HOW

ADHESIVES ENABLE INNOVATION

EPIC Meeting on Photonics for AR/VR/MR | Dr. Stephan Prinz | 11 May 2023

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DELO

FAMILY-OWNED

€ 205 M. REVENUES

990 EMPLOYEES


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

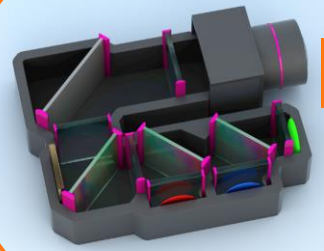

DELO


DELO

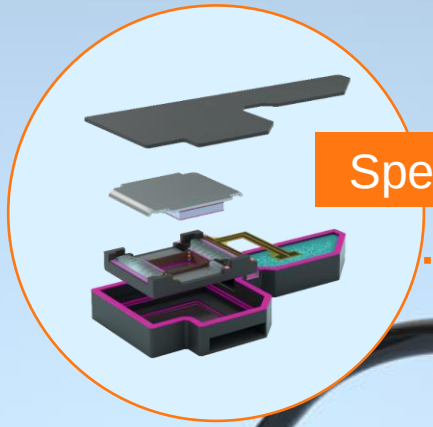

DELO

DELO

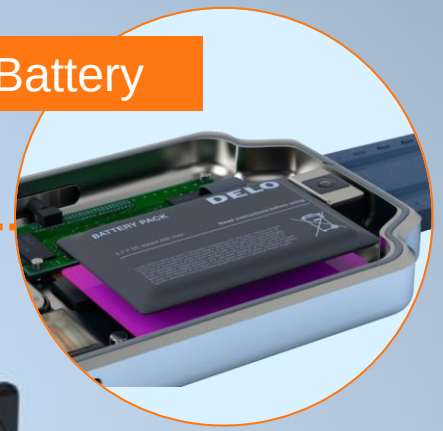
Projector



Speakers



Battery



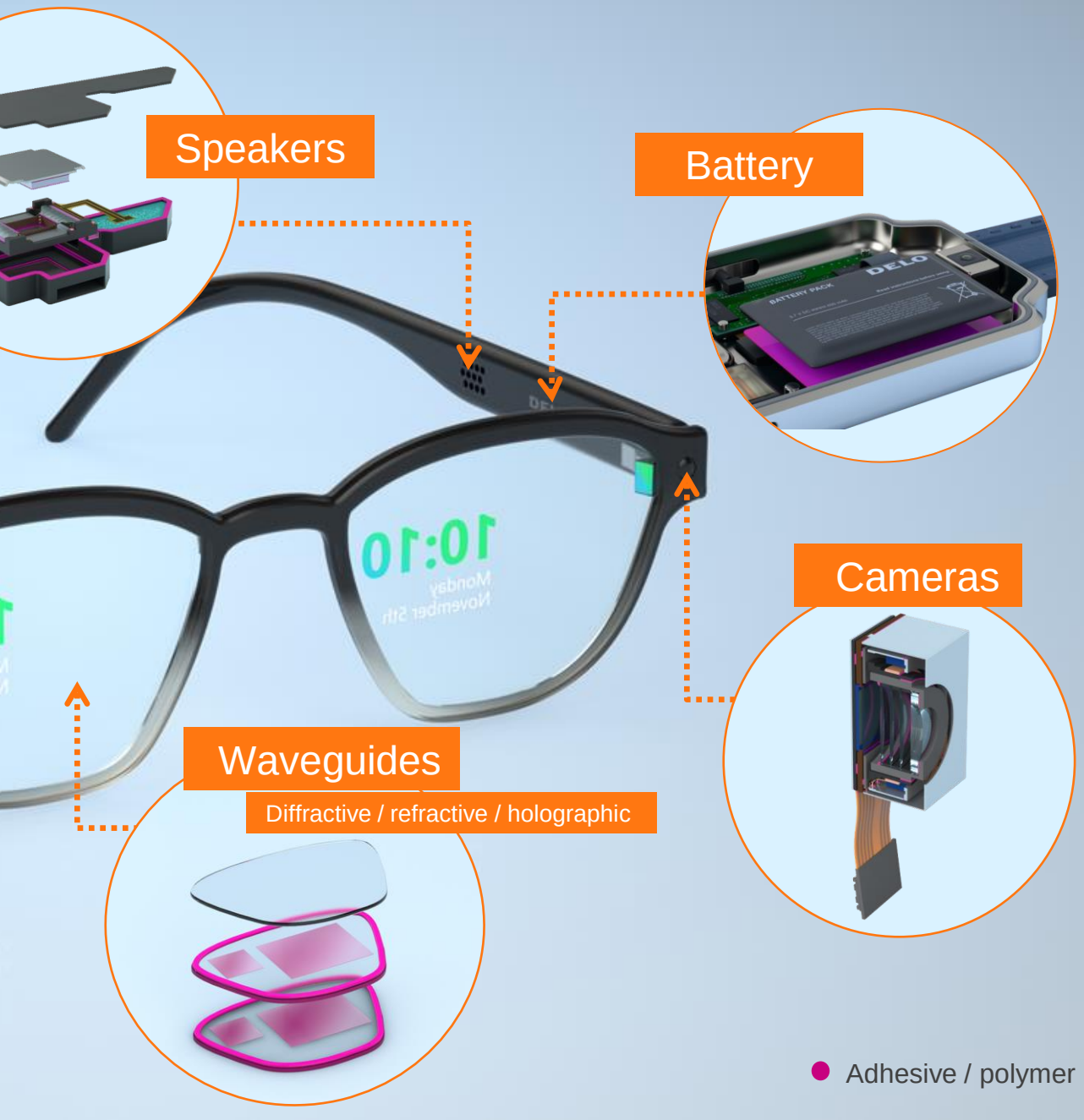
Cameras

Sensors

Waveguides

Diffractive / refractive / holographic

● Adhesive / polymer



