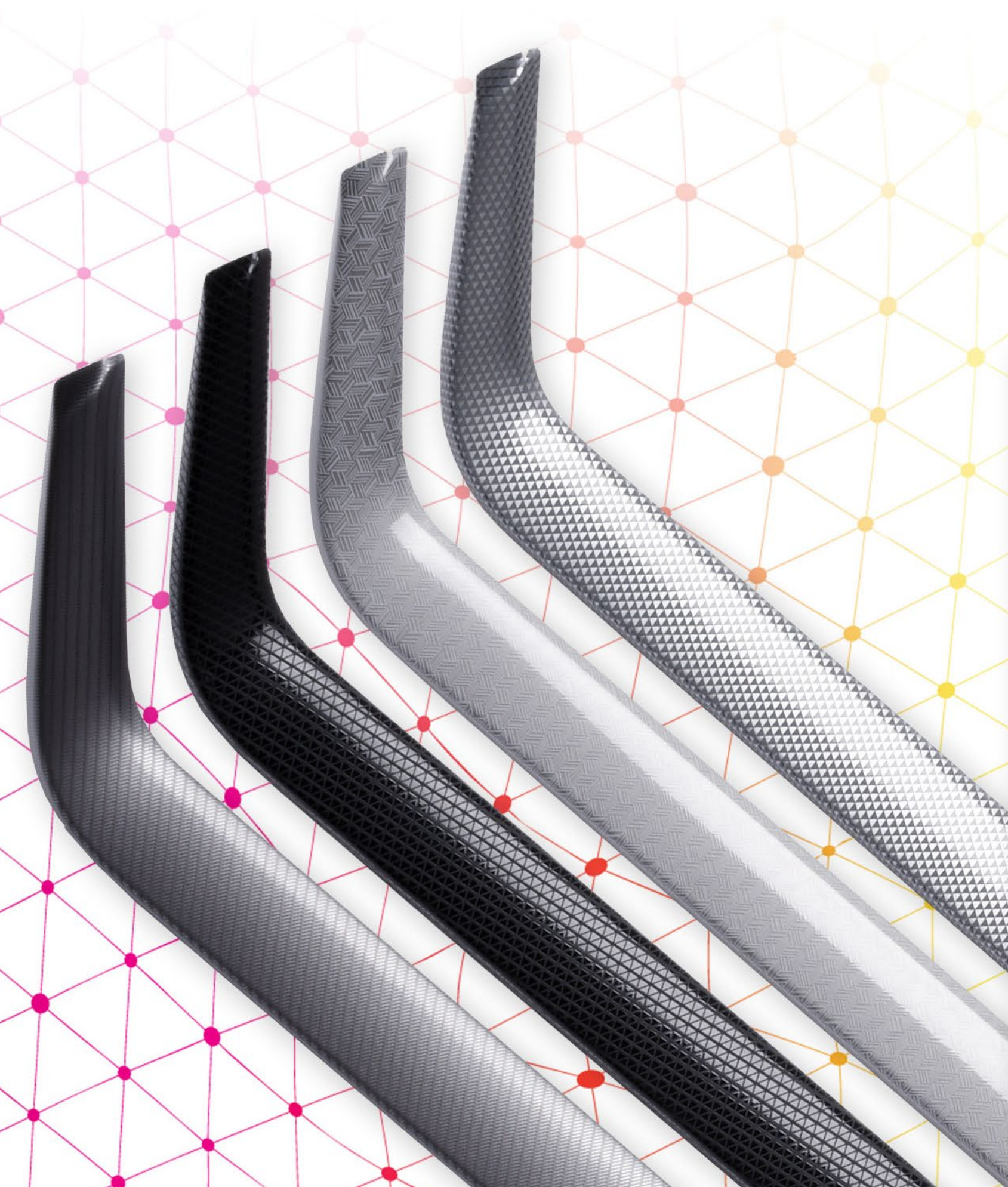


# IMD/FIM Screen Printing Inks & Lacquers for the Decoration of Automotive Front Modules & Lighting Applications



*Innovative Inks &  
Functional Lacquers*





**Screen Printing Inks**  
UV, water and solvent-based  
**Pad Printing Inks**  
**IMD/FIM Ink Systems**  
**Adhesion Promoters**  
**Protective Lacquers**

**R&D**

**Production**

**Printing Technology**

**IMD/FIM Center**



## IMD/FIM process steps

### 1. Screen Printing

typically second surface  
supplemented by first surface  
printing

### 2. High Pressure Forming

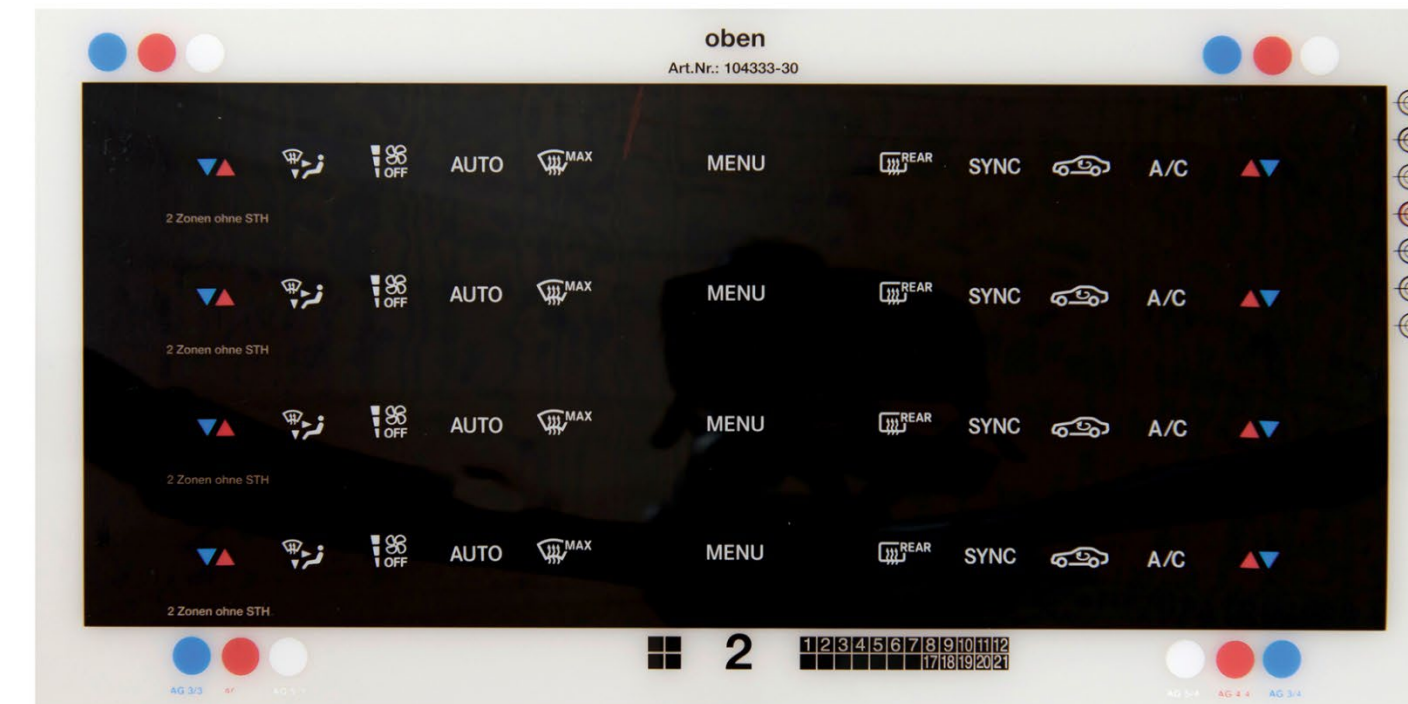
UV curing of the film hard coat  
or the dual cure screen printing lacquer  
on the first surface

### 3. Trimming

Film cutting

### 4. Injection Molding

2-component injection molding  
(PC transparent, PC/ABS black)



## The Screen Printing Process

### Screen printing as versatile printing technique:

- Different substrate types
- Different substrate thicknesses
- **Opaque and transparent colors**
- **Easy design change**
- **High ink layer thickness**
- Long-Term adhesion/durability
- Most compatible binder chemistry for IMD/FIM

Unique in a high variety of options



## High pressure forming

Excellent formability of full thermoplastic NORIPHAN® HTR N as premium selection on PC based substrates (200 – 300 % depending on ink layers + film thickness)

➤ no ink cracks, no change in color shade and opacity

Best utilized for deep drawing with reproducible graphic registration:

**pre-compensation by printing leads to stable graphic placement in the film insert**

**Niebling High Pressure Forming**

[www.niebling-form.com](http://www.niebling-form.com)



