

CHEMISTRY THAT MATTERS™



# "ENABLING AUTOMOTIVE LIGHTING WITH THERMOPLASTIC OPTICS"

SABIC'S INNOVATIVE THERMOPLASTIC RESIN

Bernd Grammer New Business Development Manager +491733005305  
EPIC Meeting at SUSS CH



## AUTOMOTIVE LIGHTING AS STYLING ELEMENT

### PERFORMANCE CONSIDERATIONS:

- High heat
- Optical performance
- Weight savings; reduced mass
- Enhanced flow
- Differentiated, paint-free styling options
- No outgassing, low moisture uptake
- Surface appearance
- Dimensional stability
- Defuse reflectivity
- Chemical resistance



### POTENTIAL APPLICATIONS:

- Headlight lenses, bezels, reflectors, inner lenses, housings, thin-wall lenses and light pipes
- Signal-lighting lenses, housings, bezels and reflectors
- LED inner lenses, outer lenses, bezels, housings, white reflectors, defuse lenses, heat sinks and plastic aspheric lenses, frames or carriers
- Fog light housings, reflectors, and high-heat lenses
- Projector lens holders, reflectors, plastic aspheric lenses, and shutters
- RCL lighting housings, bezels, inner lenses, rear lenses and light pipes

# THERMOPLASTIC RESINS USED IN AUTOMOTIVE LIGHTING



Rear lamps PMMA  
Sometimes coated for  
scratch resistance and  
weathering

Headlamps  
LEXAN™ resin PC  
Impact resistance  
Lacquer coating

Side indicator  
LEXAN™  
PC or PMMA

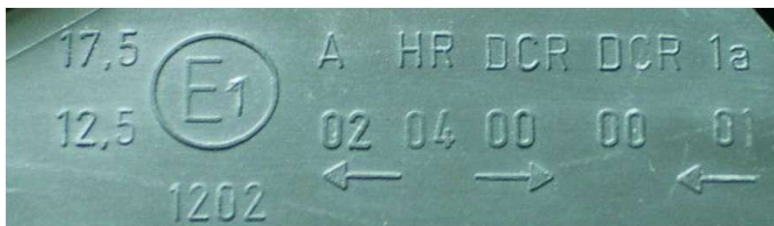
Foglamps / DRL  
LEXAN™ resin PC  
Impact resistance  
Lacquer coating



## AUTOMOTIVE LIGHTING APPROVALS

### TYPE APPROVAL NUMBERS ON THE HEADLAMP

National and international design and operating regulations apply for the manufacture and testing of vehicle lighting equipment. Special approval marks exist for headlamps and can be found on the cover lens or on the housing.



### E.g. HEADLAMP VERSION

ECE regulation 1

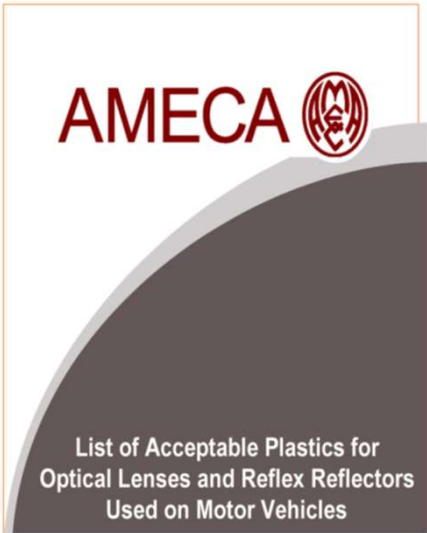
- A Marker light
- B Fog light
- C Low beam
- R High beam
- CR High and low beam
- C/R High or low beam

ECE regulation 123

- X Advanced Frontlighting System



# THERMOPLASTIC RESINS USED IN AUTOMOTIVE LIGHTING



Information on UVHC3000, UVHC3000CC, UVHC3000LS, UVHC3000K1-40, UVHC3000K1-50, and UVHC3000KZ60 hard coat may be obtained by writing to the following address:

