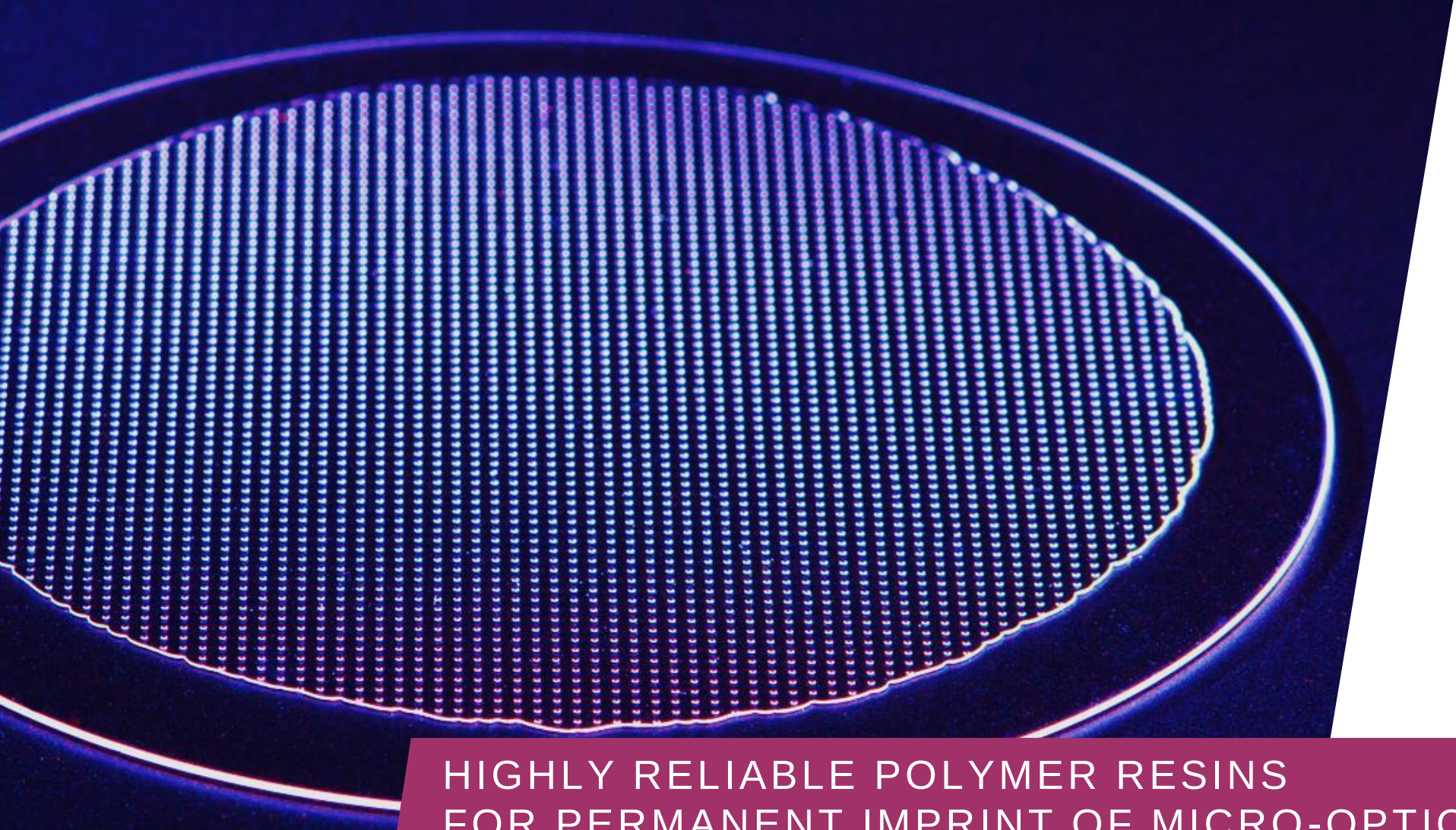


DELO

EPIC
EUROPEAN PHOTONICS INDUSTRY CONSORTIUM

HIGHLY RELIABLE POLYMER RESINS FOR PERMANENT IMPRINT OF MICRO-OPTICAL ELEMENTS

Dr. Stephan Prinz | EPIC Meeting on Photonics for Miniaturized Optics | 2024-09-19

