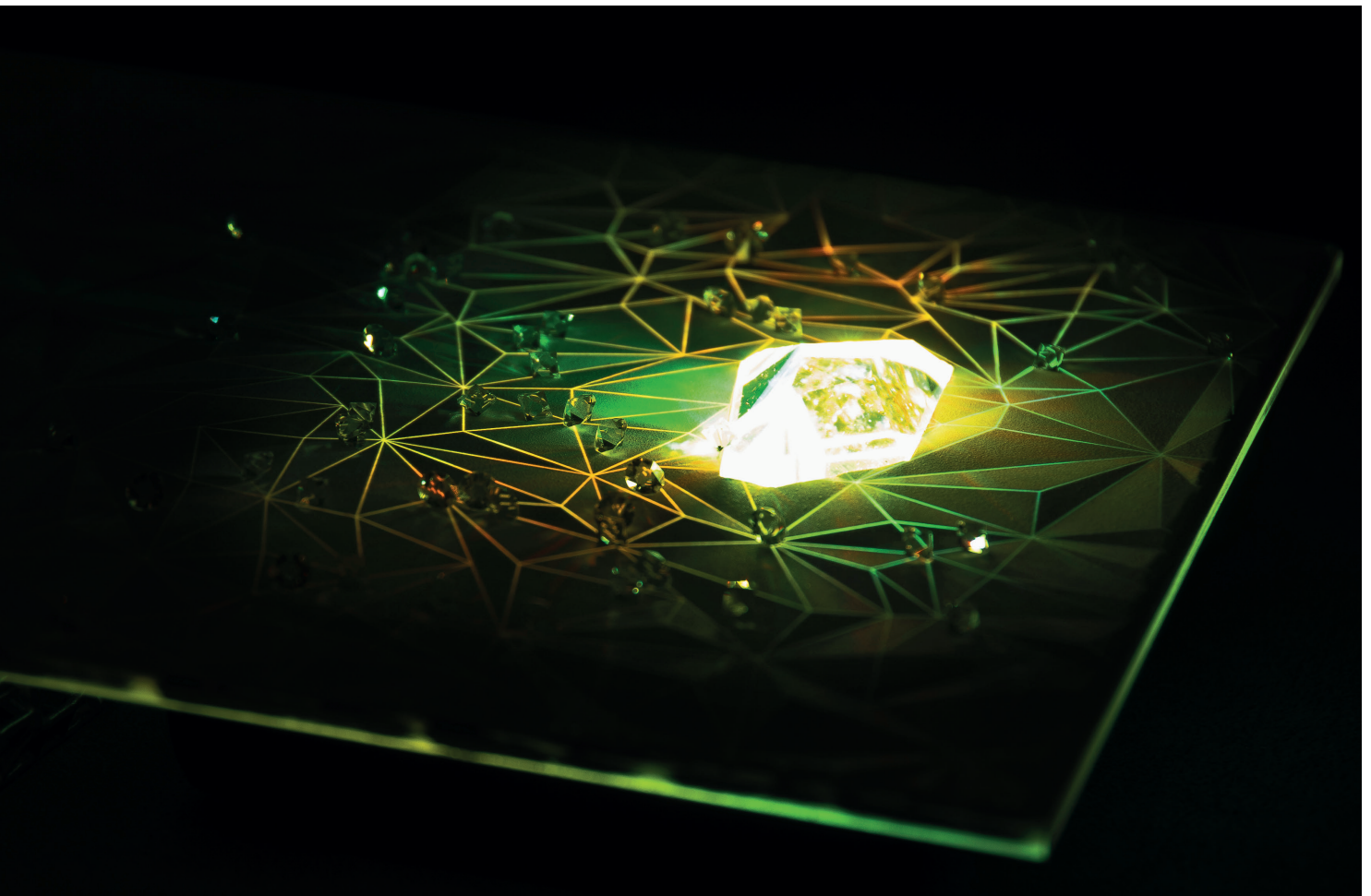


Elegant Design Ideas for the Automotive Interior

Ambient Lighting with a Wow Effect

With a symbiosis of 3D texture, coating and lighting, Reichle Technologiezentrum, Mankiewicz and Lightworks are creating a day-night design with new possibilities. The element of surprise comes from the fact that the effect of transilluminated surfaces is not visible in daylight, and only appears when the lighting is switched on.



Specially coated Swarovski crystals reflect the light as computed by the designer in advance. © Reichle

Megatrends such as electromobility and autonomous driving are changing not only the automotive industry but also the design of all products. In the automotive interior, the focus is on the surfaces – and the user experience they provide. At least that is the way it is seen by Marco Reichle, CEO of the Reichle Technologiezentrum GmbH in Bissingen/Teck, Germany.

Design and Optics Alone Are Not Enough to Provide the Desired User Experience

“Creating attractive interior spaces and ambient lighting solely through design and optics is no longer sufficient to meet modern expectations,” says Reichle. “The principal aim of interior spaces now is rather to achieve an interplay of functionality and experience.” This goal was

implemented by the laser expert in a concrete practical example. A joint project was conducted to investigate the partial transillumination of 3D-textured surfaces.

For this, Reichle brought two partners on board: the team from Bissingen has been working closely with Mankiewicz GmbH & Co. KG and Lightworks GmbH for years. Together, they

developed a new concept for ambient lighting. The clever part is an element of surprise for the vehicle occupants. It comes from the fact that the impact of transilluminated surfaces and crystals is not visible in daylight, and only appears when the lighting is switched on. This effect is achieved with a combination of surface design, lasered 3D texture and light and coating systems.

