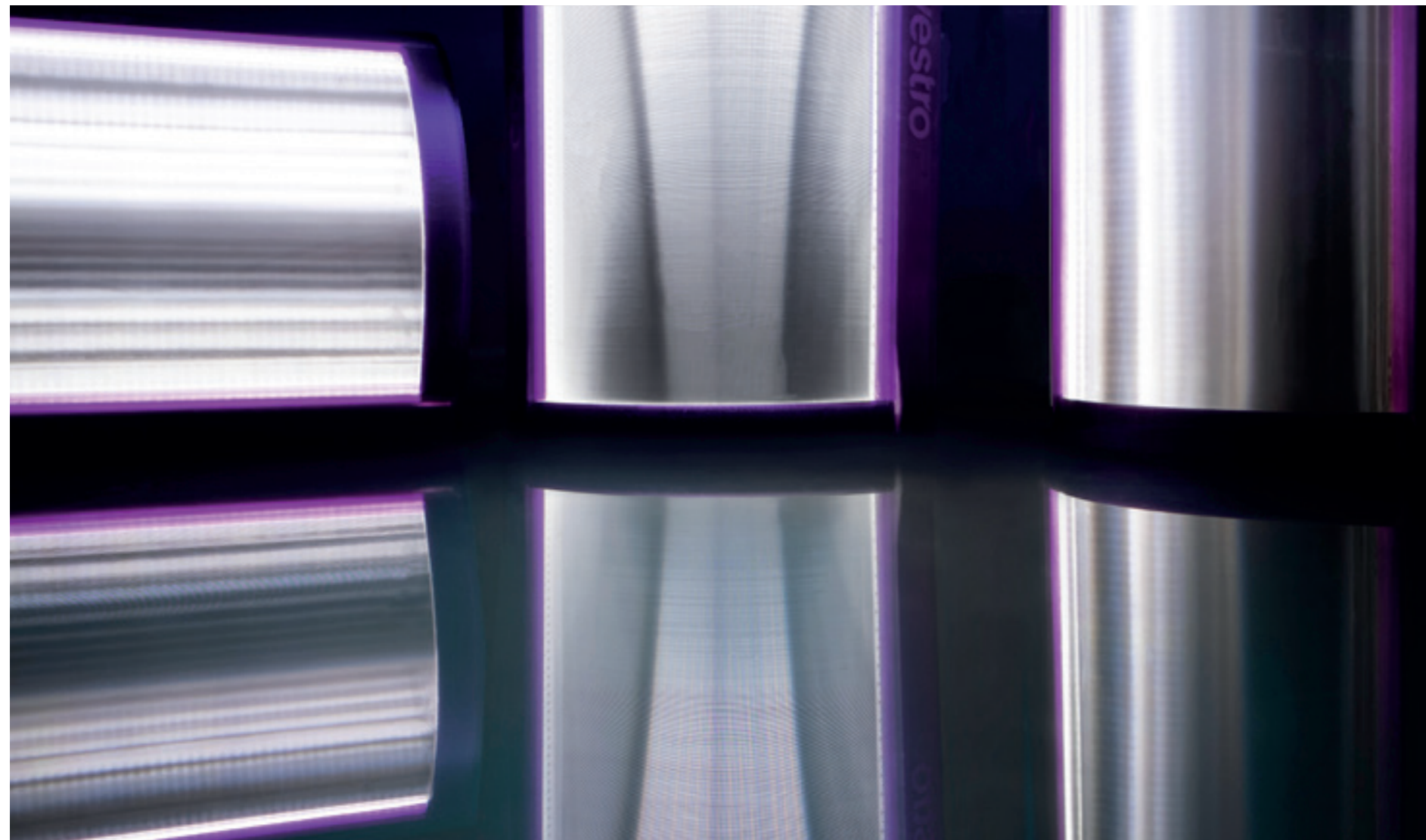
**Edge lighting made possible in polycarbonate**

## **New Frontiers**

Free formed and microstructured light guides based on Makrolon® LED offer new design possibilities in technical luminaires and ambient lighting applications. Enabling custom illumination geometries with appealing low-glare lighting.

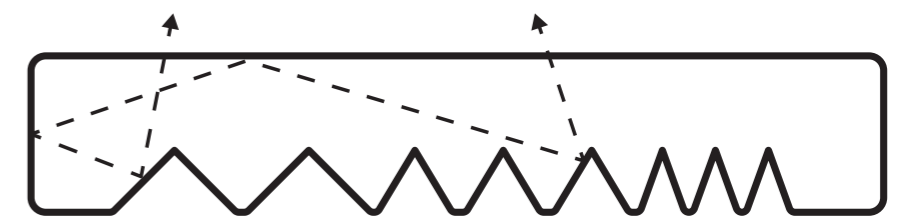


**Makrolon®**  
Edge Light  
Technology



## What's Your Idea?

In collaboration with our industry partners we cover all competencies that are necessary to develop an edge lighting luminaire from the idea phase to serial production. Let's work on your idea.



Schematic Illustration:  
Microstructured polycarbonate light guide



Covestro

# About us

## Curious, Courageous and Colorful

### Curious

We are open to new ideas and strive for progress. We are constantly looking for improvements. Curiosity drives us to listen closely and offer solutions that are creative and need-based.

### Courageous

We see opportunities where others see risks. Where others ask "why" we answer "why not?". With our knowledge and experience we can push boundaries – always with our eyes set on the future.

### Colorful

In the often dull corporate world we stand for diversity, optimism and creativity. We know that different views help to solve problems in an innovative way.

## You Are Not Just a Number

At Covestro, we feel strongly about being on equal level and on the same page as our customers. We appreciate interpersonal relationships and want to listen to and evolve with you. Your competitiveness is our success.

## Reliability is Our Priority

Our global presence makes us a reliable and flexible partner. Together we strive to find the right solutions for you needs.





**Covestro**

# Our Global presence



- Baytown, TX
- Newark, OH
- Antwerp
- Krefeld-Uerdingen
- Leverkusen
- Filago
- Greater Noida
- Map Ta Phut
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- PCS HQ: Shanghai

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Covestro

# Makrolon® Polycarbonate



## What's Next?

The possibilities are endless. You have the ideas, we have the materials  
Go ahead and start your journey with Makrolon® for LED Lighting .



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