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Some adhesive key functions

Reliable bonding
Of various materials and components

Precise & fast alignment
Of sensitive optical components

Thermal / electrical conductivity
For heat dissipation / electrical connections

Acoustic damping
To improve the sound quality

Optical functionality
Optically clear / adjustable RI / tailored transmission

Lightweight
Lighter than glass or metal

Enable mass production
Fast and reproducible processability for high UPH

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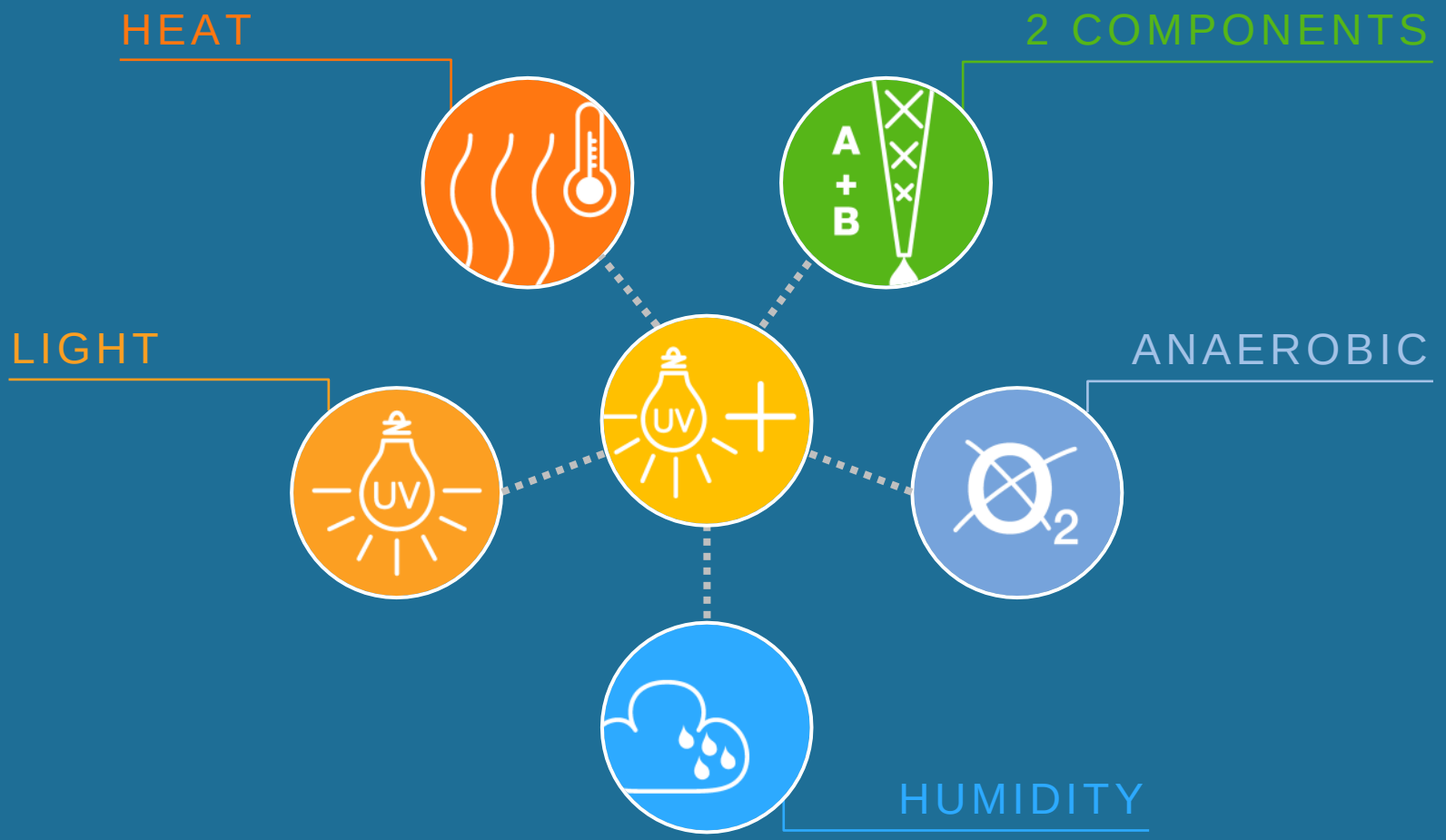
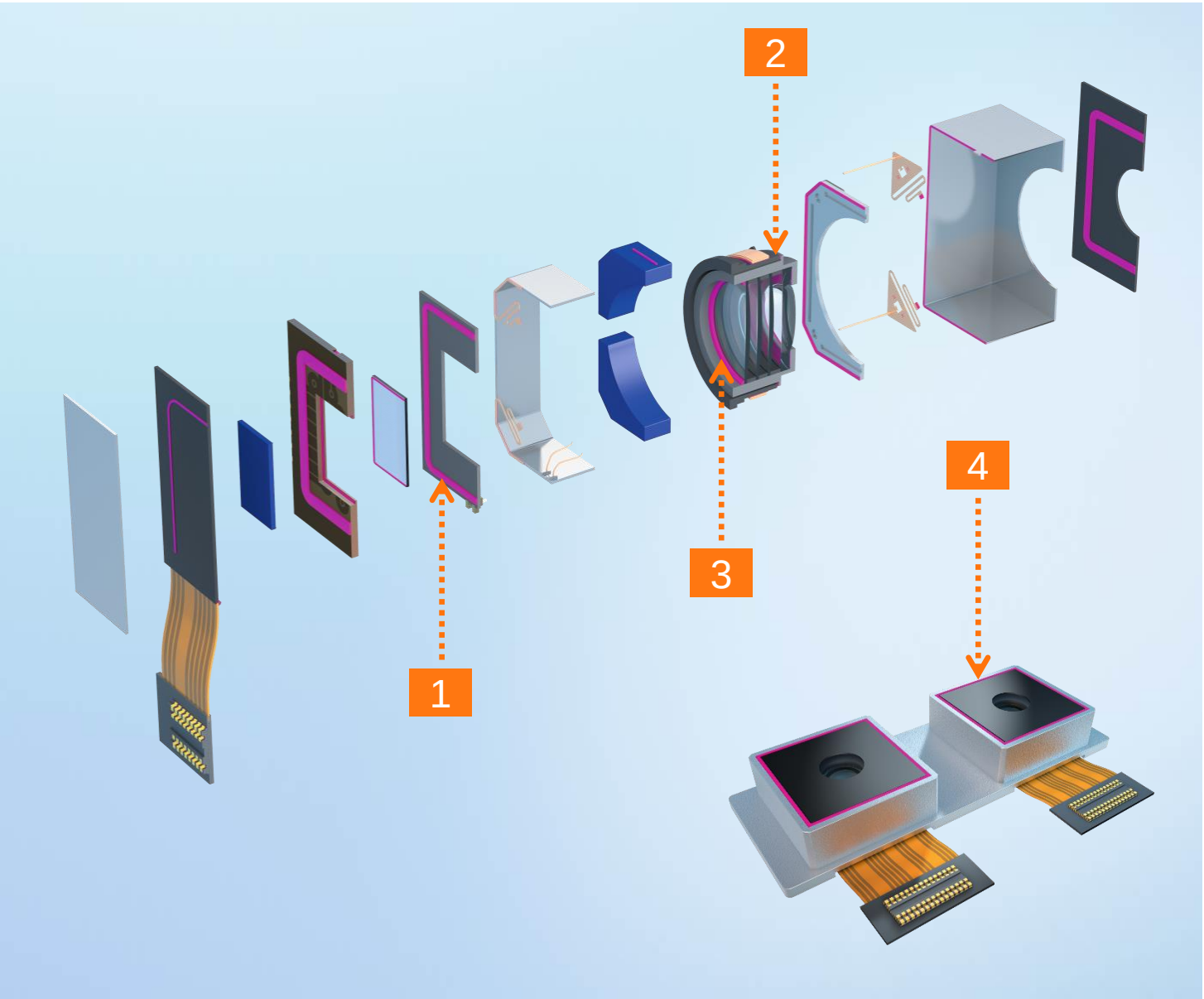


