Electric Vehicle (EV) faces of the future.

Designed to be functional.
Made to be remembered.
Crafted in Polycarbonate.
The synergy of innovation and elegance in Electric Vehicle (EV)

The automotive industry is currently undergoing a significant transformation. This is driven by the emergence of new technologies such as electric mobility and autonomous driving. It has also resulted in a shift in focus towards the development of body parts for electric vehicles that are not only more sustainable but also combine design freedom with an ever-increasing level of functionality. One area where this transformation is particularly evident is in the design of the vehicle’s exterior, especially in the frontend grille.

Market requirements vs challenges

Existing requirements already include:

- Printed décor layers
- Safety aspects (pedestrian protection and overall crash behavior)
- Resistance to environmental influences
- Reduced installation space
- Low / controlled thermal expansion
- Reduced weight
- Cost efficiency

Enhanced functionality and design have added further challenges. For instance, there is a growing demand for transparent materials in the outer skin components to enable the transmission of sensor signals or illumination light.

Sensors like RADAR, LIDAR, IR, or VIS cameras are vital for autonomous driving. Achieving high surface qualities, material purity, and component precision are crucial for ensuring the long-term functionality of these sensors. On the outer surfaces, scratch-resistant coatings are necessary to ensure that sensor signals can pass through the cover undisturbed, even after years of use.

Engineering ingenuity enabled by polycarbonate

The EV transformation has resulted in a lot of movement in the pre-development area. New opportunities for materials and manufacturing technologies are opening up. The challenge at hand is to merge specific designs with partially hidden functions in exterior components. In consequence, outer parts in the area of the former radiator grille have undergone enormous changes in recent years. One “close to reality” example illustrating this trend has been showcased by Covestro at the K fairs in 2019 and, in a much more developed state, in 2022.

Another shift induced by the move towards EVs becomes evident, i.e. the lighting integration into surrounding components. This is driven by both, design considerations and the relocation of individual lighting functions from the headlight to other areas of the vehicle. The combination of intriguing design, lighting, and heating functions is featured in Covestro’s latest frontend concept, as demonstrated (see pictures below).

Questions have been raised about the testing standards and regulations that must be met in the targeted vehicle exterior applications. For example, in the United States and beyond, the use of materials listed via the Automotive Manufacturers Equipment Compliance Agency, Inc. (AMECA) is expected.

This requirement touches a wide range of thermoplastics, coatings, and other raw materials used for lighting components. Now it becomes potentially relevant to many new exterior body part concepts. Covestro answers the call for AMECA compliant materials with our Makrofol® and Makrolon® polycarbonate portfolios.
Crafting future design through advanced-engineering materials

Developed in collaboration with industry leaders, this frontend grille exemplifies excellence in both aesthetics and functionality. The seamless outer surface of the grille features a pioneering black & metallic, chrome-like body color appearance. The design distinguishes itself from traditional metalized materials and incorporates true 3D décor elements as well as LED illumination systems. The functionality includes glowing edges realized via In-Mold Electronics (IME), a hidden-until-lit logo, a lightbar, and a display.

Through sensor integration, a radar module is discreetly hidden behind a metal-free chrome-like film, allowing it to operate seamlessly without compromising the panel’s visual appeal. The integration of electronics includes an embedded heating-wire system via film, ensuring the functionality of both the display and radar. Film Insert Molding (FIM) provides designers with the flexibility to explore various form factors and achieve desirable part-to-part variation.
Material selection is critical for the frontend grille design process. The material of choice must possess the essential properties required:

- Tailored range of transparency
- Scratch, UV light, and chemical resistance
- Sufficient toughness
- Adequate thermal expansion
- Glass-like surface quality
- Injection moldability
- Cost efficiency

However, the need for transparency significantly limits the range of material options. The demand for cost efficiency further narrows the list of potential materials down to PMMA and polycarbonate. Despite their similar properties, polycarbonate has emerged as the preferred choice due to its higher toughness on impact.

**Covestro offers a one-stop-shop solution** to our customers. We combine our strong application development expertise in the whole process chain of FIM. A small selection from our broad portfolio of polycarbonate resin and film products is given below.

**Film grade** | **Typical application** | **Description**
---|---|---
Makrofol® DE 1-1 000000  | Decor layers | Highly transparent / good formability
Makrofol® DE 1-4 000000  | Decor layers | Translucent / improved printability on one side
Makrofol® DE 4-4 160021  | Emblems, wire heaters | Translucent / improved printability on both sides
Makrofol® LM243 2-4 160025  | Headlamps, lighting | Diffuser / defined transmission and half power angle
Makrofol® LM296 1-2 760150  | Hidden-thr-fit features | Dark tinted / 50% transmission
Makrofol® LM302 1-2 000000  | Radar covers | Visually transparent / very fine matt surface
Makrofol® LM903 1-4 160008  | Reflector layers | Opaque white
Makrofol® ST342 1-1 940002  | LiDAR covers | Opaque black / IR transparent / easy forming
Makrofol® ST362 1-1 940006  | LiDAR covers | Opaque black / IR transparent
Makrofol® UV244 1-1 000000  | Wire heaters | Transparent / UV protected
Makrofol® UV503 1-4 000000  | Decor layers with special requirements | Transparent / UV protected / ANEC-listamaterial

**Resin series** | **Typical application** | **Description**
---|---|---
Makrolon® AG Series | Frontend grilles, automotive glazing parts | Visually transparent / translucent. Available in tinted neutral density colors
Makrolon® AX Series | Black exterior trim parts, sensor cover, exterior panels with integrated sensors | Visually opaque. Available in sensor transparent (NIR) black colors
Bayblend® MF Series | Large exterior parts with high dimensional stability, 2nd component for 2K parts | Reduced Coefficient of Thermal Expansion (CTE) for higher dimensional stability and optimized shrinkage behavior
Makrolon® LED Series | Lightguides, lenses and other optical components | High transparency and purity
Makrolon® TC Series | Heatsinks and thermally conductive housing applications | High thermal conductivity. Available as electrically insulating

Not finding what you are looking for? Mass balance, bio based, recycled? Please contact us. We will turn the future of mobility into reality.