® Niebling SAMK 650

# Cross-sectional view as compatible pairing between film, ink and resin

| Film        | Ink  | Adhesion Promoter   | Resin                             |
|-------------|--|---|-----------------------------------|
| <b>PC</b>   | NORIPHAN <sup>®</sup> HTR N  | -   | PC, PC/ABS, PMMA, TPU, Silicone   |
|             | NORIPHAN <sup>®</sup> PCI N  | NoriPress <sup>®</sup> SMK                                  | ABS, PA 6, PA 11, PA 12, PC, PMMA |
|             | NORIPHAN <sup>®</sup> N2K<br><small>(N2K is not back moldable with PMMA)</small> |   |                                   |
|             | NORIPHAN <sup>®</sup> XMR  | NORIPHAN <sup>®</sup> HTR N                                 | PC, PC/ABS, PMMA, TPU, Silicone   |
|             | NORIPHAN <sup>®</sup> XWR  | NORIPHAN <sup>®</sup> N2K                                   | PC, PC/ABS, TPU, Silicone         |
|             |  | NoriPress <sup>®</sup> SMK                                  | ABS, PA 6, PA 11, PA 12, PC       |
|             | NoriCure <sup>®</sup> IMS (UV)   | NORIPHAN <sup>®</sup> XMR + HTR N<br>AquaPress <sup>®</sup> | PC, PC/ABS, PMMA, TPU, Silicone   |
| <b>PMMA</b> | Noricryl   | -   | PMMA, ABS, SAN                    |
| <b>PET</b>  | NORIPHAN <sup>®</sup> N2K  | -   | PC, PC/ABS                        |
|             | NoriPET <sup>®</sup>   | -   | ABS, SAN                          |
|             | NORIPHAN <sup>®</sup> XMR  | NORIPHAN <sup>®</sup> HTR N                                 | PC, PC/ABS, PMMA, TPU, Silicone   |
|             | NORIPHAN <sup>®</sup> XWR  | NORIPHAN <sup>®</sup> N2K                                   | PC, PC/ABS, TPU, Silicone         |
|             |  | NoriPress <sup>®</sup> SMK                                  | ABS, PA 6, PA 11, PA 12, PC       |
| <b>PP</b>   | NORIPHAN <sup>®</sup> XMR<br>NORIPHAN <sup>®</sup> XWR<br>NoriPET <sup>®</sup>   | NoriPress <sup>®</sup> PP                                   | PP                                |
| <b>PA</b>   | NoriAmid <sup>®</sup>  | NoriAmid <sup>®</sup> APM                                   | ABS, PA 6, PA 11, PA 12           |

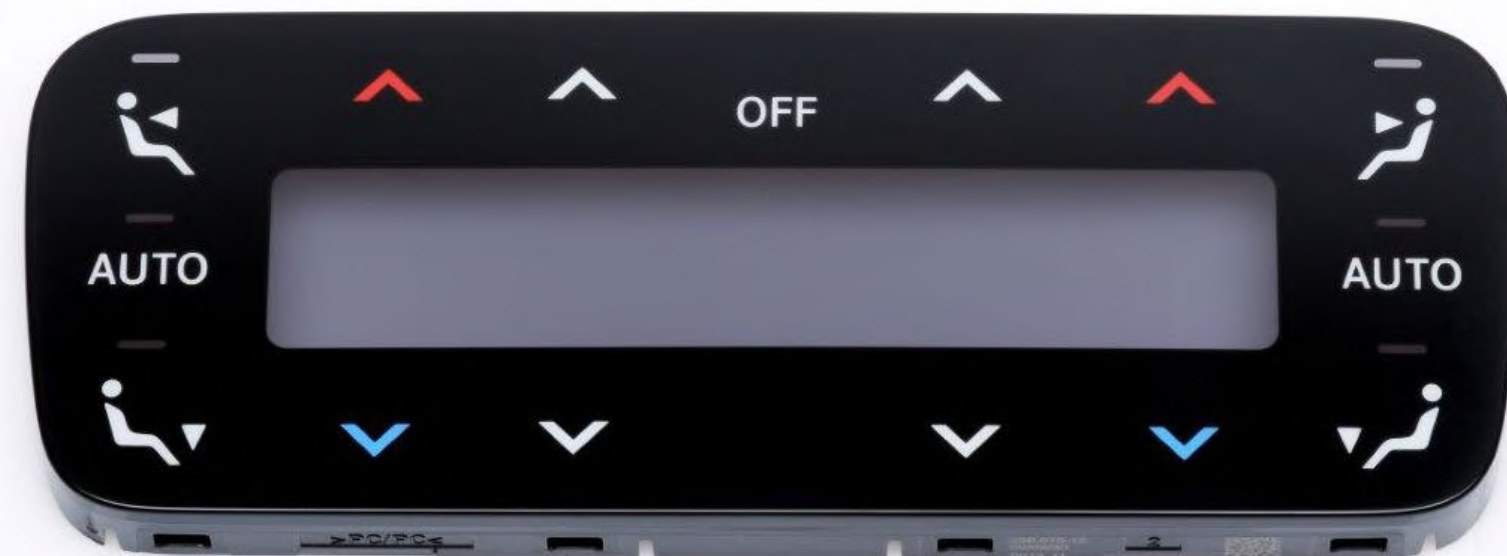
## Automotive interiors parts – state of the art



© CCL  
New Albea



© SYMBIOSE  
VW ID7

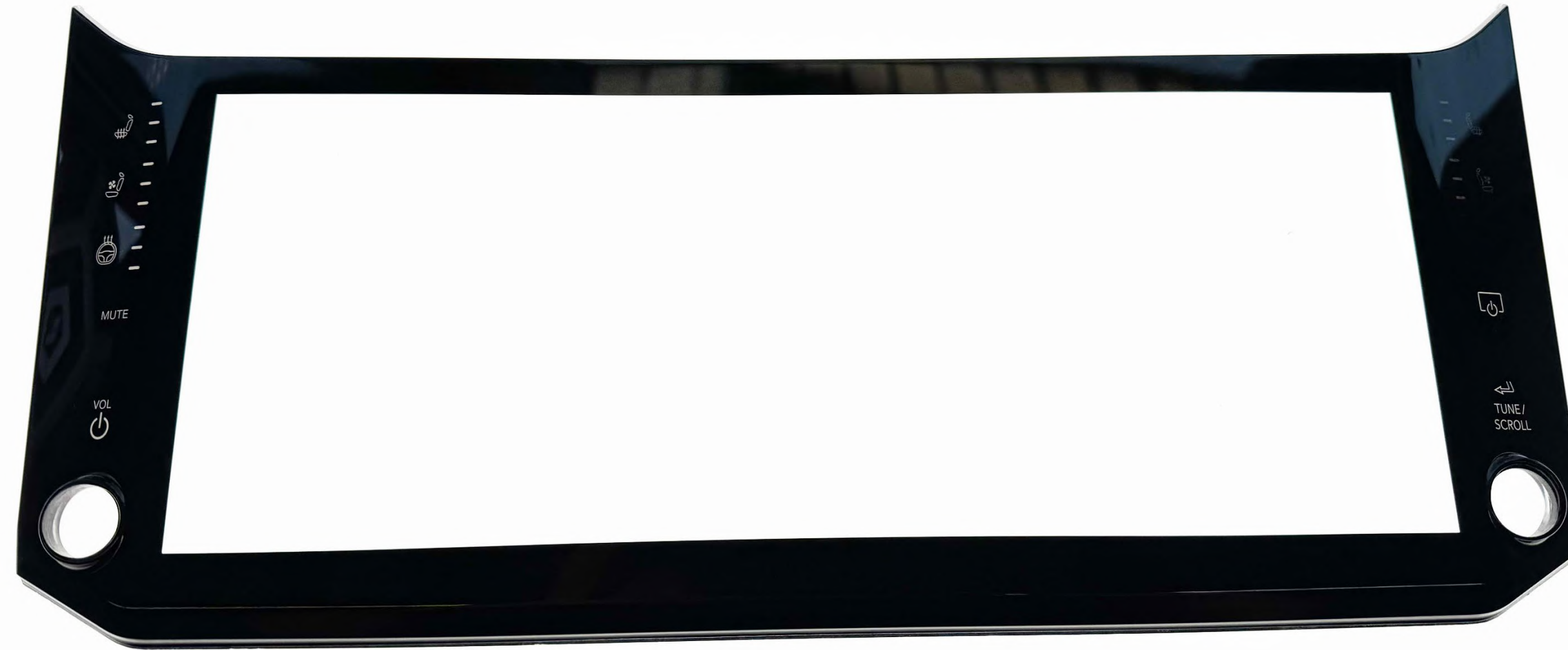


© Bö-La



© VW Teramont

## Automotive interiors – trend to larger display panels



® CCL  
Stellantis Jeep



® INTOPS GM

## Non-conductive black color shades

NORIPHAN<sup>®</sup> HTR N is an established, formable, backmoldable and solvent-based one-component screen printing ink for the film insert molding technology.