DELO

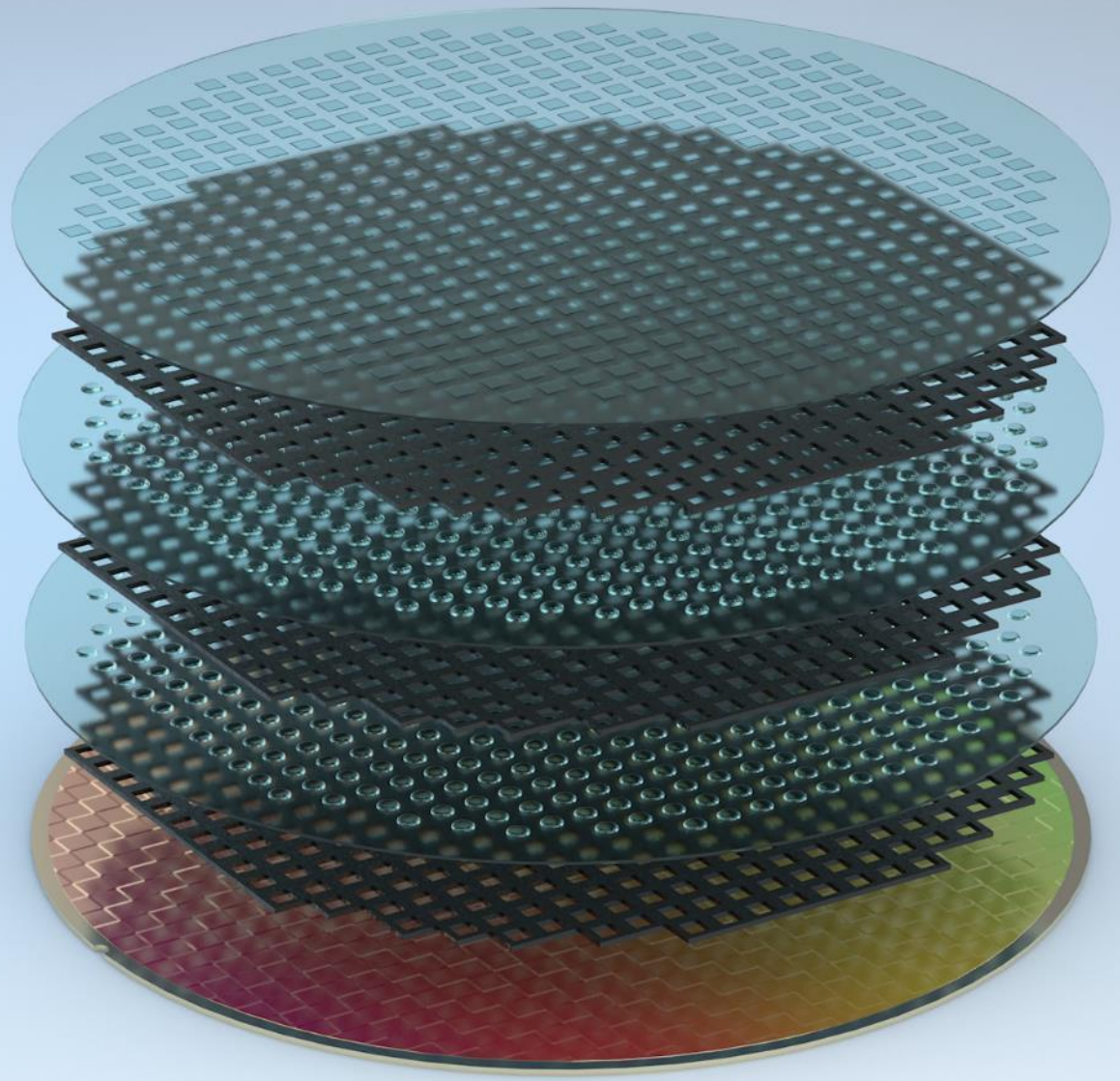
FAMILY-OWNED

€ 230 M. REVENUES

1100 EMPLOYEES


DELO
DELOMONOPOX AD066
1 part epoxy adhesive
DELO
DELO-DOT PN3
DELO
Adhesives / Polymers
Dispensing Equipment
Curing Equipment