The Texturing of the Surfaces Is Lasered into the Mold

In this project, a crucial role was played by the product design. In a first step, the designers shaped the surface of the part such that an aesthetic surface is created in daylight while at the same time patterns and effects that are normally invisible become visible at night. The developed surface was machined into the mold inserts on a 5-axis laser system from the manufacturer GF Machining Solutions. The challenge here was that no CAD data records of the shrunk plastic part, including texture, existed. Reichle Technologiezentrum therefore uses algorithms developed by its research and development department to introduce textures accurately, even into shrunken parts, with a tolerance of only one to two hundredths of a millimeter. Subsequently the surface was provided with a specially developed multilayer coating system, which permits partial transillumination and creates a light concept that determines the type of illumination.

Personalizations of the Logo through to Antibacterial Design

As regards the personalizability of the day-night design, the technology allows maximum design freedom. From the 3D texture implemented with laser technology, through the light, to coating, which can be given "anti-fingerprint" or even antibacterial properties, entirely new design possibilities are opened for the user. The holistic design concept involves completely closed surfaces, which meet all the requirements of the automotive standard. Decoration, texture, coating and light meld seamlessly together without additional contour guides, and offer a tactile and optical experience. Even logos, lettering and graphics can be



Decorative strips in the vehicle with partial transillumination in day-night design. © Reichle

engraved in this way. The basic plastic part forms the basis of the design, meaning that no additional investment is required. By realizing the transillumination on the part surface itself, undesirable parallax effects can be additionally avoided. Compared to conventional film backmolding, which cannot be implemented on textured surfaces with partial lighting, the day-night design concentrates on 3D-textured surfaces, thus allowing a high degree of precision and an accuracy of fit of a few micrometers.

Thanks to the design freedom, it is available as an optional extra or else personalized to a quantity of one in large series. The possible applications are in particular decorative trim, complete door panels, center consoles or, in the near future, exterior applications, such as front headlamps, tail lights, radiator grilles, or even outer skin parts – but also applications for electrical equipment, »

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Seeing the future of the interior in a symbiosis of light and decor: Marco Reichle, director of the Reichle Technologiezentrum. © Reichle

aircraft, furniture and bath and kitchen fittings. Typical applications such as different textures in different driving modes, illuminated serial numbers for special series or a combination with touch functions are only some of the conceivable possibilities.

The Reichle Technologiezentrum, together with Lightworks GmbH, develops the entire lighting technology. Starting with the lighting simulation, development of the entire lighting system, via design of the low-profile light guide with the necessary outcoupling optics, through to realization in the injection mold, making exclusive use of high precision femto laser technology, which is essential for the necessary precision.

In the development project, Mankiewicz developed and implemented the special coating systems, so that a transillumination solution that is invisible in the day design could be realized by means of completely closed surfaces. Likewise, the special laser primer is a new development that is convincing for its layer thickness of only a few micrometers.

The Challenges of the Lighting Concept

For the special ambient lighting, each individual technology also poses special challenges:

- **Moldmaking:** depending on the texture and texture depth, an offset must be maintained in the mold, so that an absolute dimensional accuracy can be ensured and the mold parting surfaces fit precisely. The required offset concept can be very complex, in particular for fade-out effects.
- **Laser Texturing:** the accessibility in the mold for the laser beam must be ensured. During the laser texturing

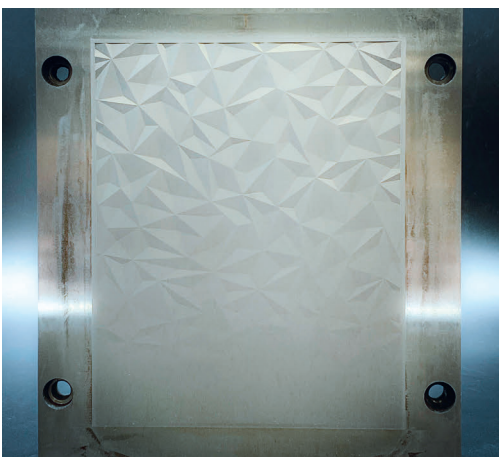
itself in the mold, there are no major challenges, they lie rather in the prior design development.

- **Injection Molding:** stable dimensional stability throughout the series process. The wall thicknesses of the plastic parts consisting of transparent PC or PMMA are 2 to 3 mm.
- **Coating:** the very thin layer thicknesses of the special coating systems.

Is There a Trend for the Future of the Automotive Interior?

Marco Reichle is satisfied with the results of the project. What moved him to start this development project? Reichle: "Vehicles are unimaginable today without ambient lighting, however for many years they have been realized in very similar ways via contour light guides. In the future, we see a symbiosis of light and décor, which is why we decided to integrate ambient lighting directly into decorative trim or general plastic parts, so that we can provide an element of surprise in the night design. Our effort was therefore in particular to realize the entire topic on 3D-textured surfaces, since no technical, process-stable solution has been available until now. Film backmolding with partial, accurately fitting areas onto a texture or graining is not feasible with present technology.

A series-capable solution for overmolding crystals is currently being developed in order to be able to present an economic manufacturing process. ■



The left-hand picture shows a mold insert, the pictures to the right of it show two different lighting versions that appear when the lighting is switched on. © Reichle