



Background image: © Covestro AG and Amanda Wallgren

**Makrolon® Makroblend® Bayblend® Apec®**

## Electric Vehicle Supply Equipment Design and Material Solutions



# Covestro and the EV charging industry

Engineering plastics enable customers to create individual designs for electric vehicle (EV) charging stations while meeting global market requirements. Our strong, lightweight package of weatherproof materials meets electrical insulation standards, making it ideal for both, robust outdoor EV charging solutions and stylish wall box designs. As a true high-tech material, polycarbonate is not only robust, breakproof, and lightweight, but it also offers a high degree of design freedom. These properties are advantageous for the EV charging industry.

Covestro is partnering with innovation leaders along the EV value chain to make electric car charger materials reliable, affordable, and more sustainable. Our Makrolon® polycarbonate resins and Bayblend® polycarbonate blends can be used in charger housings, front covers, display lenses, light guides, and connectors for both indoor and outdoor charging stations. Arfinio®, a lightweight and durable material, can be used for housings that are repairable and exhibit warm and pleasant haptics.

Elastomers, polyurethanes, and thermoplastic polyurethanes such as Texin® and Desmopan® can be used for decorative parts and in charging connectors and their associated holders and power cables.

Covestro offers Makrolon® grades with UL flame class rating (UL 94 V-0/1.5 mm and 5VA/3.0 mm) and f1 listing to meet global EV charging requirements.

## Co-design of EV charging devices

All of our EV charging station solutions build on our extensive expertise in electrical and automotive applications and partnerships with leading electrical vehicle supply equipment providers. The combination of industrial and material-specific knowledge is what drives value-adding services, which include:

- Color, Material, Finish CMF (Color, Material, Finish) and design services
- Mechanical testing
- Computer-aided engineering (CAE) analysis
- Processing technology advisory

## Material solutions that meet the high requirements of the EV charging industry



<b>Outdoor weatherability</b> Shields EV supply equipment against harsh weather conditions	<b>Impact resistance</b> Protects electronic components against impact loads, e.g. vandalism, hail, etc.	<b>Aesthetic design</b> Surface finishing with style-match design for OEMs	<b>Safety</b> Flame retardant and secure against high currents	<b>Protection</b> Durability and reliability in material performance

# Main components for EV chargers



<b>Weathering resistance</b>	<b>Impact resistance</b>	<b>Low temperature impact resistance</b>	<b>Flame retardancy (UL 94)</b>	<b>Heat resistance</b>
● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
<b>Light guide light diffusion</b>	<b>Signal transmittance</b>	<b>Colour &amp; finish</b>	<b>Chemical resistance</b>	<b>Bio-circular-attributed material</b>
●	● ●	● ● ●	●	● ● ●

# Design cover

# Housing, front cover, and wall mount bracket

	Makrolon® 6557	Makrolon® 6557 RE	Makrolon® LED5902 FR	Makrolon® LED5902 FR RE	Makrolon® 6717	Makrolon® 2807	Makrolon® 2807 RE	Makrolon® 6487	Makrolon® 6487 RE	Makrolon® 6485 GR	Makrolon® FR6007 R20 <sup>1</sup>	Makrolon® FR6020 RE	Makrolon® FR6040	Makrolon® 9417	Bayblend® FR3010 BBS910	Bayblend® FR3016 W
<b>Material</b>	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC GF	PC+ABS	PC blend
<b>Sustainable share</b>	-	up to 88.3% bio-circular*	-	up to 85.8% bio-circular*	-	-	up to 88.3% bio-circular*	-	up to 87.5% bio-circular*	30% PCR**	20% PCR**	up to 80.8% bio-circular	-	-	-	-
<b>MVR (300 °C; 1.2 kg)</b>	10	10	6	6	3	9	9	9	9	10	9	9	10	6	15 (240 °C/5 kg)	32 (240 °C/5 kg)
<b>UL 94 classification</b>	UL 94 V-2/1.5 mm, V-0/3.0 mm, all colors	UL 94 V-2/1.5 mm, V-0/3.0 mm, all colors	UL 94 V-0/1.0 mm, 5VA/3.0 mm, CL	UL 94 V-0/1.0 mm, 5VA/3.0 mm, CL	UL 94 V-0/2.0 mm, all colors	UL 94 V-2/0.75-2.4 mm, HB/2.5 mm, all colors	UL 94 V-2/0.75-2.4 mm, HB/2.5 mm, all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VB/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm, all colors	UL 94 V-0/1.5 mm, 5VB/2.0 mm, all colors	UL 94 V-0/0.75 mm, all colors
<b>Izod notched impact</b>	65	65	50	50	60	70	70	70	70	13	74	67	65	10	35 (ISO 180A)	12 (ISO 180A)
<b>[kJ/m²] at different T [°C]</b>	12 at -30 °C	12 at -30 °C	-	-	15 at -30 °C	15 at -30 °C	15 at -30 °C	12 at -30 °C	12 at -30 °C	9 at -30 °C	-	46 at -20 °C	50 at -30 °C	-	10 at -30 °C (ISO 180A)	5 at -30 °C (ISO 180A)
<b>UV stabilized</b>	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes
<b>f1 listed</b>	yes	yes	yes	yes	no	yes	yes	yes	yes	no	no	yes	yes	yes (BK, GY)	no	yes