CURING MECHANISMS

DUAL CURING FOR HIGHER PRODUCTION RATE

- Adhesive / polymer

Compact camera module - bonding challenges



1 Active alignment
- fast preliminary UV fixation for high-precision placement of housing

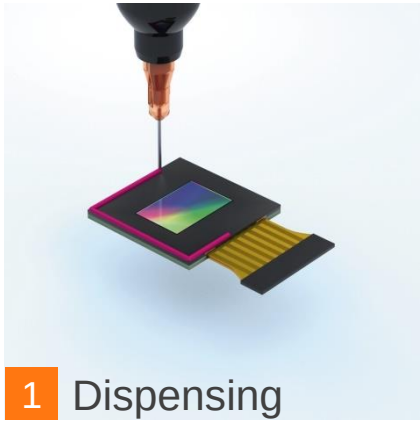
2 Lens barrel attach
- adjusted flowability
- good bonding strength to PC/LCP

3 Retainer ring replacement
- black dual-curing adhesives
- fast UV / light fixation

4 Bracket bonding
- heat-curing adhesives
- very good flow properties

Active alignment

Active alignment process



1 Dispensing

2 Alignment

3 Light fixation

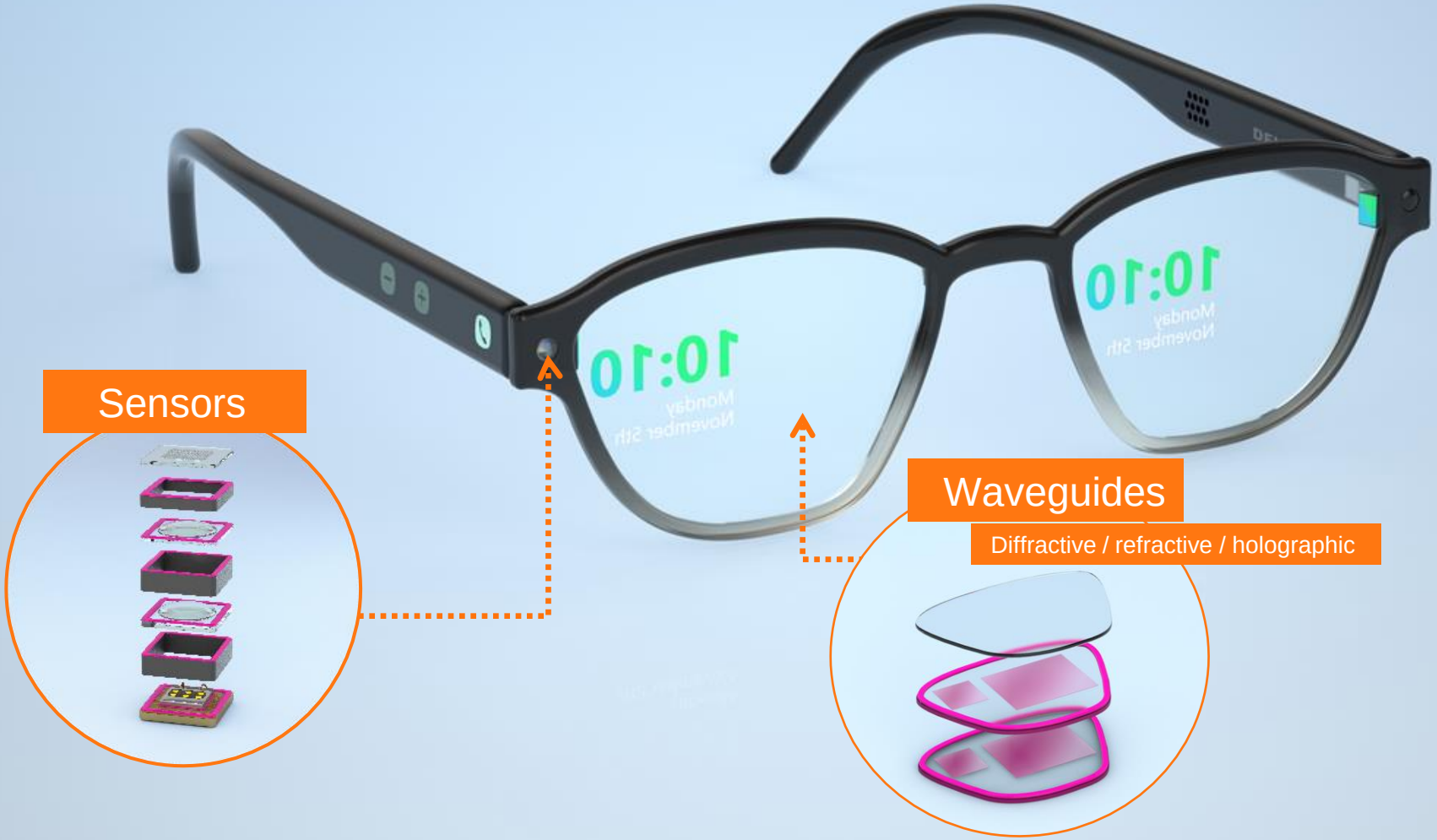
4 Curing

Adhesive technical properties

- High UPH due to UV fixation
  - » << 1 s with DELOLUX 503