Due to the development of the new deep black opaque color shade **NORIPHAN<sup>®</sup> HTR N 990/011 NC**, a carbon black-free, non-conductive black is available for printed electronic applications.

The color shade has a high optical density, an electrical resistance in the giga ohm range and is radar transmissible.

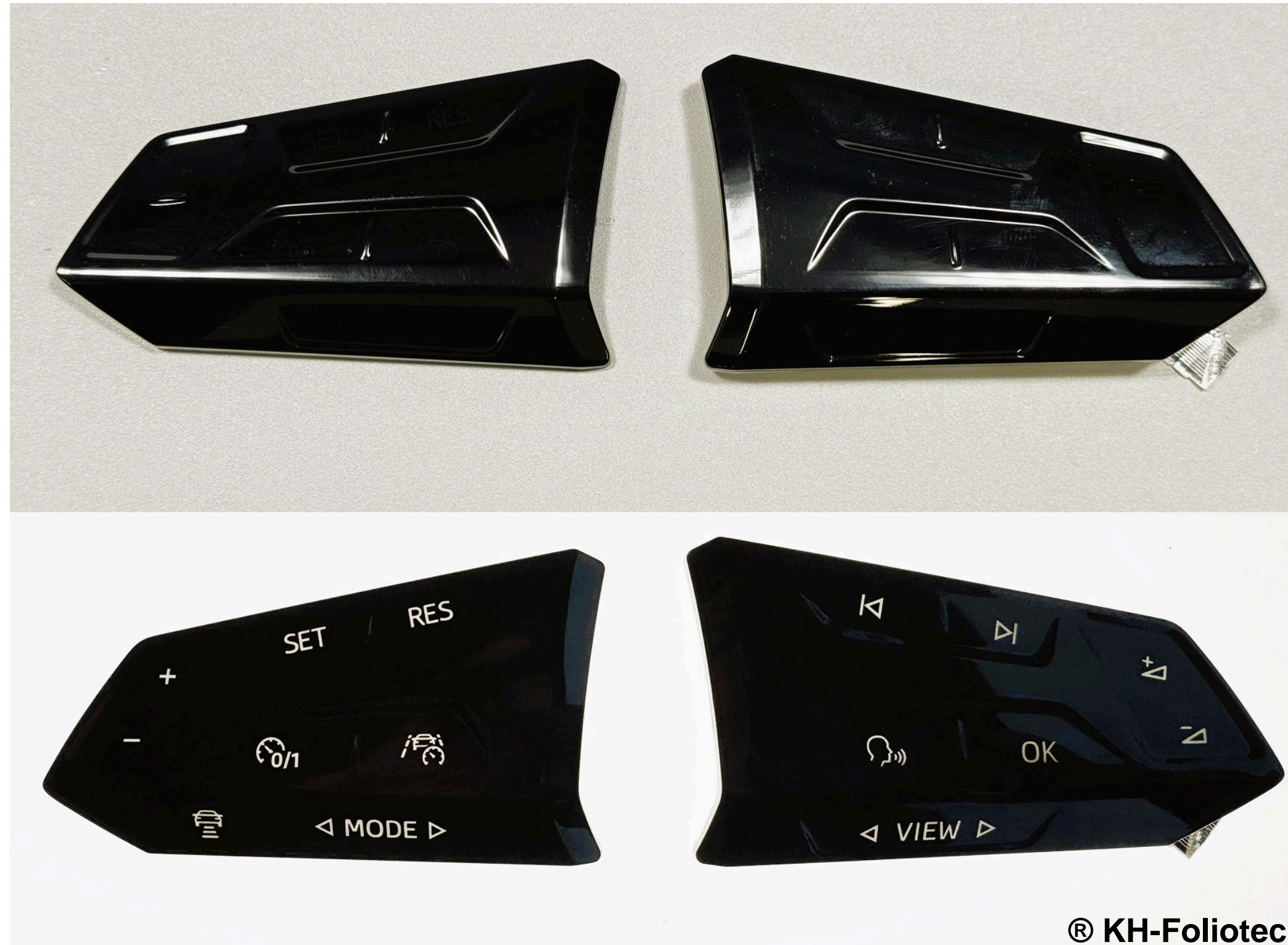
Further non-conductive color shades with different appearances and properties are available from stock.



## Functional IMD/FIM parts:

Printed with NORIPHAN® IMD/FIM screen printing inks  
and non-conductive black color shades + bonded sensor films

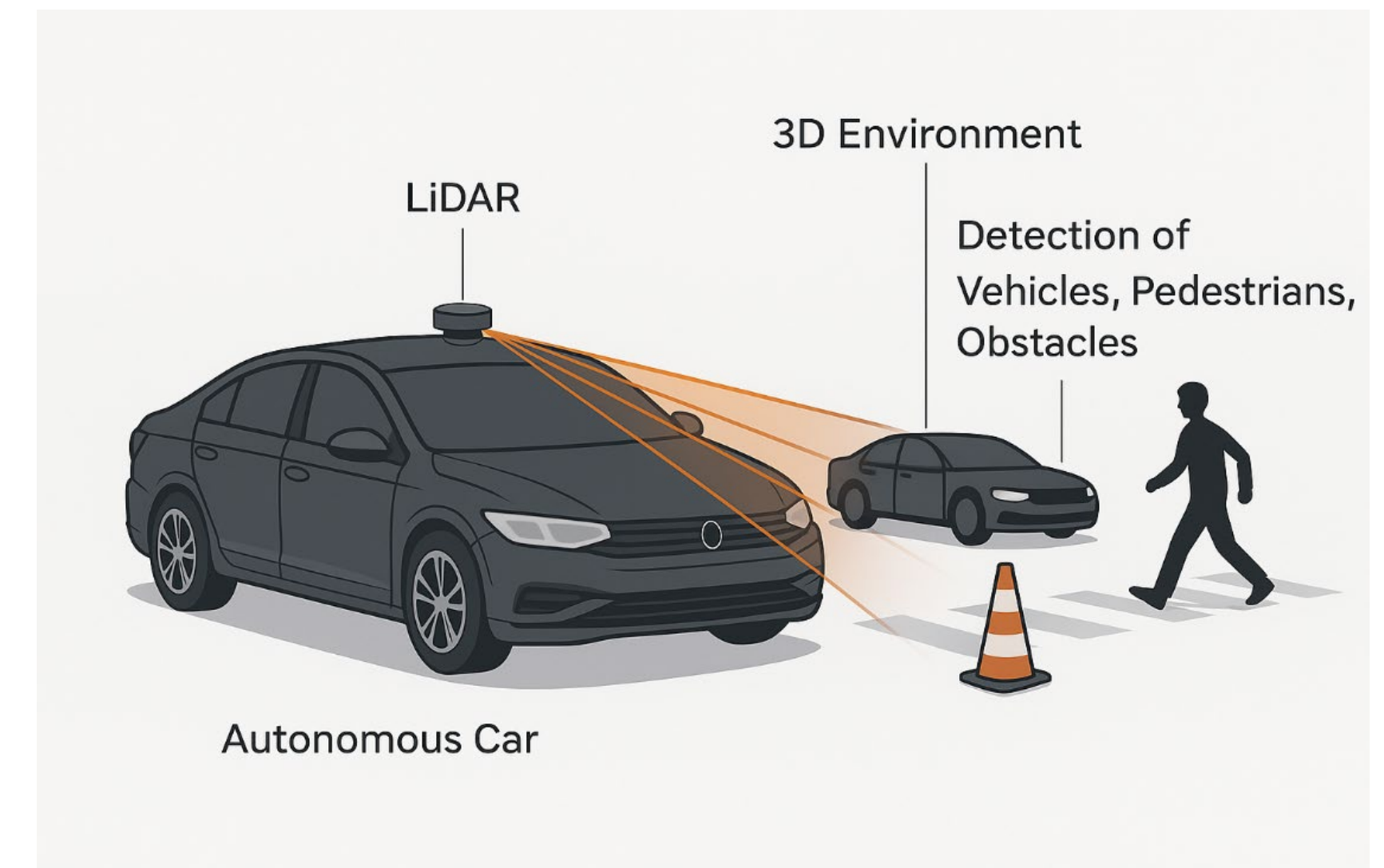
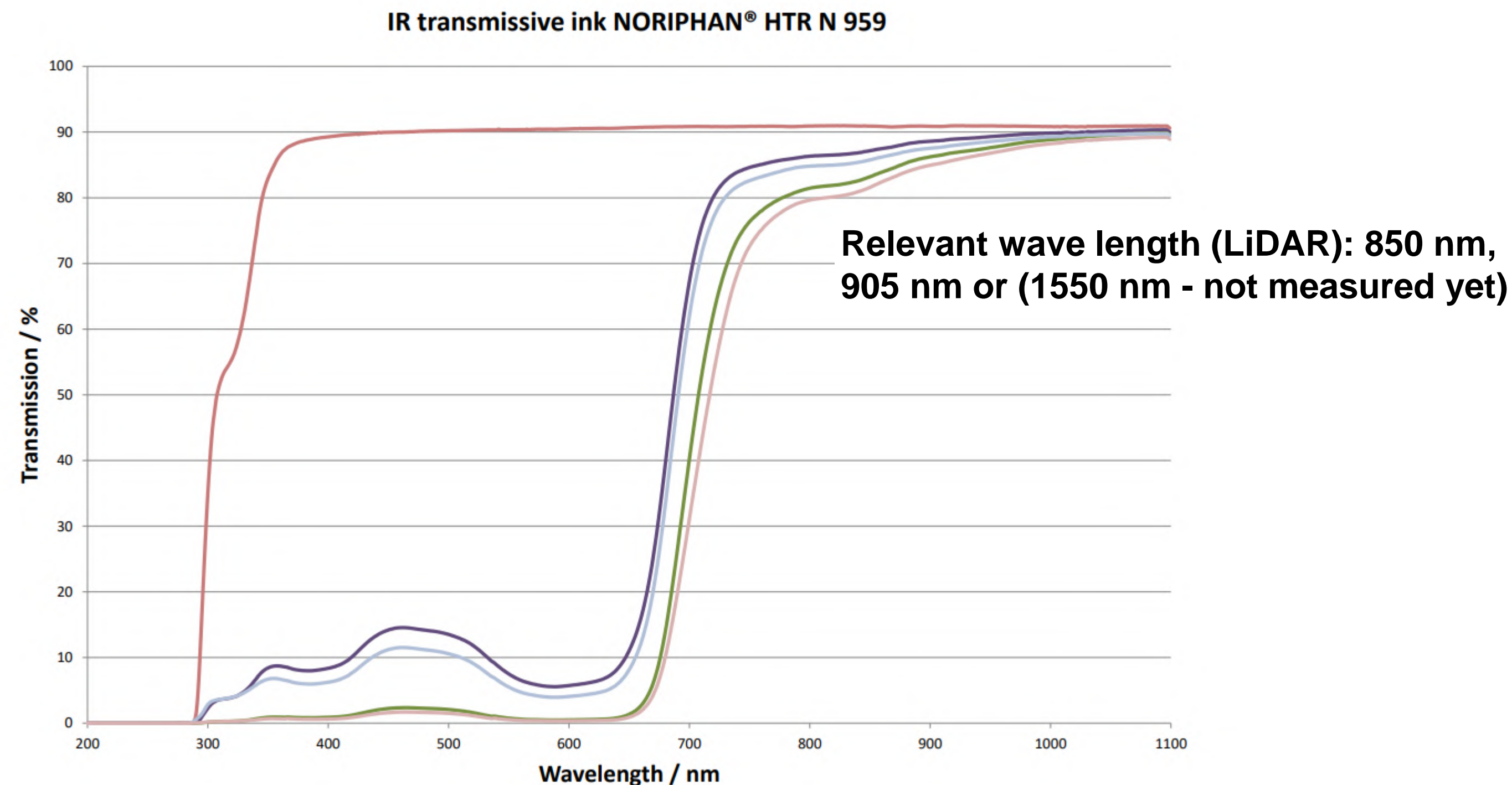
### VW Steering Wheel Switch