Wafer-level optics



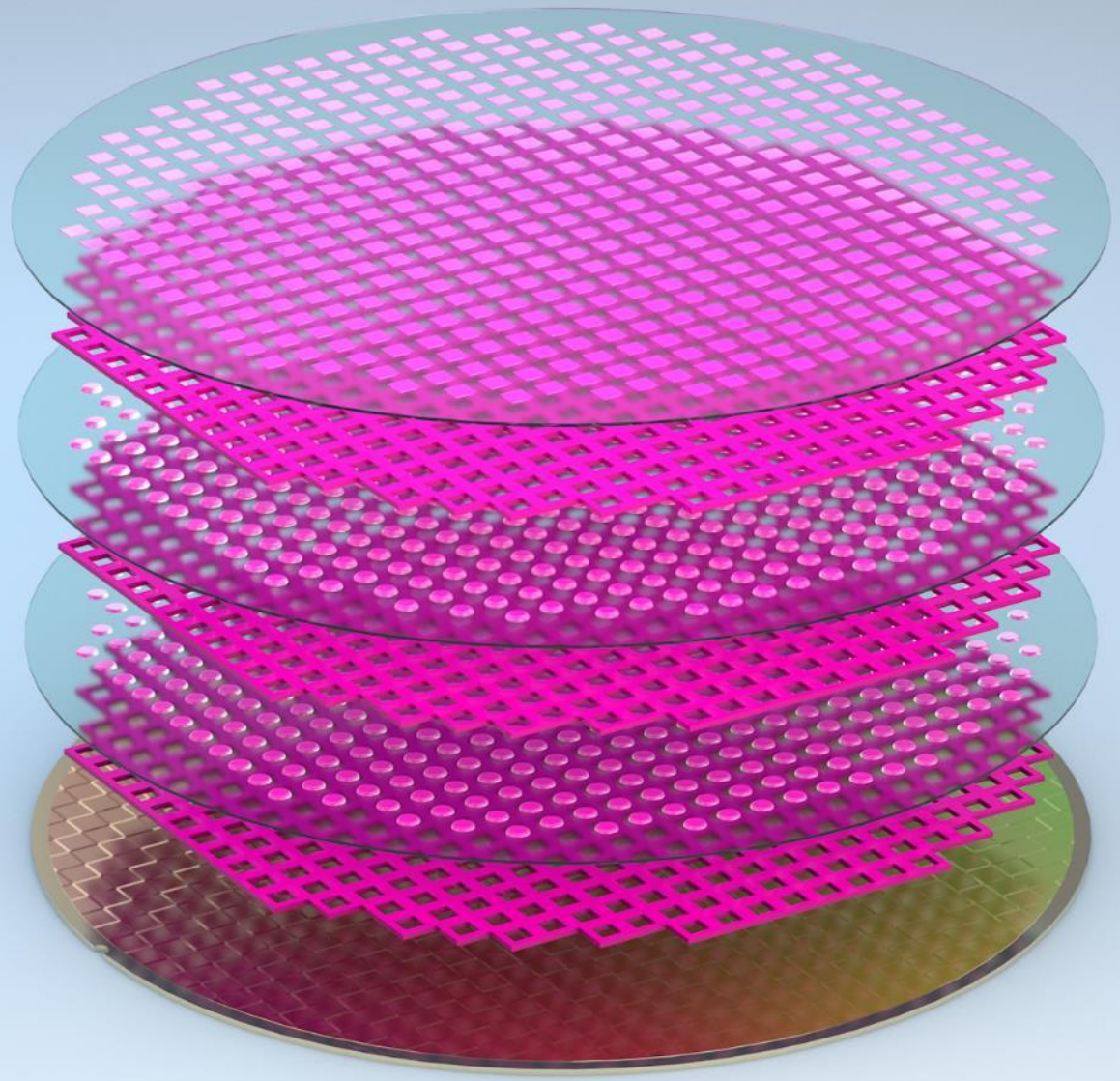
WAFER-LEVEL OPTICS

Design and manufacture of cost-effective miniaturized optics at wafer-level using Nanoimprint Lithography (NIL)

DELO – WHAT WE DO

DELO offers NIL-compatible **functional polymers** with designed optical properties and excellent reliability **for direct imprint of micro / nano-optics**

Wafer-level optics



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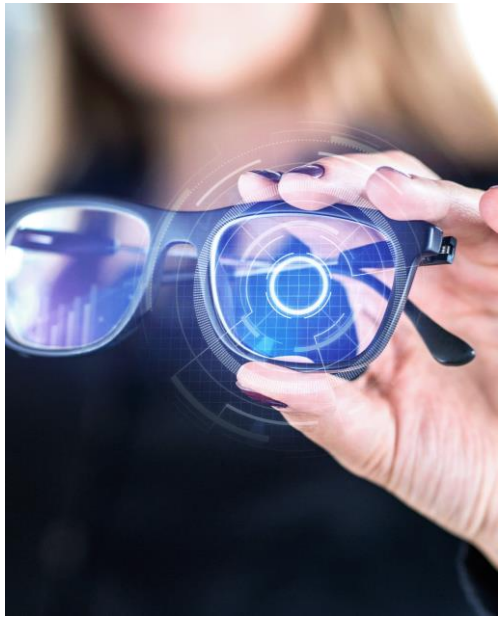