- Very low shrinkage for high optical stability
- Low temperature curing
  - » typically +80 °C, +60 °C also possible
- Excellent adhesion to plastic substrates
- Passes all reliability tests, for example
  - » +85 °C / 85 % r.h. > 500 h
  - » Drop test, tumble test
  - » Temperature cycling

Replication of optical elements (lens, DOE) from a UV-curing optical polymer

Nanoimprint Lithography (NIL)



- Adhesive / polymer

Nanoimprint Lithography (NIL)

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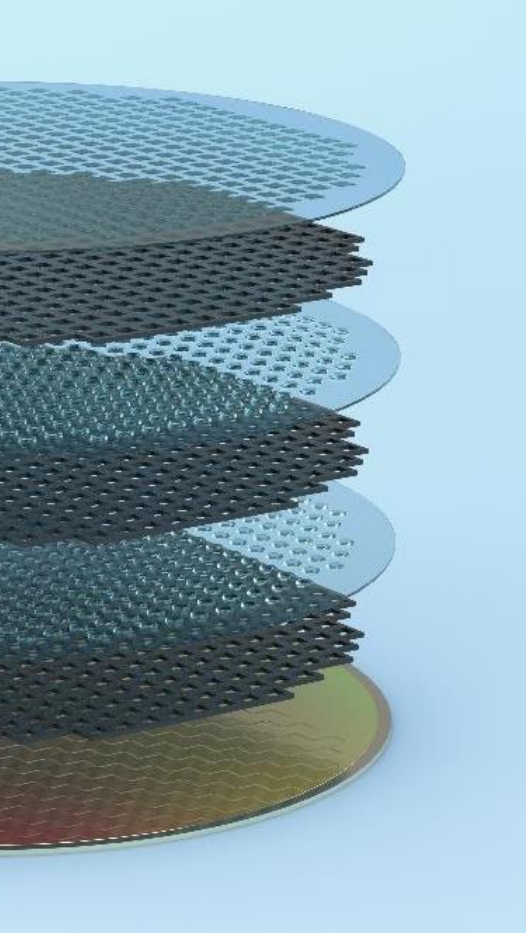
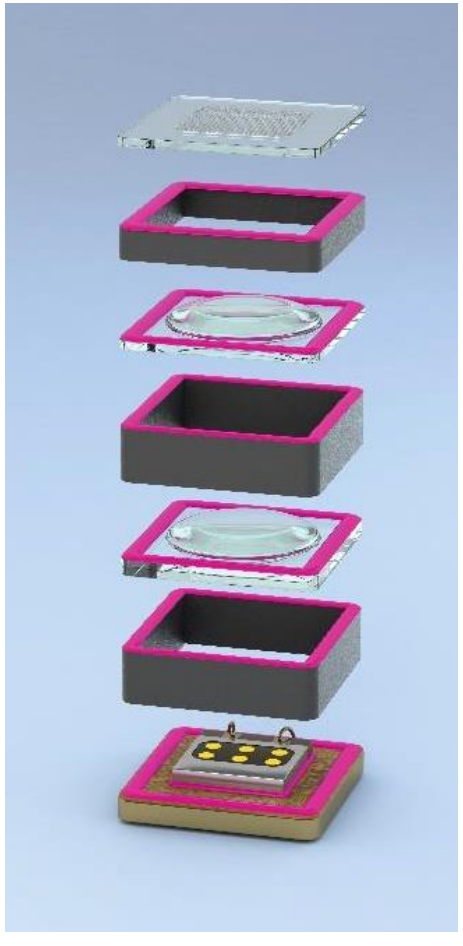
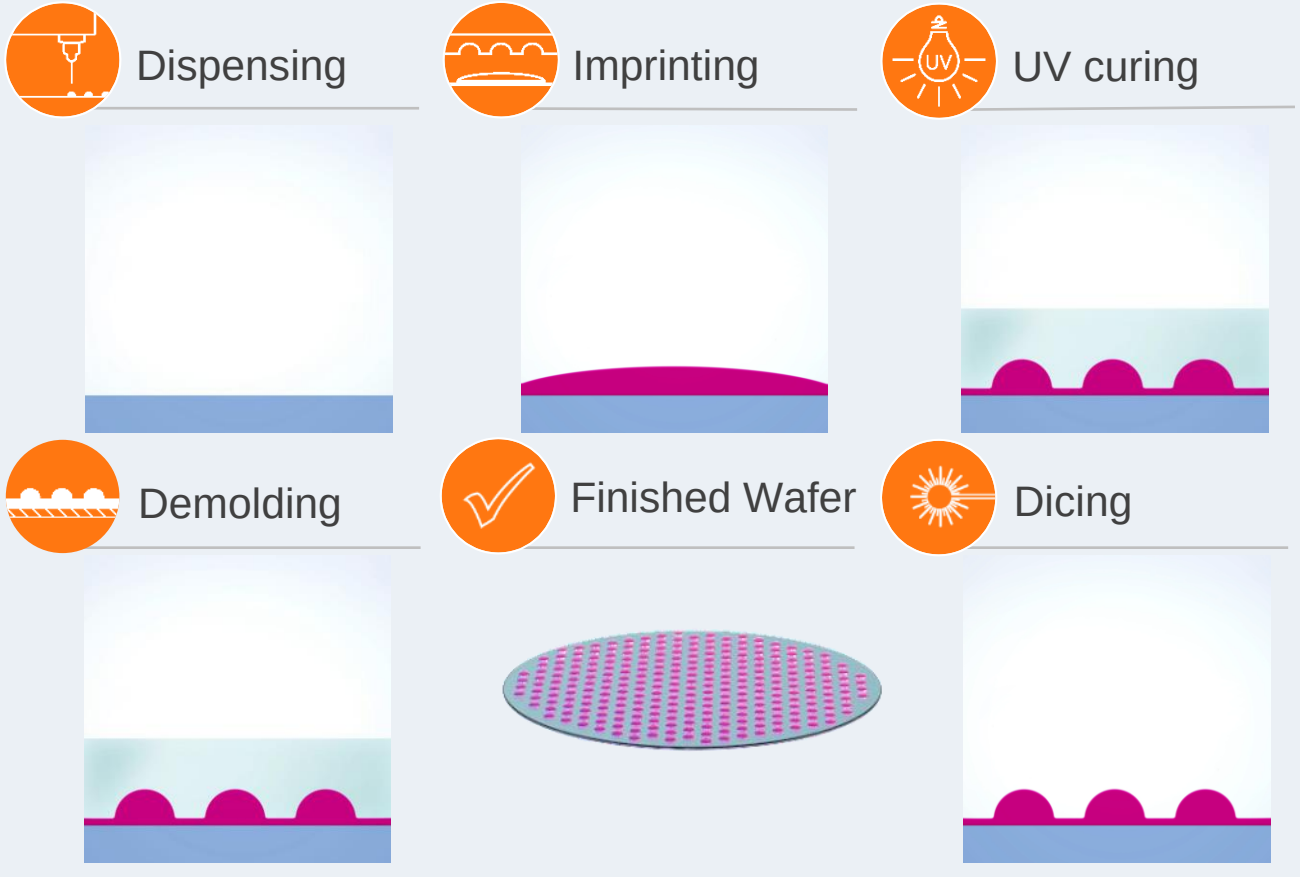
Replication of optical elements (lens, DOE) from a UV-curing optical polymer