<sup>1</sup>Only available in Asia  
 #Makrolon® grades tested at 3 mm and Bayblend® grades at 4 mm  
 \*Attributed share of bio-circular feedstock via mass balance, ISCC PLUS (International Sustainability and Carbon Certification) certified  
 \*\*Partly made from post-industrial recycled (PIR) content or post-consumer recycled (PCR) content  
 \*\*\*Contact us for more information about Bayblend® and Makrolon® RE products



# Sustainability

At Covestro, we are curious to find more sustainable material solutions that drive the circular economy.

Our **Circular Intelligence (CQ)** solutions represent a smarter approach to more sustainable materials and technologies. **CQ** is more than a concept; it's a pledge. With our **CQ portfolio**, we substantiate our vision to become "fully circular" and offer high quality products with claimable environmental benefits.

In our relentless pursuit of sustainability, we developed the RE series: **Makrolon® RE, Bayblend® RE, Makroblend® RE, and Apec® RE**. Some of our selected **Makrolon® RE** grades are even **climate-neutral\***. The innovative polycarbonate RE series is **ISCC Plus certified\*\*** with partially bio-circular content, attributed via mass balance. These materials represent a significant stride towards intelligent circular material solutions, tailor-made as direct drop-in raw materials for a reduced carbon footprint of your final product. With the RE product series, we give biological waste and residues a second life. The RE series possess the same properties and performance as standard grades. This is our key for high-quality applications.

Our **CQ portfolio** also includes our R series, with grades containing partially post-consumer or post-industrial content, mechanically recycled.

Our newcomer in the **CQ series** is **Makrolon® RP**. This series consist of recycled attributed products related to chemically recycled post-consumer feedstocks, attributed via mass balance, and also **ISCC Plus certified\*\***. Both RE and RP series are drop-in solutions.

The RP series is available with a recycled attributed share of up to 89%.

The transition to a global circular economy is a large-scale project that can only be achieved through cross-sector collaboration. We are always looking to join forces with industry partners to become fully circular together.

## Innovation & Collaboration

We work with creative designers, technology innovators and create partnerships along the EV charging value chain. As a result, we are driving innovations in EV applications and envisioning the EV chargers of the future. We have developed material solutions that combine performance with aesthetics and sustainability. Together with partners we work on solutions for integrated functionalities such as smart electronics, modern lighting, touch control, connectivity (wireless, 4G/5G, NFC) and pave the way for circular designs.



Here you find more information about our more sustainable RE series:

\* **Climate neutrality** is proven via an assessment of a partial product life cycle from resource extraction (cradle) to the factory gate, also referred to as cradle-to-gate assessment.

\*\* **Life cycle assessment (LCA)** calculation acc. to ISO 14040/14044. LCA with preliminary value chain data, cradle to gate, biogenic carbon included, with no burdens from first life, impact assessment acc. to CML 2001-Aug 2016, replacing key raw materials with mass balanced bio-circular ones according to ISCC PLUS, replacing electricity grid mix with renewable electricity used for the manufacturing processes from Covestro when feasible. No compensation measures have been applied. The LCA methodology developed by Covestro AG is scientifically based and reflects the state of the art. ID No. 0000083440: Covestro AG – Certipedia. Covestro has implemented a management system certified by TÜV ID-Nr. 0000084999: Covestro AG – Certipedia that legitimates the allocation of renewable electricity to selected products, implemented now on specific sites. RE products have a low GWP (global warming potential), selected grades at selected sites are climate neutral. Climate neutral products are those with a GWP equal or lower than zero. At sites without renewable electricity allocation up to 85% carbon footprint reduction is possible.