## NORIPHAN<sup>®</sup> HTR N 959 – IR Transmitting Black

is a carbon black free, non-conductive black color shade for functional touch panel applications. The color shade has a black appearance in incident light. Under transmitted light the color shades appear transparent.

- For IR, LiDAR & Radar applications (e.g. *active systems with sender*)
- Transmissible up from ca. **700 nm** for **IR** rays, **LiDAR** and **Radar**



## NORIPHAN® HTR N 959 – IR Transmitting Black



## Light Scattering Lacquer for Automotive Lighting

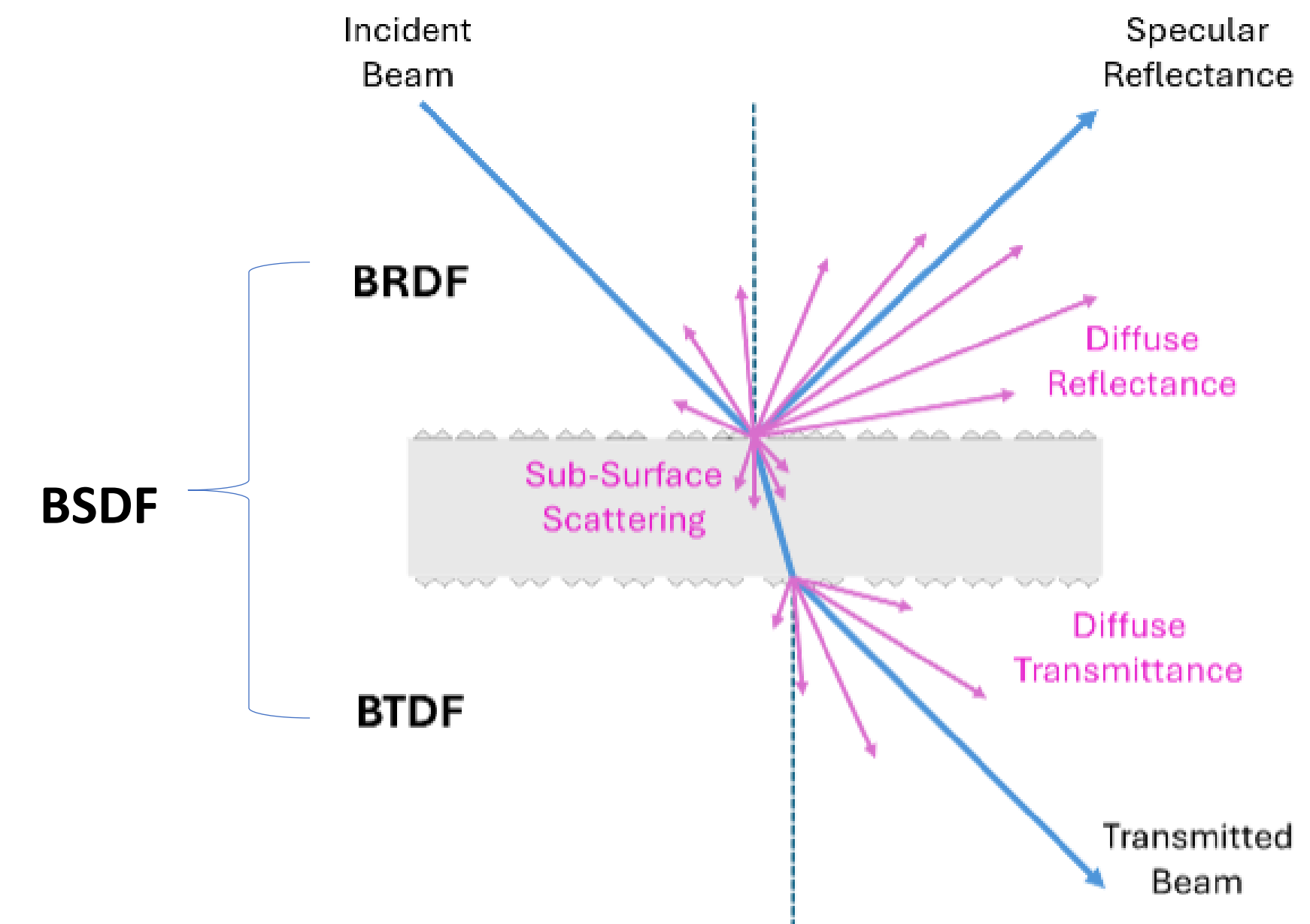
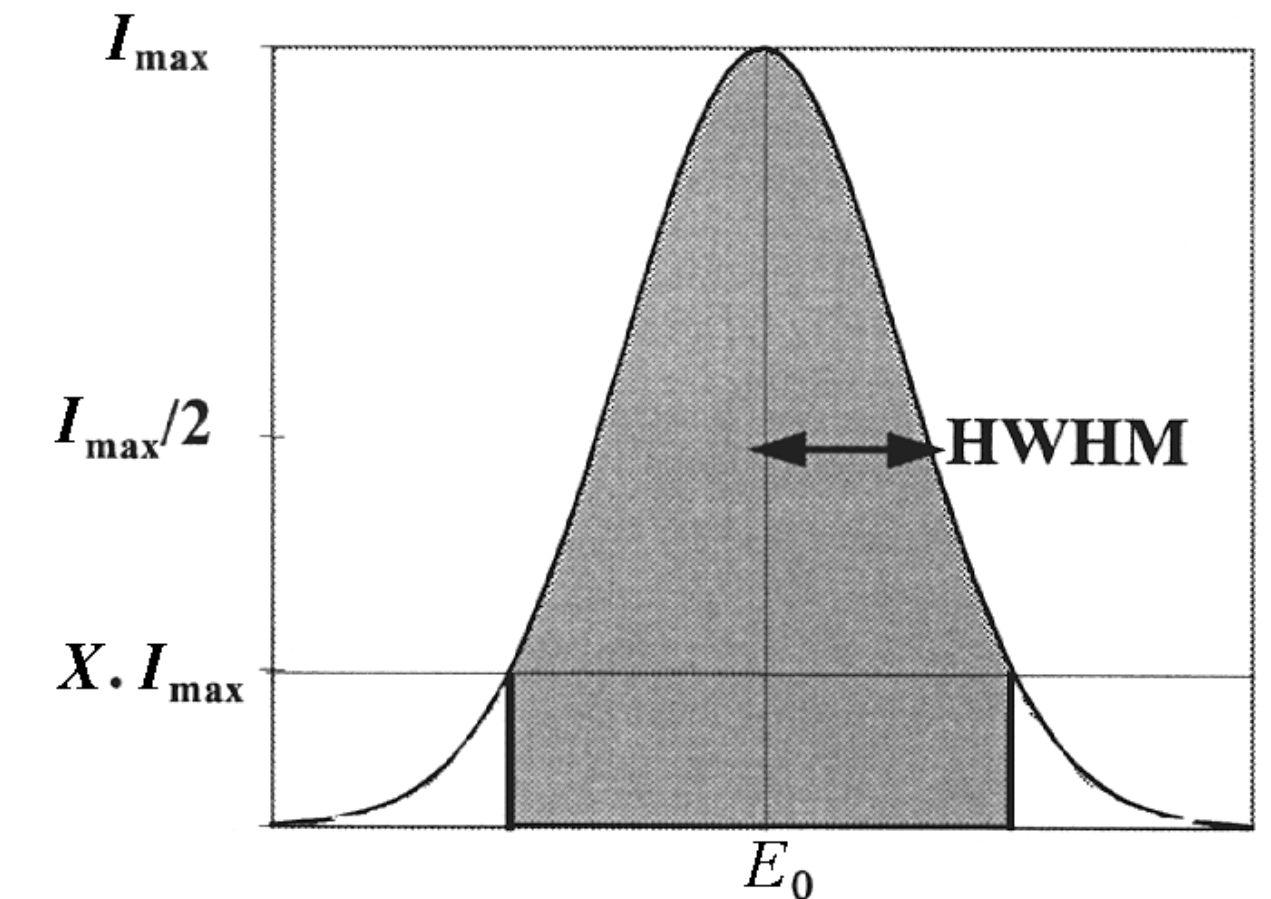
### NORIPHAN® HTR N 093/800