Material solutions for wafer-level micro-optics

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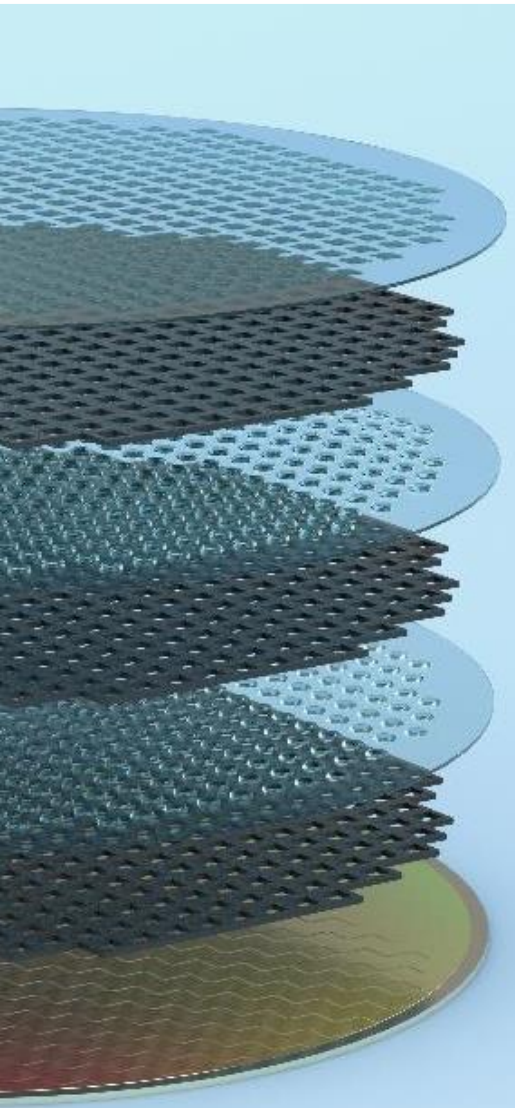
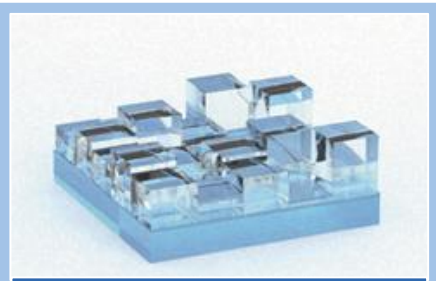
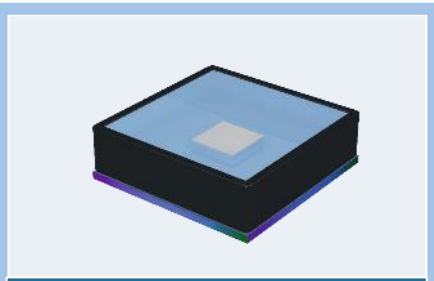