AUGMENTED REALITY

OPTICAL SENSING

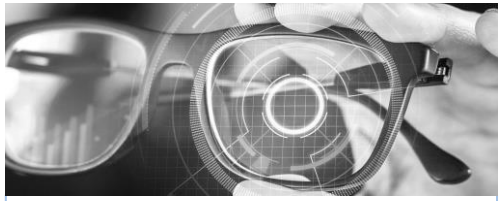
AUTOMOTIVE LIGHTING

IMAGING

Stephan.Prinz@DELO.de

Wafer-level optics applications

DELO



AUGMENTED REALITY

Waveguides

Surface relief grating, high refractive index

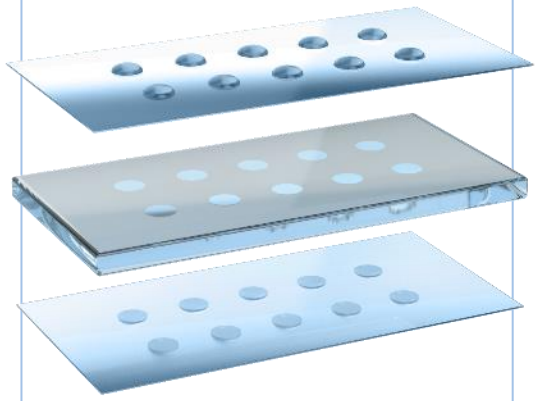
OPTICAL SENSING

Diffractive optical elements

Multi-level nanostructures

AUTOMOTIVE LIGHTING

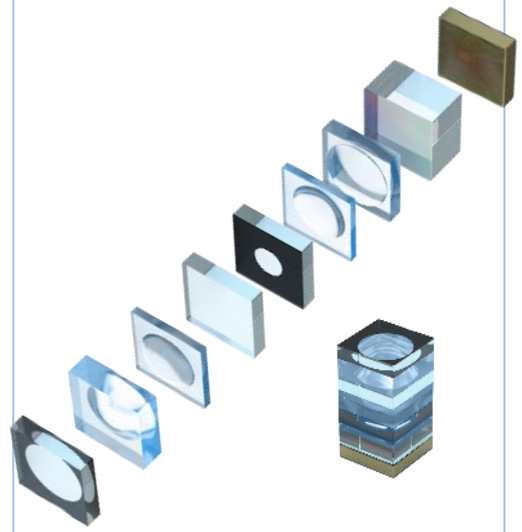
Projector / Headlamp



Precisely aligned micro-lens arrays

IMAGING

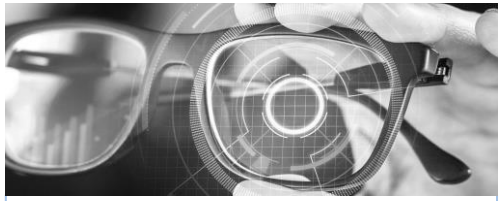
Miniaturized camera modules



Achromatic lens doublet, functional layers

Stephan.Prinz@DELO.de

Wafer-level optics applications



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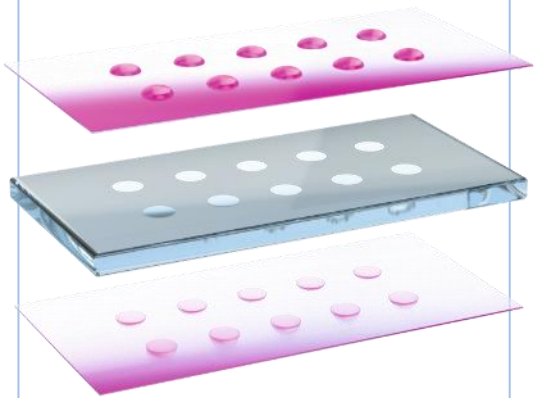

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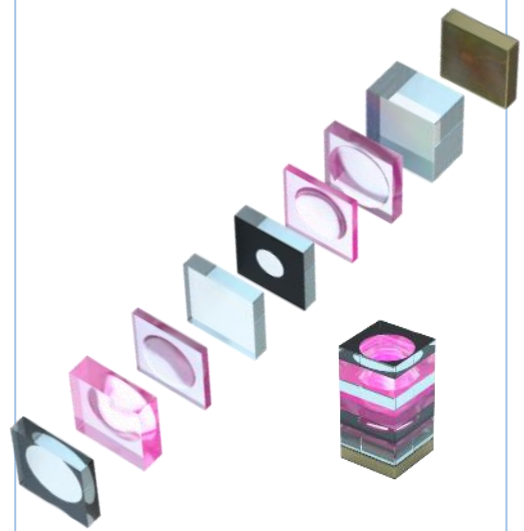
Miniaturized camera modules



Achromatic lens doublet, functional layers

Functional polymers are highlighted in magenta.

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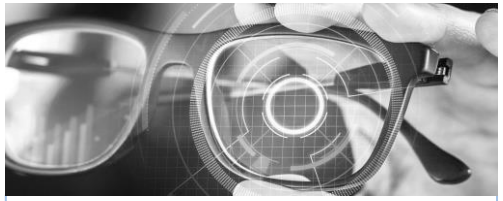
Wafer-level optics applications



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RELIABILITY IS ESSENTIAL

Functional polymers are highlighted in magenta.

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Wafer-level optics applications

AUGMENTED REALITY

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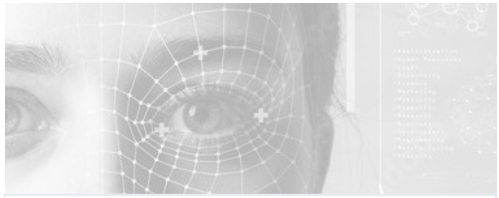

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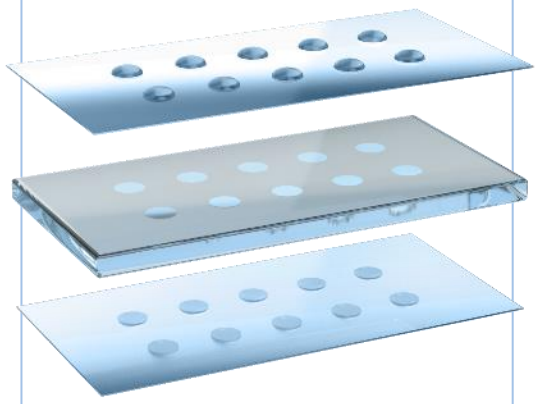

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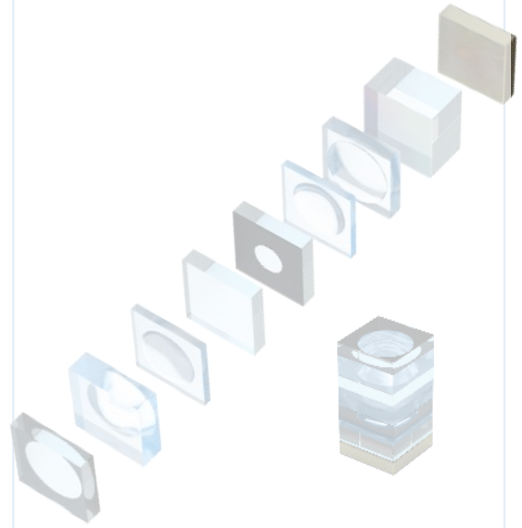