# First EV Charger made from Makrolon® RE with a low Carbon Footprint

The more sustainable product **Makrolon® RE** has celebrated its premiere in an application within the field of electromobility. The globally operating Dutch company EVBox is using a compound from the new product series to manufacture the entire housing of their new Wallbox EVBox Livo. **Makrolon® RE** is partly produced from bio-waste and residues, some of which are obtained using renewable energy sources, resulting in a very low CO<sub>2</sub> footprint.

- **Durable**  
Suitable for indoor and outdoor use
- **Reduced CO<sub>2</sub> footprint**  
Makrolon® RE with more than 80% lower carbon footprint than conventional polycarbonate
- **Bio-circular raw materials**  
Bio-circular contents of ISCC PLUS certified waste and residues of biological origin are allocated via mass balance
- **Drop-in solution**  
Makrolon® RE grades have identical high-performance properties to standard Makrolon® grades
- **Meeting global EV charging industry requirements**  
Makrolon® RE grade with 5VA rating and f1 listing are available



Discover why EVBox uses Makrolon® RE for their Livo chargers



Here you find more information about our innovative material solutions for charging stations



# Wallbox Design Demonstrator

## Revolutionize charging: unleash a sustainable future of electromobility

The new wallbox design demonstrator uses Covestro's Makrolon® RE and Makrofol® material solutions in combination with design technologies from LEONHARD KURZ and injection molding technology from Sumitomo (SHI) Demag. The partners visualized together sustainable charging in a "vehicle-to-grid" concept. This means that the vehicle battery is used as a buffer storage unit that releases electricity to the grid to compensate for power fluctuations.

## Where aesthetics meets sustainability in the evolution of EV technology

Representing enhanced versatility both in terms of design and functionality, the wallbox design demonstrator offers a range of possibilities for technology integration. Due to their superior performance qualities, transparent Makrolon® RE poly-

carbonate and Makrofol® films are well-suited to backlight and sensor integration. They are compatible with in-mold decoration (IMD), film insert molding (FIM), and hot stamping production processes. Using the latest technologies from KURZ and Sumitomo (SHI) Demag, Covestro material solutions enable a streamlined manufacturing process and unlock an advanced array of functional and design possibilities.

## Easy processing with Film Insert Molding

Film Insert Molding (FIM) process technology allows a printed decorative contour film to be directly back-molded with a resin to create a robust decorated end part in one step. This protects the graphics, which can even be customized, from external influences. Designers are looking for sophisticated shapes and quick, cost-effective customization, and film technology is a great answer.



Here you find more info about our project:

## Makrolon® and Makrofol® enable slim, smart, and elegant surfaces for comfortable touch and feel and easy handling.

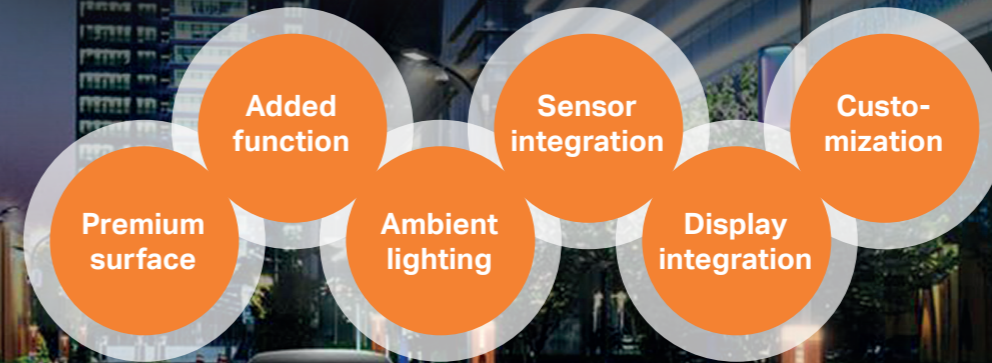


Wallbox Design Demonstrator in cooperation with LEONHARD KURZ and Sumitomo (SHI) Demag

# Surface design and integrated functions

## Enabling attractive design features with integrated functionalities

In addition to the functionality of chargers for electric vehicles, the design also plays an important role for the end user. Film technologies are well established in a variety of automotive and consumer goods industries and offer great design features