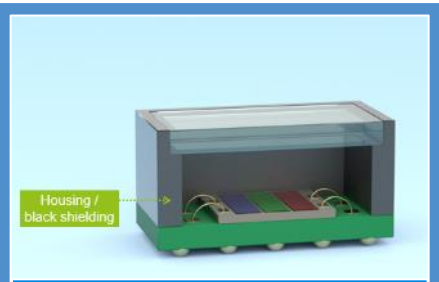
Nano Structures

Lens Structures

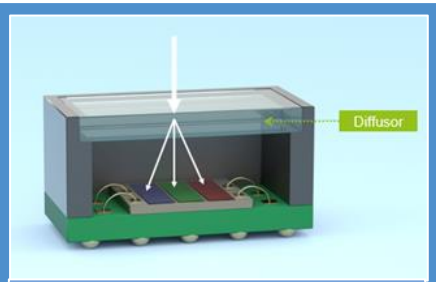


Encapsulation

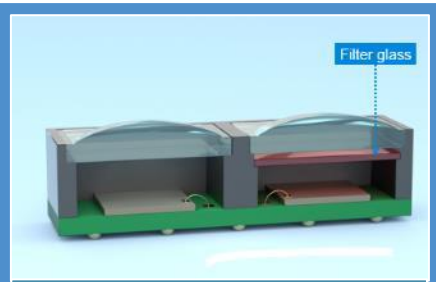
Optical solutions



Light Blocking



Diffuser Material

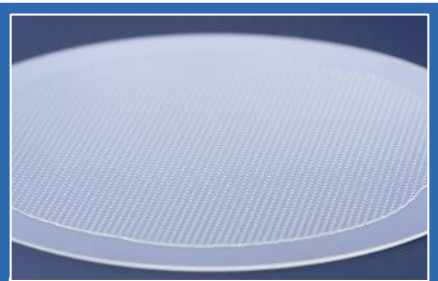


Filter Material

Functional solutions