The white (transparent) formulated screen printing lacquer is part of the one-component NORIPHAN® HTR N IMD/FIM ink range and therefore back moldable.

The lacquer is used to diffuse punctually LED spots into a homogenously spread light area.

The diffusing lacquer can be used instead of cost-intensive light management films.

### High light diffusion/scattering & transmission values



# NORIPHAN® HTR N 093/800 Light Scattering Lacquer

Printing substrate: Makrofol® DE 1-1

Printing inks: NORIPHAN® HTR N 953 Deep Black - double print negative

Symbols and logos are printed with NORIPHAN® HTR N 093/800 Light Scattering Lacquer - single print.

All prints from second surface.



## **Proell IMD/FIM screen printing ink – NORIPHAN® HTR N 945/545 – diffusive white color shade for protected second surface exterior applications is AMECA approved.**

AMECA List of Acceptable Plastics for automotive lamp lens materials.

- 5 Year Duration List of Acceptable Plastics for Optical Lenses and Reflex Reflectors

### **Two approved layer constructions:**

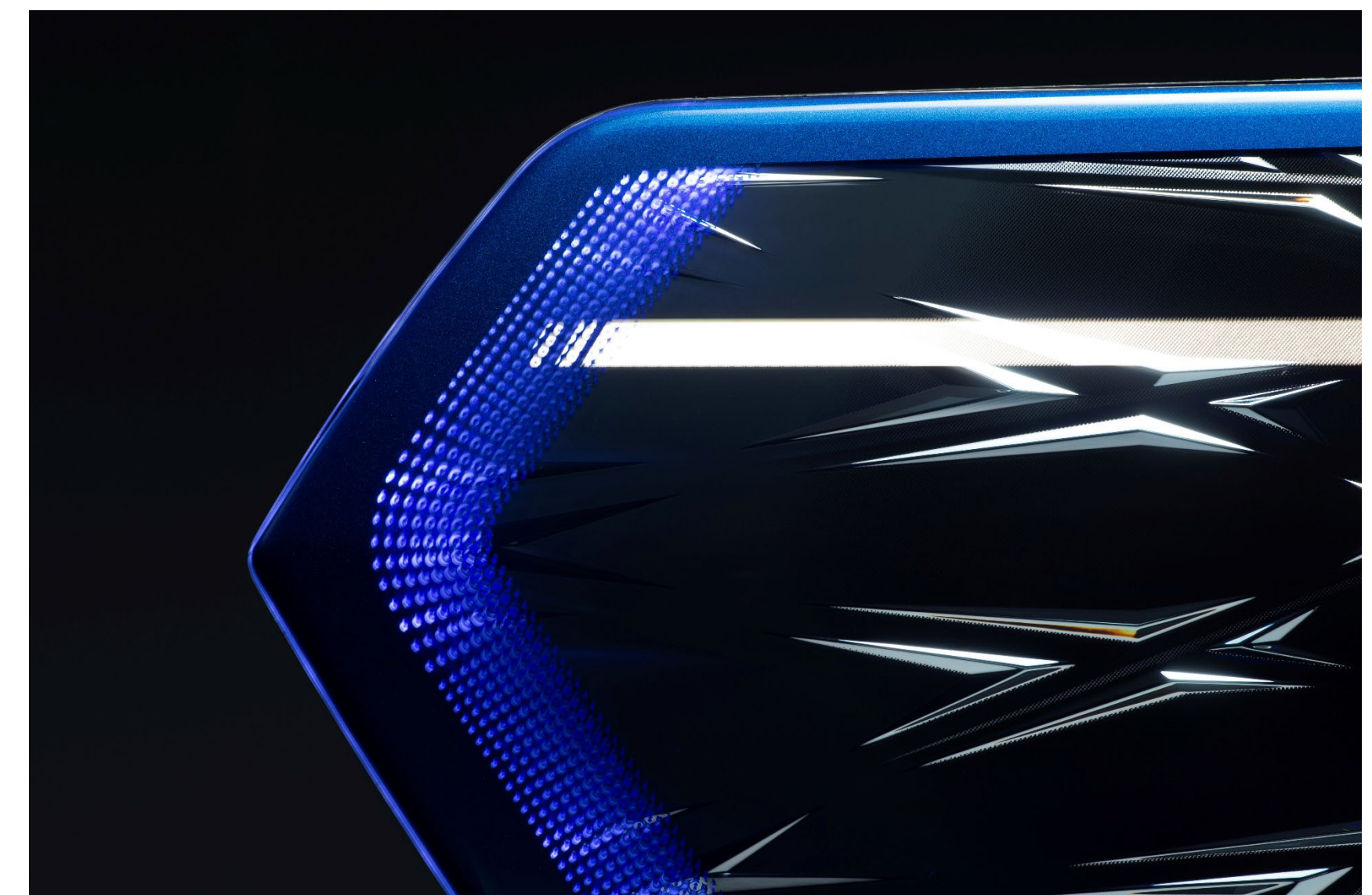
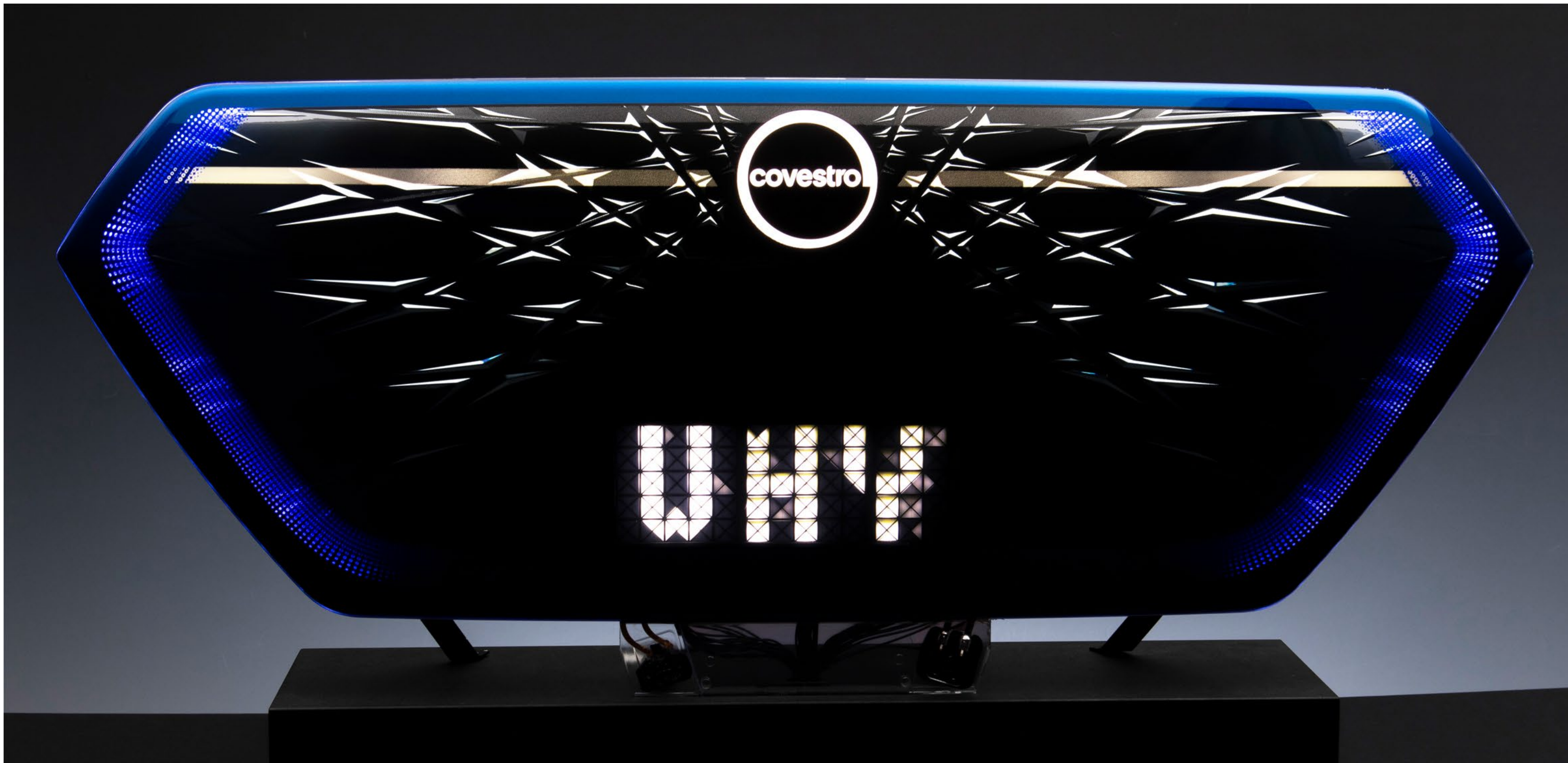
A Makrofol® DE film is second surface screen printed with NORIPHAN® HTR N 945/545 – diffusive white color shade – and is protected by back molding with Makrolon® AL 2447 with Momentive UVHC 5000 hard coat.