Achromatic lens doublet, functional layers

Stephan.Prinz@DELO.de

DVN article about Micro Optics in Vehicle Lighting

DELO

DrivingVisionNews.com
Automotive lighting and driver assistance technologies

Tue, 8 March 2022 Weekly Newsletter
NEWSLETTER #741 中文版

Editorial

Micro Optics: The Next Revolution In Vehicle Lighting

DVN was invited to SÜSS MicroOptics in scenic Neuchatel, Switzerland. CEO Reinhard Völkel with his team Christopher Bremer, Patrick Heissler, Wilfried Noell and Pascal Zwahlen gave DVN a very warm welcome; thank you!

Microoptics development and production is vastly different to classical car headlamp business. The production facility DVN had the opportunity to visit is wafer-based in class-1000 and -100 cleanrooms. The critical processes are metalising on glass; photolithography; plasma etching; lens imprinting; bonding; dicing; wafer-level testing, and other things exotic to the eyes of a car lighting guy. All the more surprising that nearly half of SÜSS' microoptics business is already automotive.

Micro lens arrays (MLA) are used in the car for a projection, sharp at any distance, of graphics, symbols, or light carpets beside the car, as a greeting and orientation function. First application was in a BMW 7 series.
Another even more interesting application is front lighting. MLAs are used, for example, in the headlamps of the Lucid Air and Genesis G90. MLA are one of a few solutions to create super slim headlamps down to 10 mm lens height. Advantages are the precise light, the tiny lit surface, and the small overall package. Disadvantages up to now were low efficiency and high price. Both are actively addressed by SÜSS MicroOptics' manufacturing roadmap.
We see a clear design trend in the direction of invisible or at least hidden headlamps. One solution is using a very "loud" DRL/position light and hiding the main functions below in a dark environment. Next radical design step is reducing the main functions to get rid of the hidden elements which are diminished, but of course still visible. Until now, tier-1 suppliers could reduce the size of their LED modules by better LEDs, more efficient thermal management, and smaller lenses to meet the designers' demands. But as the trend goes into the extreme, new concepts are unavoidable. MLAs are a solution for such extreme design. DVN thinks it is dangerous for any tier-1 to ignore this technology, even if the business cases of the car makers don't (yet) allow MLA.

Conclusion: No doubt, microoptics has the potential to become a revolution in vehicle lighting technology.

Wolfgang Huhn
DVN Senior Advisor

Wolfgang Huhn

- DVN Senior Advisor
- Former "Leiter Licht und Sicht" at Audi
- "Man of the decade" by DVN in 2011

Is he right..?