Wafer Bonding

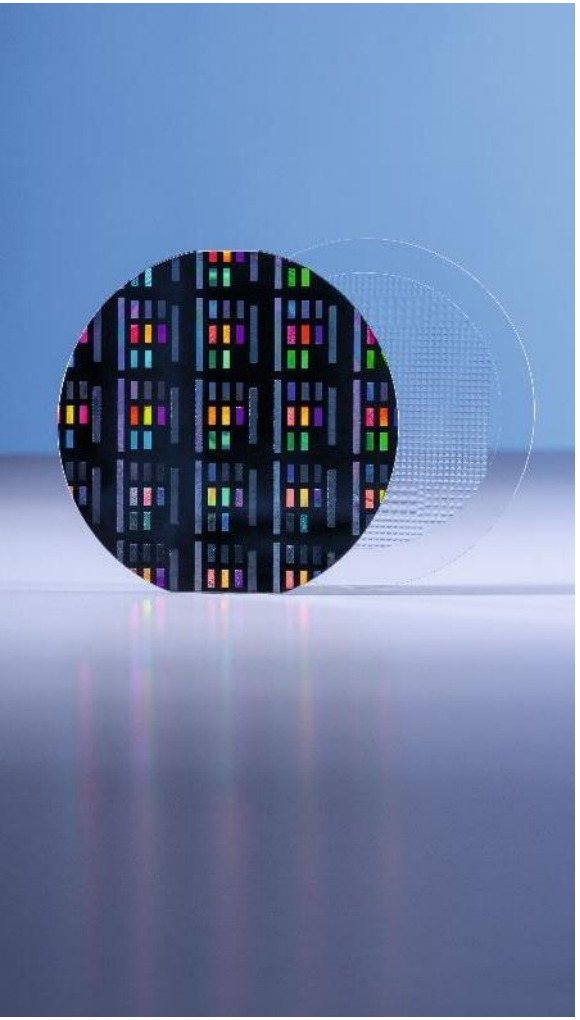
Wafer Stacking



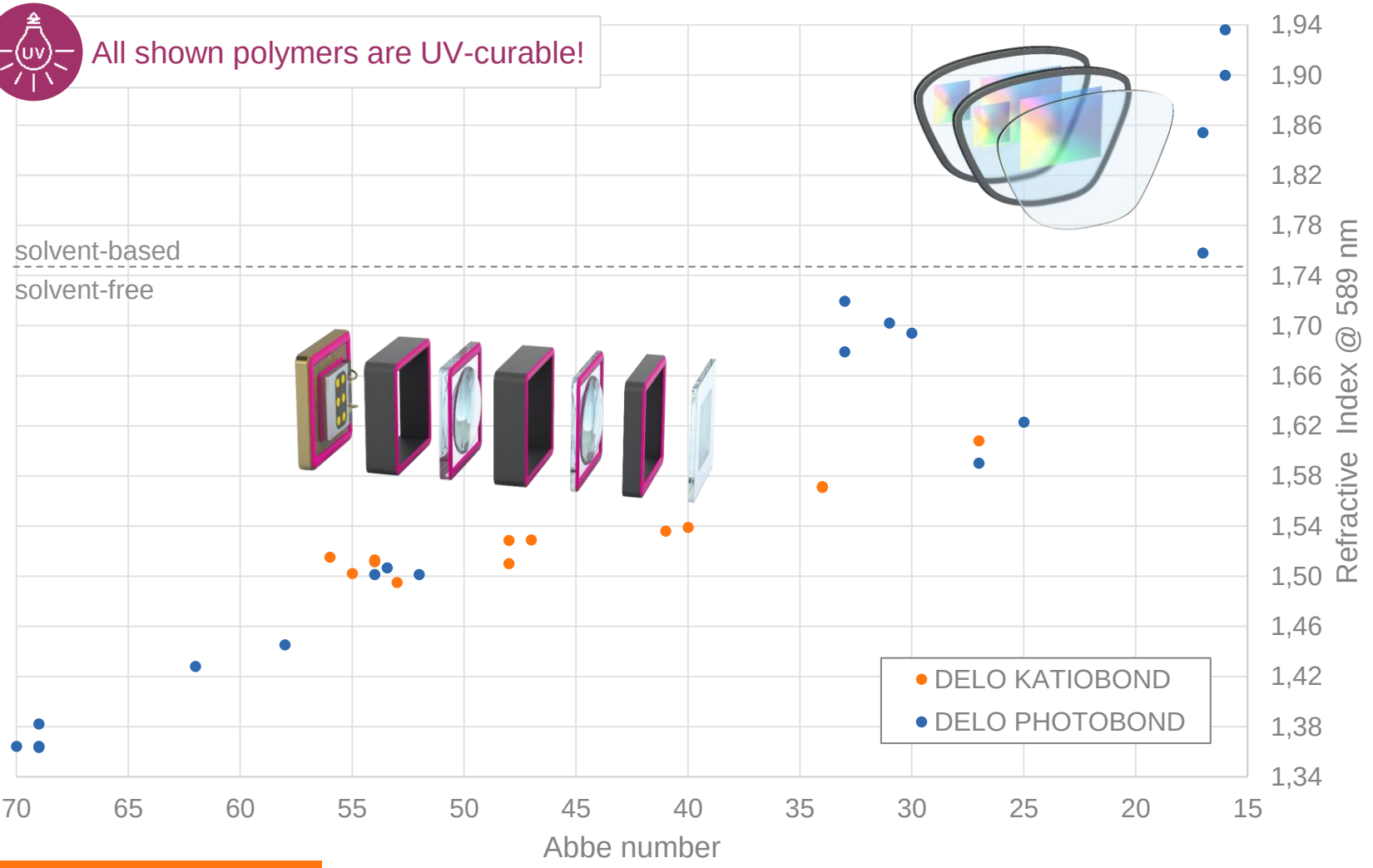
Stamp Material

Process solutions

Adjusting Refractive Index

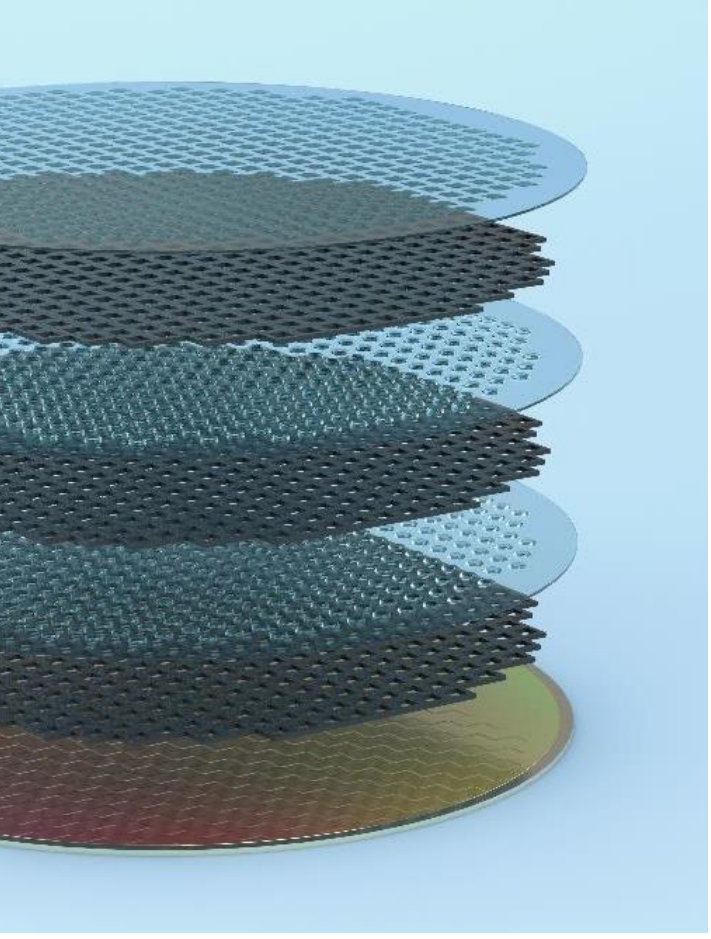


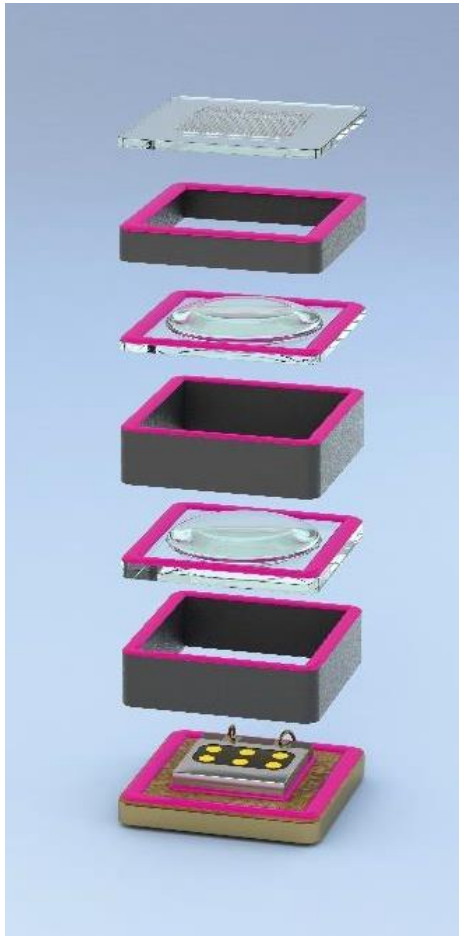
All shown polymers are UV-curable!