A Makrofol® DE film is second surface screen printed with NORIPHAN® HTR N 945/545 – diffusive white color shade – and is protected by back molding with Roehm PLEXIGLAS® 8N

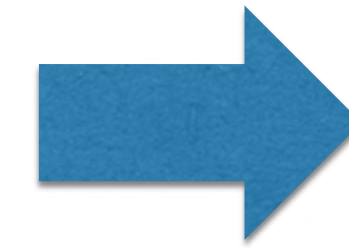
# IMD/FIM Front Modules & Emblems – Serial Parts



# Large IMD/FIM Parts – covestro Front Module



® covestro



Grille Panel Assembly – Functional electronics meets seamless aesthetics

- Makrolon® AG, Makrolon® TC, Bayblend® T, Makroblend®
- Makrofol® DE
- 2K, dual-FIM, 2D-printed film | 3D-shape matching, IME for integral heating wires & plug over-molding, heat management
- Crafted in collaboration with Forvia | Hella, New Albea, Pröll, Summerer, TactoTek, Techniplas, and Toray

## Grille Outer Panel Subassembly

### Outer Panel (1<sup>st</sup> shot)

- Makrolon® AG
- Dual-film FIM, 2K injection molding
- PC tailored for coated transparent glass-like applications
- High purity and batch consistency via optimized production process
- Wide range of additive packages and colors

### Hardcoat

### Inner-film

- Picasus PC, using Makrofol® DE film
- Metallic appearance with non-metal (polymeric) material
- Busbar printed directly onto Inner-film
- Film provided courtesy of Toray
- LED illumination crafted with ISME® technology in collaboration with TactoTek and Techniplas
- Printed with transparent ink, courtesy of Pröll

### Outer-Film

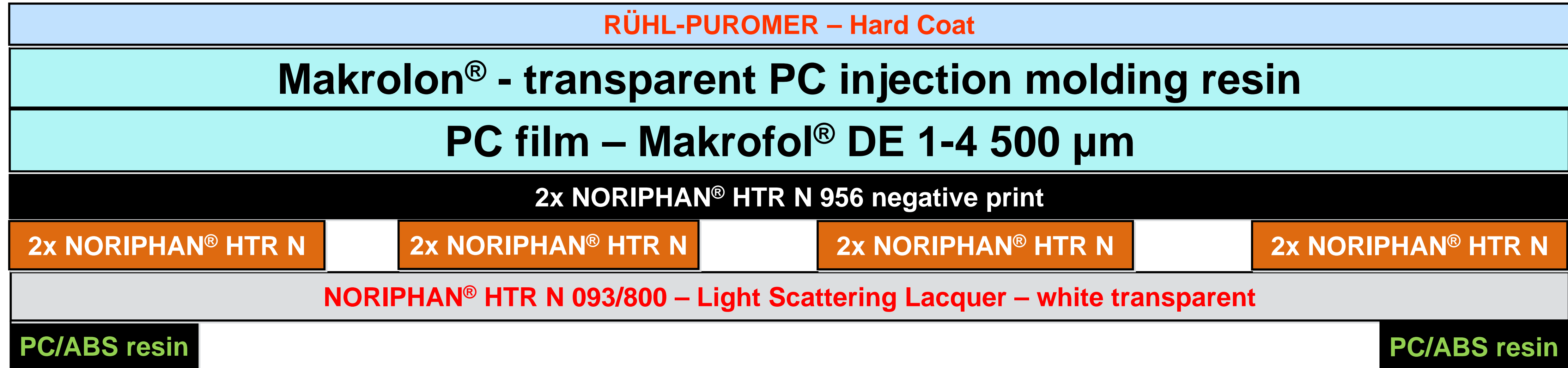
- Makrofol® DE, Makroblend®
- Film printed with body color, metallic ink, courtesy of Pröll
- Connector plug (2x)
- Heating-wire system, crafted in collaboration with New Albea



# Large IMD/FIM Parts – RESRG AUTOMOTIVE Front Module



## Proell proposal for the ink layering of the RESRG AUTOMOTIVE front module:



**The front module is produced in IMD/FIM technology plus additional PUR coating in the mold to protect the part.**

**For this part, Nissha Germany has screen printed a covestro Makrofol® DE 1-4 film on the second surface with several ink layers of NORIPHAN® HTR N.**