Stephan.Prinz@DELO.de

24-09-16

Image: Lucid

Image: Genesis

Image: BMW

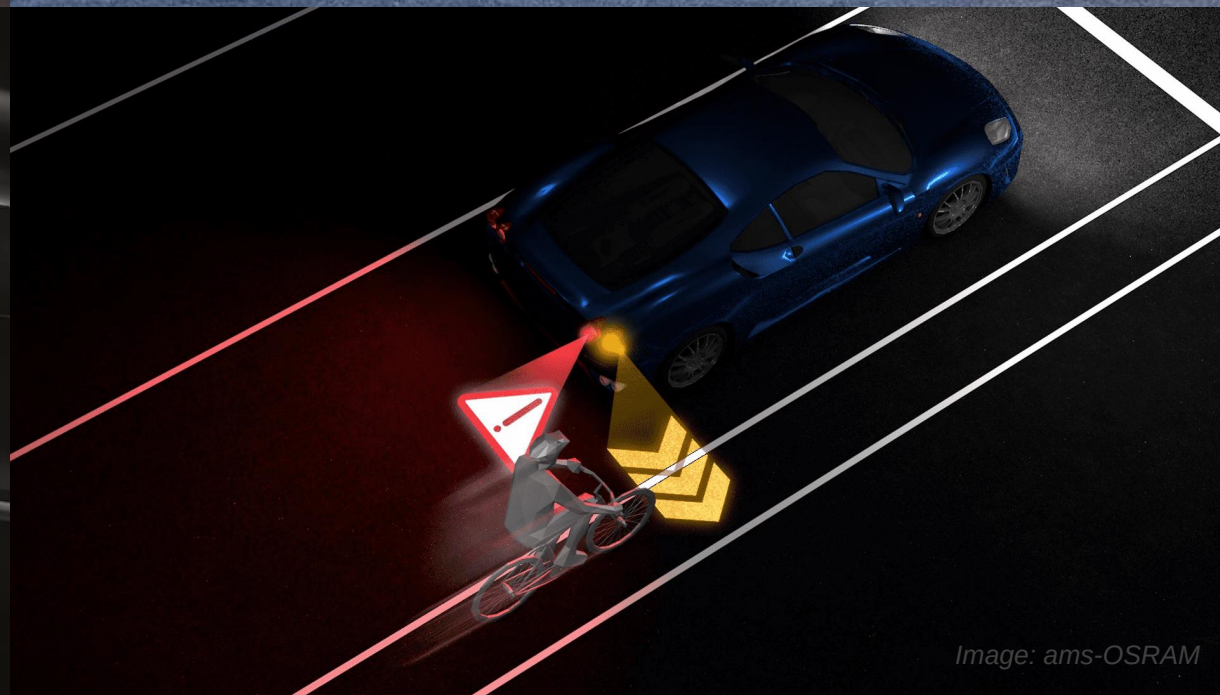


Image: ams-OSRAM

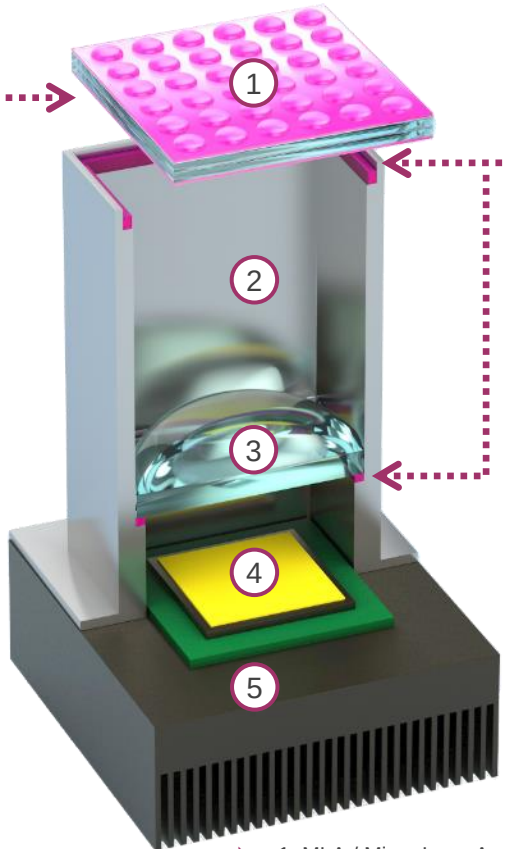
Materials and adhesives in MLA modules

Micro Lens Arrays (MLA) are used in **headlamp** and **projection system** modules, because they enable an accurate light control by simultaneously having a very compact module for slim designs

Optical Materials
for imprint of lenses in MLA

DELO KATIOBOND OM6113 & OM6115

- High transmission in the range of visible light
- Optical stability after humidity, high temperature and UV radiation
- Mechanical stability to withstand stresses from temperature changes



1: MLA / Micro Lens Array
2: Housing
3: Collimating Lens
4: LED
5: Heatsink

Optical Adhesives
for MLA and lens bonding

DELO PHOTOBOND OB4189 & OB4116

- High aspect ratio for Active Alignment of MLA
- Low outgassing: Total mass loss < 1.0 %
- High optical and temperature stability

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Transmission after 125°C storage

High transmission in the range of visible light

Optical stability after humidity, high temperature and UV radiation

Can we do better?

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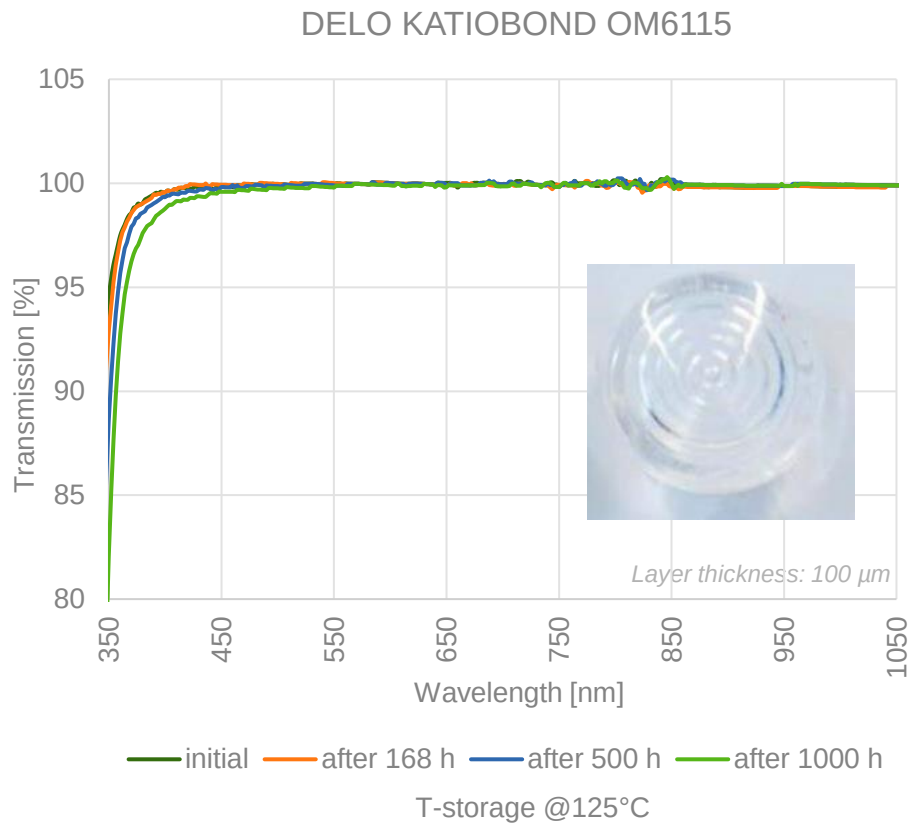
24-09-16

Transmission after 125°C storage



High transmission in the range of visible light

Optical stability after humidity, high temperature and UV radiation

YES, we can!