Broad range of RI available to enable optical design freedom

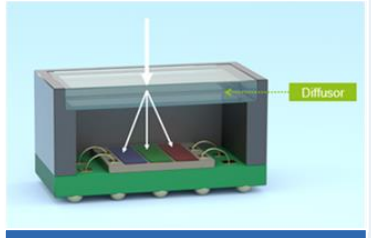
Nanoimprint Lithography (NIL)



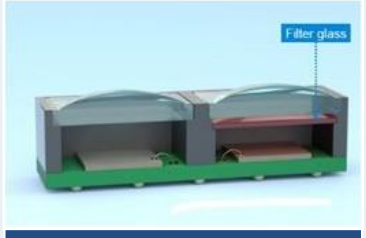


Benefits of wafer-level packaging with polymers

- All liquid process
- Maximum design freedom
- Minimum package size
- Maximize UPH
- Optimized mechanical stability
- Reflow stable package



Ambient light sensing



ToF sensing

3D sensing

Nanoimprint of grating structures

DELO

Opt. Express 15, 2067-2074 (2007)

Polymer-based diffractive optical elements

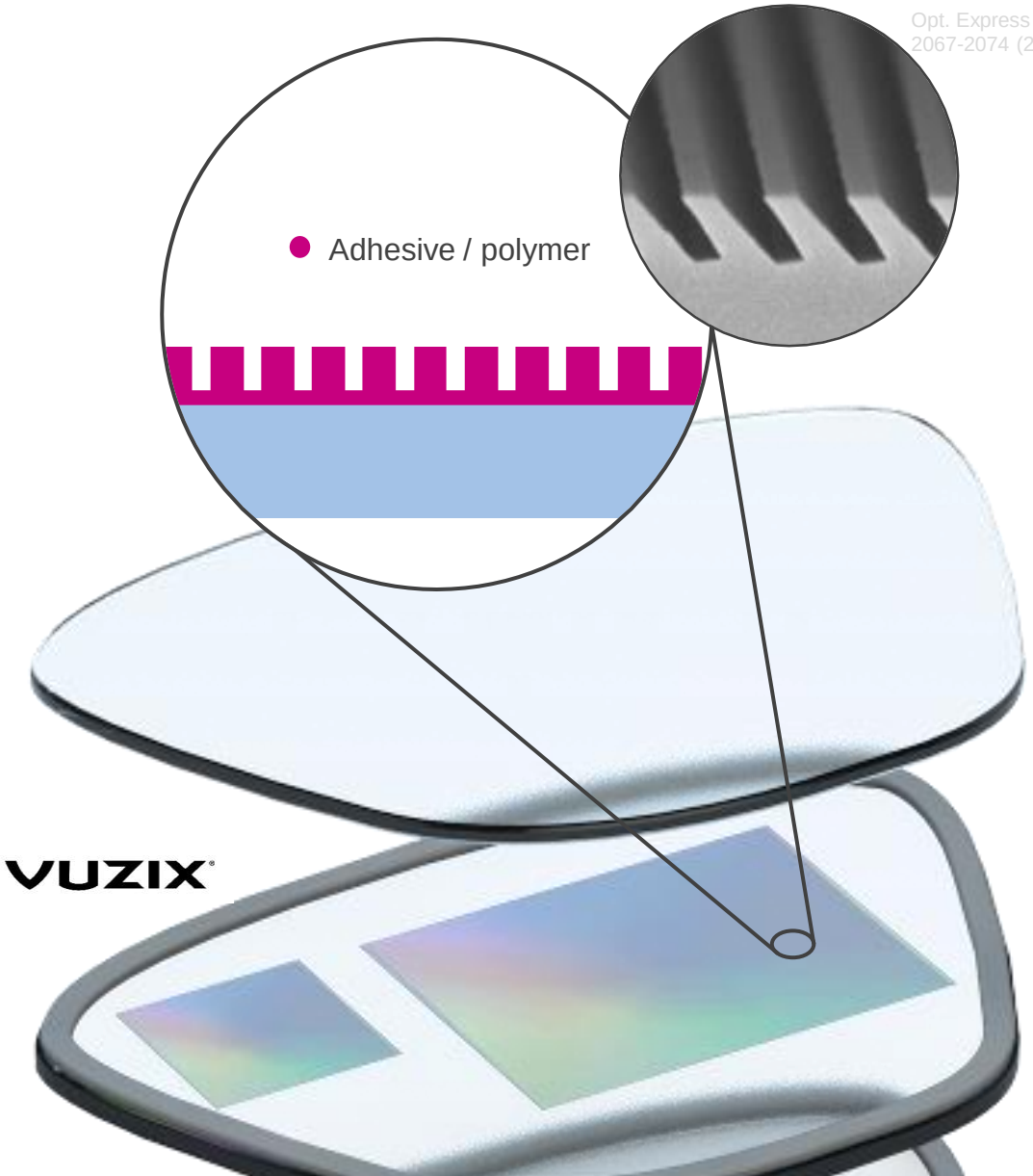
- Surface relief gratings (SRG) imprinted on glass waveguide
- High refractive index of polymer
- Allows arbitrary grating structures*
  - » slanted, blazed, binary, analog
  - » Modulation of depth, slant, duty cycle
- Mass-producible on the wafer- or panel-scale via UV Nanoimprint Lithography (UV-NIL)

*depending on master template

Microsoft HoloLens

magic leap

VUZIX



Combines high quality glass substrate with easy and fast processability of polymer

Currently dominant waveguide technology

Summary

Adhesives enable ARVR

- Adhesives can do more than just bond parts together!
- Smart usage of adhesives enables completely new designs and processes
- Involve adhesive experts early in your project to benefit from their know-how
- Be smart – don‘t underestimate the importance of proper adhesive selection!

We are looking for…

- New process ideas and partners to transfer those into mass production
- Raw materials to extend our current product portfolio
- Innovative companies who want to push boundaries for high-tech adhesives

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