Makrofol® SR906 1-1	PC/PMMA	Film suitable for FIM	UV protection	High gloss
Makrofol® LM914 1-2	PC/PMMA	Film suitable for FIM	-	Grey tinted
Makrofol® UV244 1-1	PC	Film suitable for FIM	UV protection	High gloss
Makrofol® UV508 7-2	PC/PVF	Film suitable for FIM	UV protection	High chemical resistance
Makrofol® Multilayer sheet*	PC/PMMA	Sheets > 1mm thickness	UV protection	-

\* under development

# Lighting

		Makrolon® DQ5122	Makrolon® DQ5142	Makrolon® DQ5162	Makrolon® DQ5922FR	Makrolon® DQ5942FR	Makrolon® DQ5962FR	Makrolon® 6557	Makrolon® 6557 RE	Makrolon® 6717	Makrolon® LED5902 FR RE
<b>Material</b>		PC, diffusive	PC, diffusive	PC, diffusive	PC, diffusive	PC, diffusive	PC, diffusive	PC, transparent	PC, transparent	PC, transparent	PC, transparent
<b>Sustainable share</b>		-	-	-	-	-	-	-	up to 88.3% bio-circular*	-	up to 85.8% bio-circular*
<b>MVR (300 °C; 1.2 kg)</b>	cm³/10 min	34	34	34	5	5	5	10	10	3	6
<b>UL 94 classification</b>	mm	UL 94 V-2/0.75-2.2 mm	UL 94 V-2/0.75-2.2 mm	UL 94 V-2/0.75-2.2 mm	UL 94 V-0/0.8, 5VA 3.0 mm	UL 94 V-0/0.8, 5VA 3.0 mm	UL 94 V-0/0.8, 5VA 3.0 mm	UL 94 V-2/1.5 mm, V-0/3.0 mm, all colors	UL 94 V-2/1.5 mm, V-0/3.0 mm, all colors	UL 94 V-0/2.0 mm, all colors	UL 94 V-0/1.0 mm, 5VA 3.0 mm
<b>Izod notched impact</b>	(ISO 21305 / based on ISO 180/A), [kJ/m²] at 23 °C	12 / based on ISO 179eA	12 / based on ISO 179eA	12 / based on ISO 179eA	9	7	12	65	65	60	50
	[kJ/m²] at different T [°C]	12 at -30 °C	12 at -30 °C	12 at -30 °C	-	-	-	12 at -30 °C	12 at -30 °C	15 at -30 °C	-
<b>UV stabilized</b>		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
<b>f1 listed</b>		yes	yes	yes	yes	yes	yes	yes	yes	no	yes

# Charging plug housing

	Makrolon® FR6020	Makrolon® FR6020RE	Makrolon® FR6040	Makrolon® FR6011
<b>Material</b>	PC	PC	PC	PC
<b>Sustainable share</b>	-	up to 80.8% bio-circular*	-	-
<b>MVR (300 °C; 1.2 kg)</b>	9	9	10	4
<b>UL 94 classification</b>	UL 94 V-0/1.5 mm, 5VA/3.0 mm all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm all colors	UL 94 V-0/1.5 mm, 5VA/3.0 mm all colors	UL 94 V-0/1.5 mm, all colors
<b>Izod notched impact</b>	67	67	60	70
	46 at -20 °C	46 at -20 °C	45 at -30 °C	20 at -30 °C
<b>UV stabilized</b>	yes	yes	yes	yes
<b>f1 listed</b>	yes	yes	yes	no

# Makrolon® grades tested at 3 mm and Bayblend® grades at 4 mm

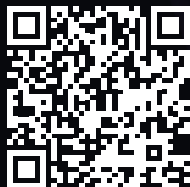
\* Attributed share of bio-circular feedstock via mass balance, ISCC (International Sustainability and Carbon Certification) Plus certified

\*\* Contact us for more info about our RE series, PCR portfolio or further products

# Get in touch with us



**Interested in  
polycarbonate solutions?**  
Get more info here



**Interested in  
film solutions?**  
Check out our website

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Special thanks to our collaboration partner Umea Institute of Design and the involved students. Designs from the following students were featured in this brochure: Amanda Wallgren, Christoffer Weinreich and Rebekka Quiroz Wiberg.

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