**Forming is performed with the QIN-FORM thermo-forming process.**

**Afterwards the formed films are trimmed and placed in the mold.**

**The surface of the PC film is overmolded with a transparent Makrolon® resin at first.**

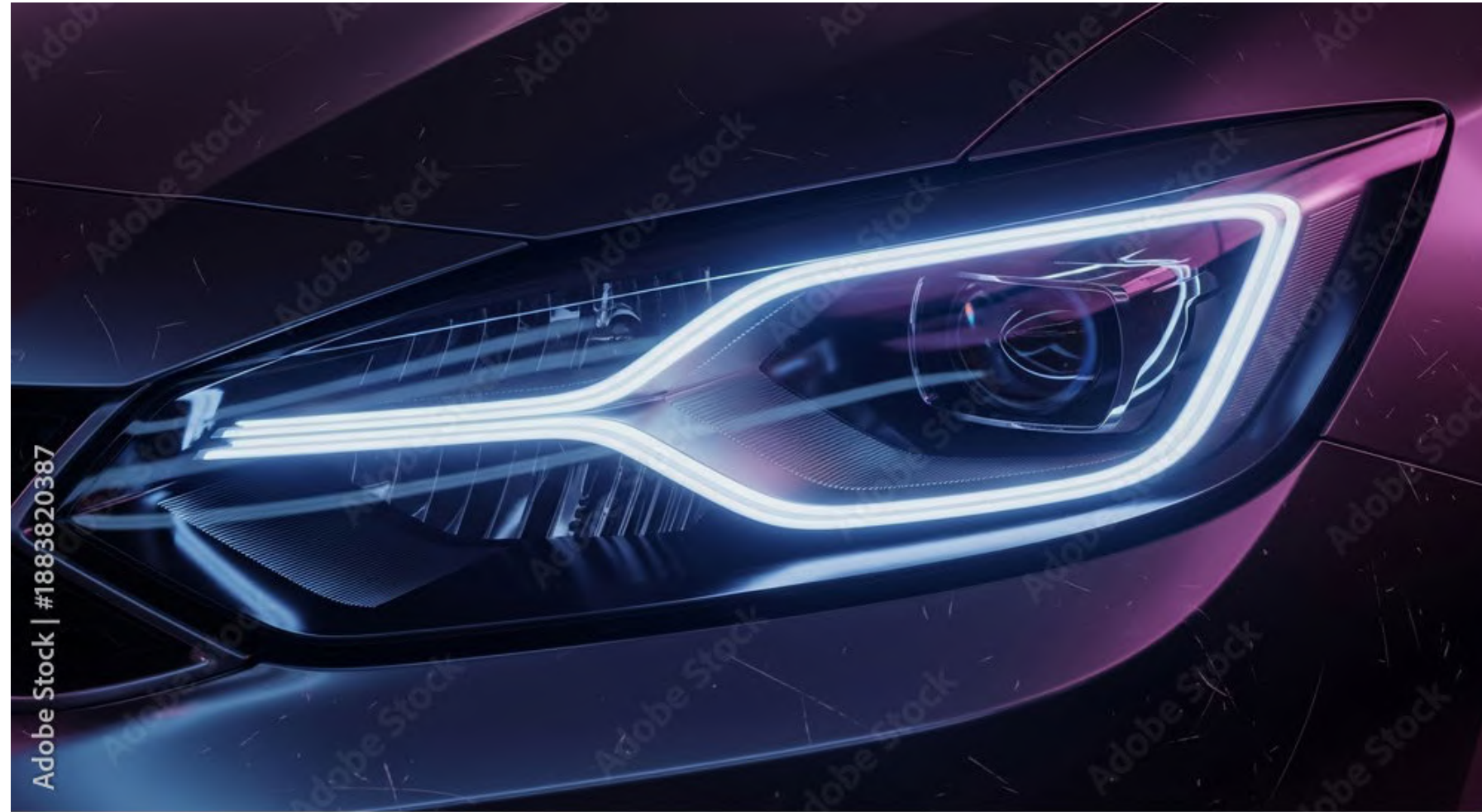
**A partial backmolding with black PC/ABS on the reverse side directly onto the inks follows subsequently using the same tool.**

**In a final process step, the PC surface is protected with a RÜHL-PUROMER coating in the mold with the KraussMaffei ColorForm process.**

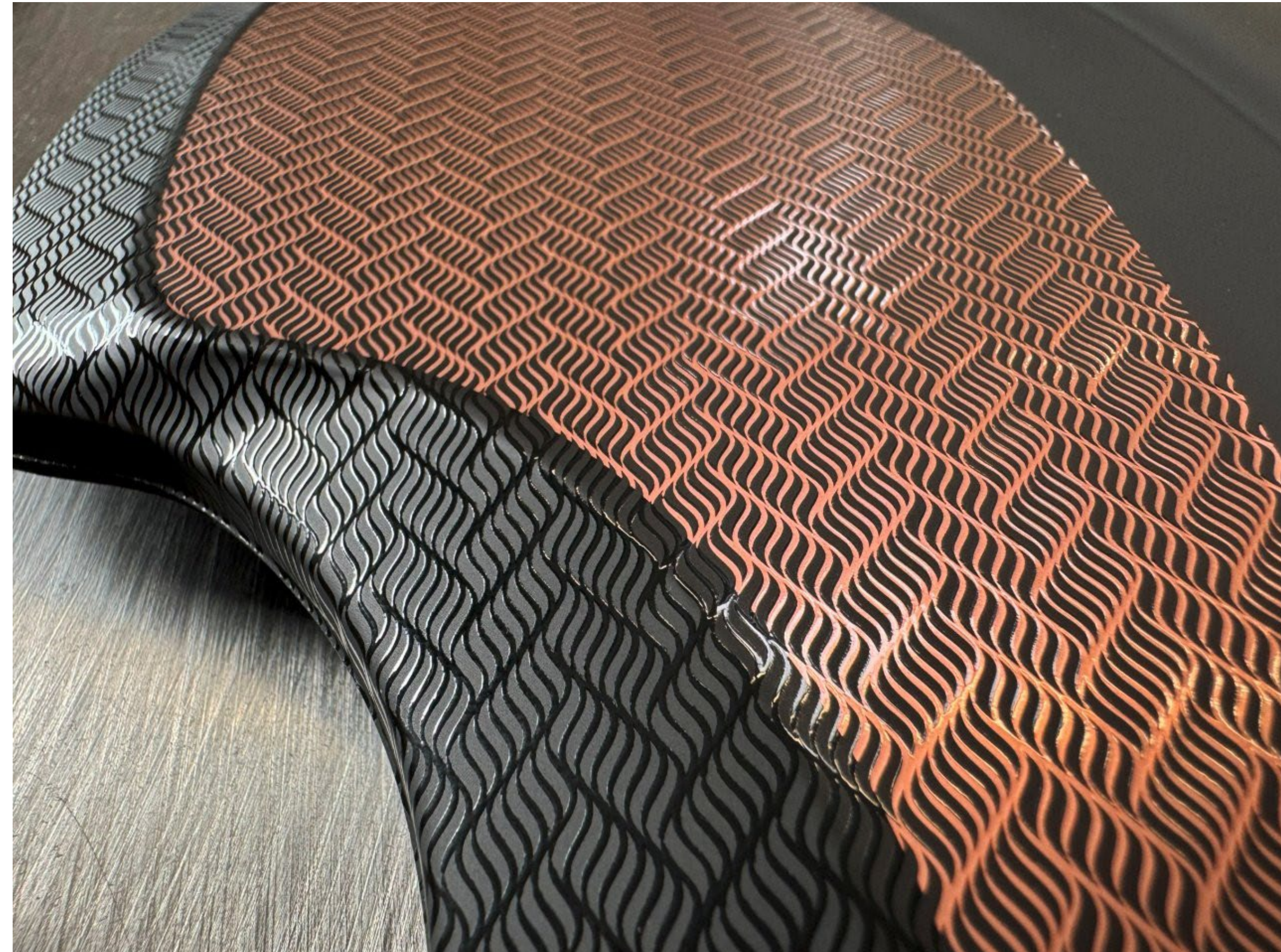
**The front module has a dimension of 102 cm x 42 cm.**