High and stable material transmission achieved

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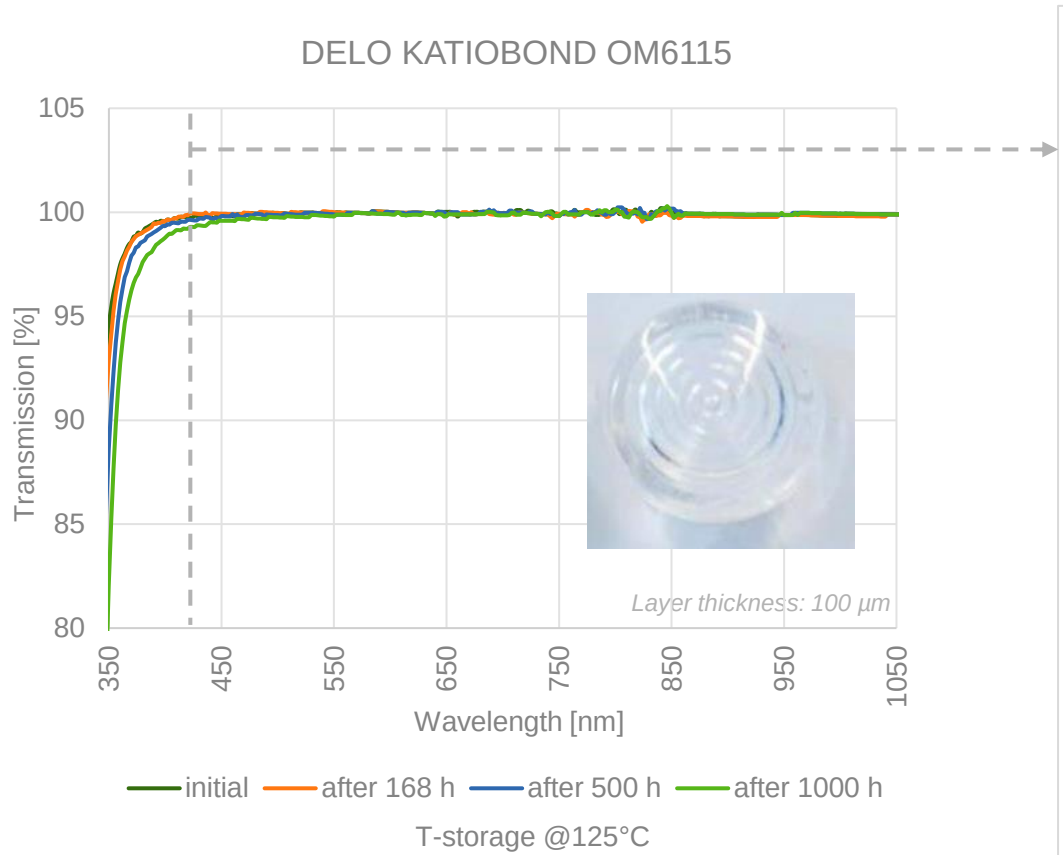
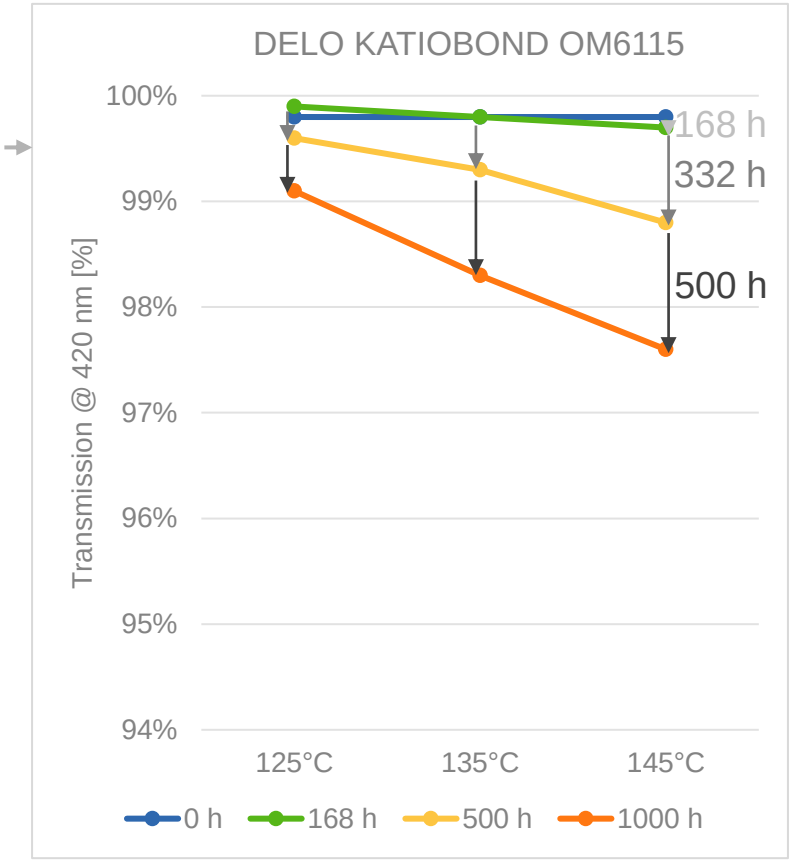
Transmission at elevated temperatures





Transmission remains high even after storage at elevated temperatures up to 145°C

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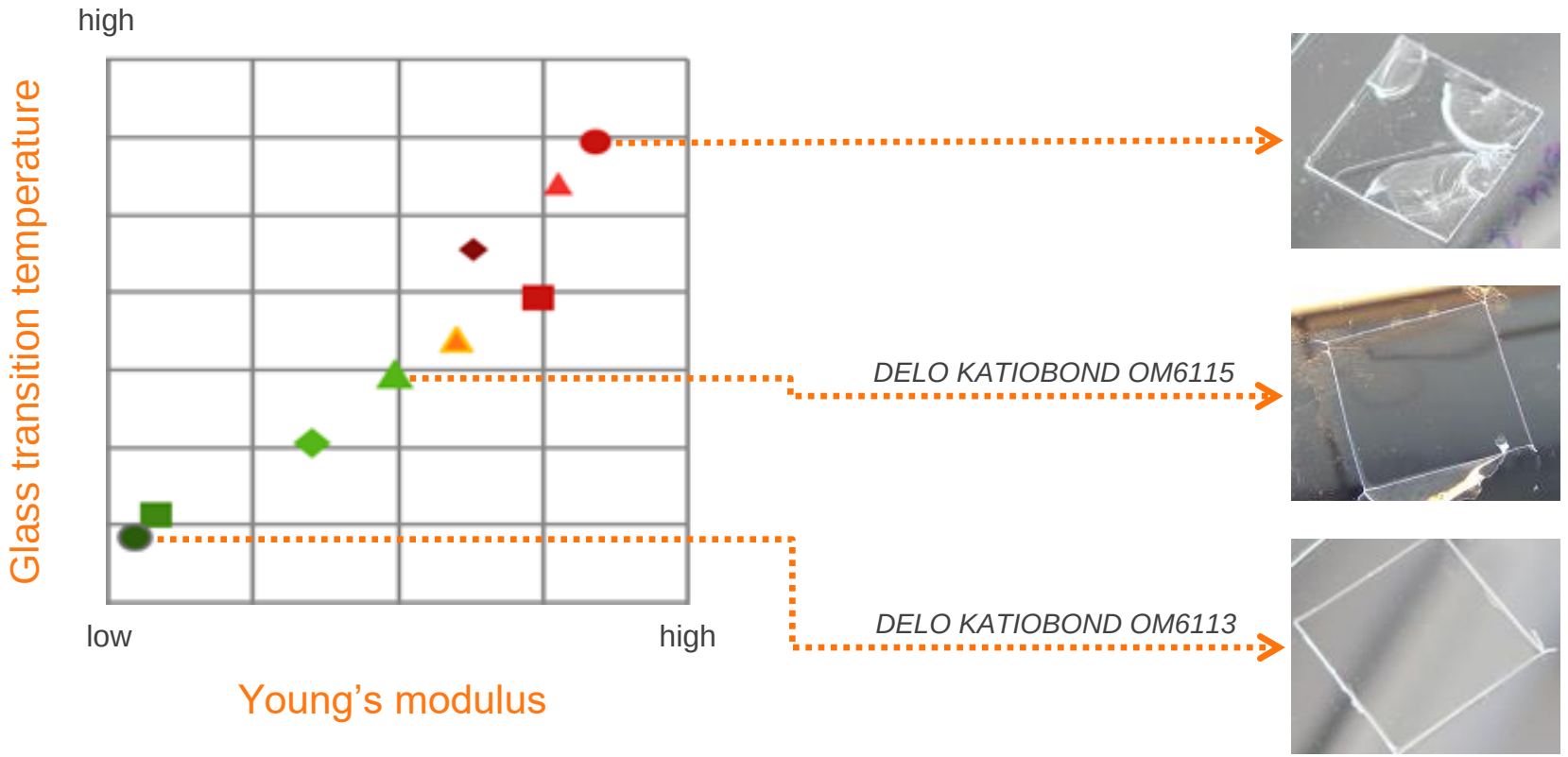
Mechanical stability after T-shock

Performance after T-shock

-40°C / +120°C for 500 cycles



- No delamination due to material flexibility
- Passes automotive reliability tests

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Material requirements

Optical Properties
Index of refraction
Dispersion
Transmission
Scattering

Mechanical Properties
Young's modulus
Glass transition temperature
Thermal expansion
Scratch resistance

Processing
Good filling of structures
Stamp interaction
Shrinkage control
UV curing
Demolding

Reliability
Optical stability
Dimensional stability
Adhesion to substrate

- Material properties can be tailored
- Which material properties does your application need?

Get in touch!

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