**For serial applications even larger parts are possible.**

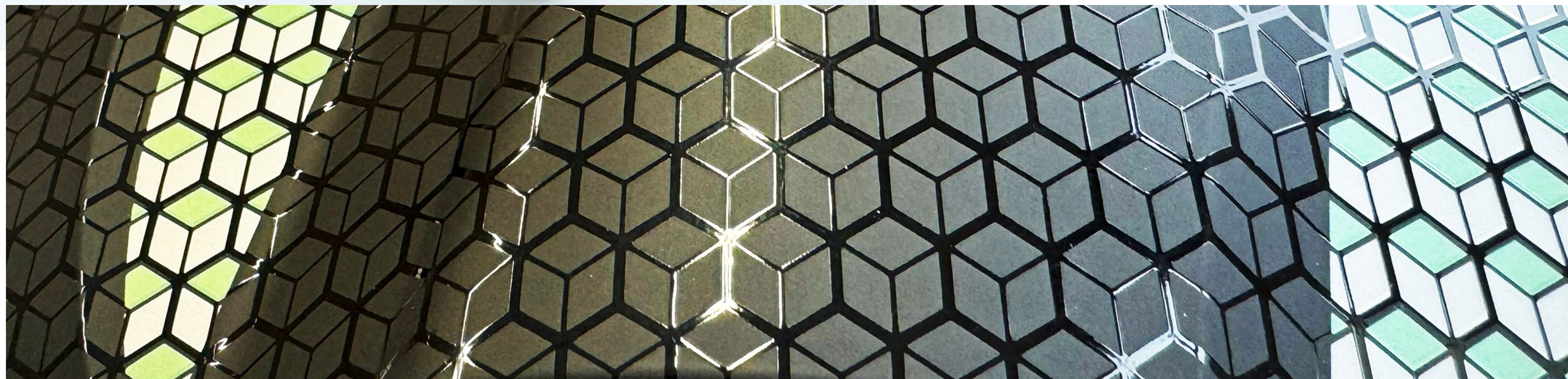
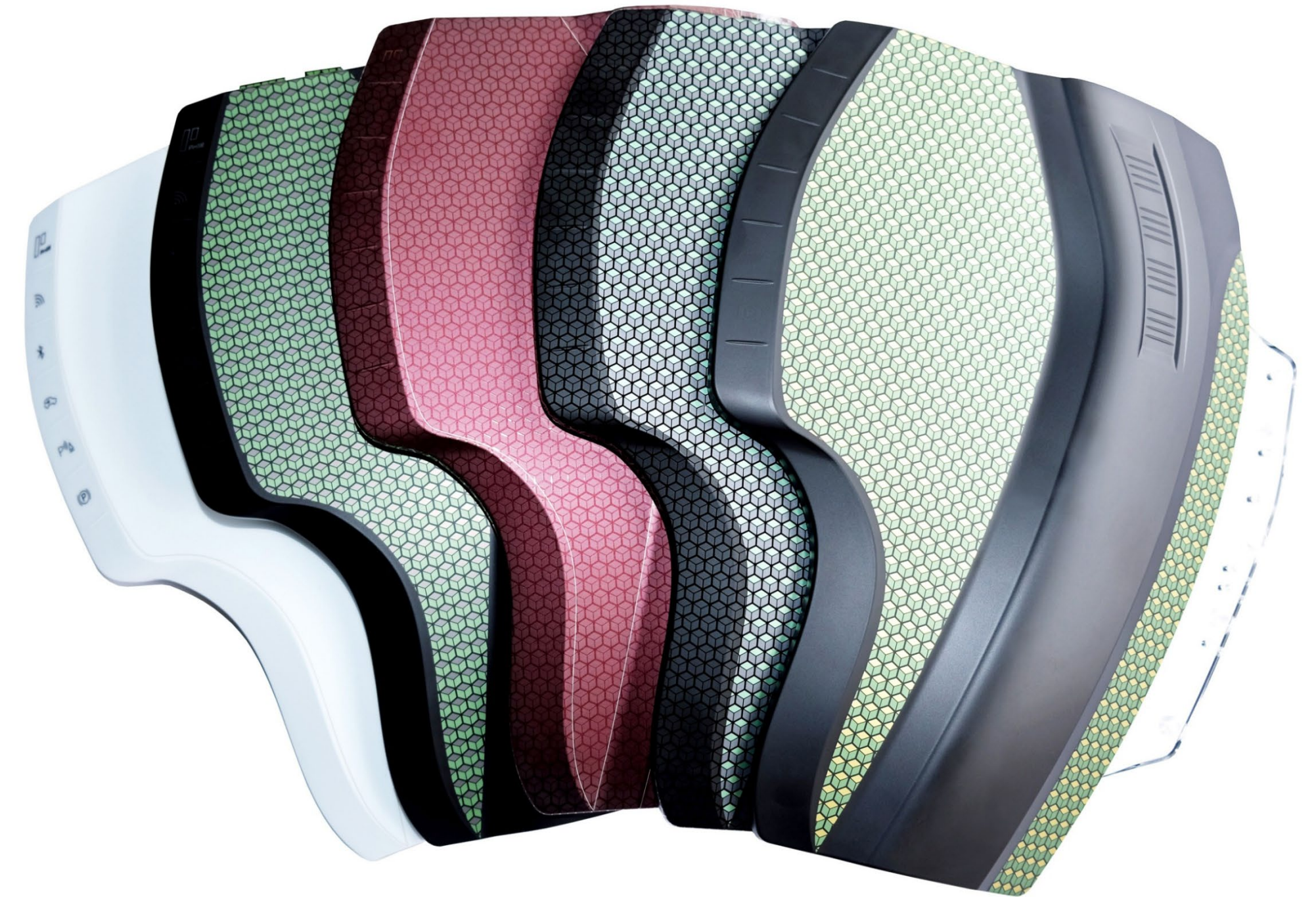
# Potential IMD/FIM Applications in Automotive Front Lighting



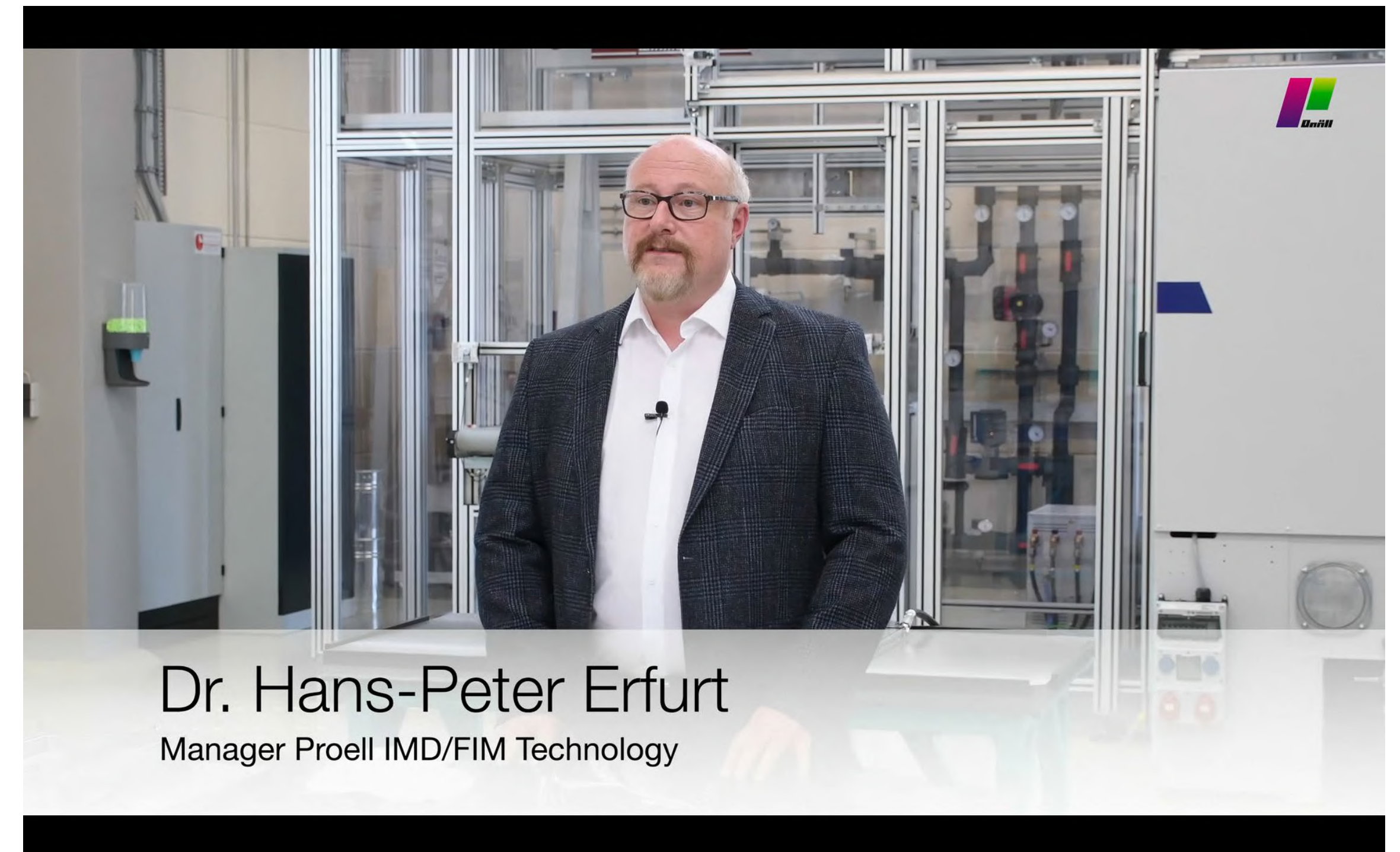
Haptic designs printed with **Norilux® FastCure 1** on first surface for automotive interior applications



# Proell Center Stack Design Consols protected with Norilux®



Watch the films about screen printing & the process steps in IMD/FIM on [www.proell.de](http://www.proell.de)



## Thank you for your attention!

Please contact us for further information: [hans-peter.erfurt@proell.de](mailto:hans-peter.erfurt@proell.de) [schubart@proell-services.de](mailto:schubart@proell-services.de)