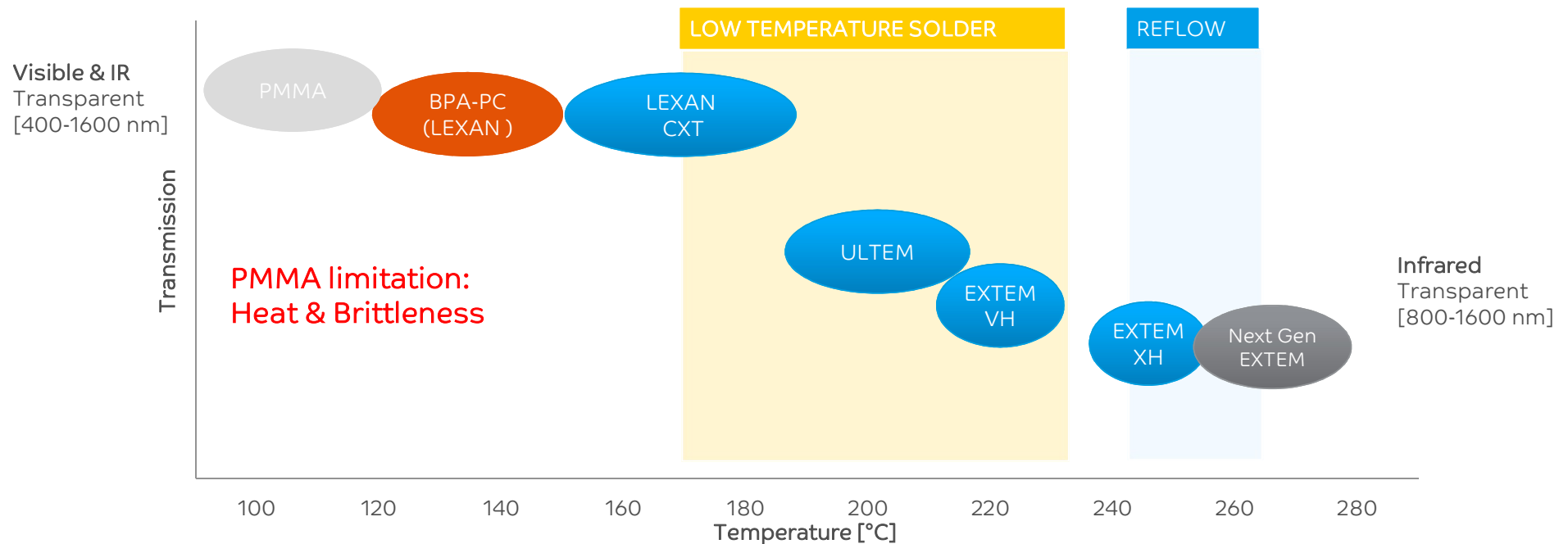
Momentive Performance Materials GmbH      Momentive Performance Materials Inc.  
Building V7      260 Hudson River Road  
51368 Lverkusen      Waterford, NY 12118  
Germany      [www.momentive.com](http://www.momentive.com)

<u>MFR.</u>	<u>TRADE NAME AND FLOW FORMULATION</u>	<u>TYPE OF RESIN</u>	<u>NUMBER</u>	<u>COLOR</u>
Sabic USA  www.sabic-ip.com	LEXAN® LS-1	Polycarbonate	111	White #!
	LEXAN® LS-1A		111C	White #!
	LEXAN® LS-2		111H	White #!
	LEXAN® LS-2A		111M	White #!
	LEXAN® LS-3		111S	White #!

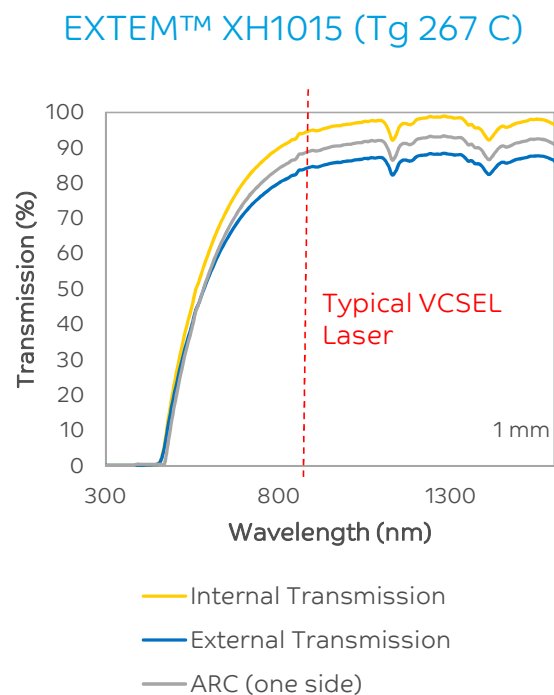
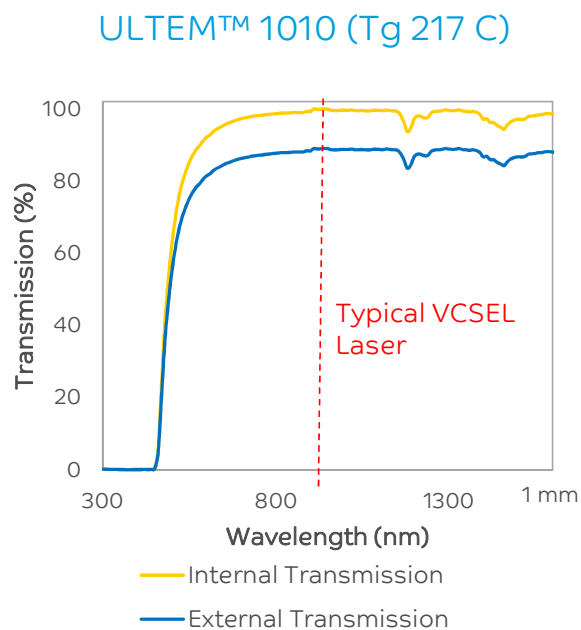
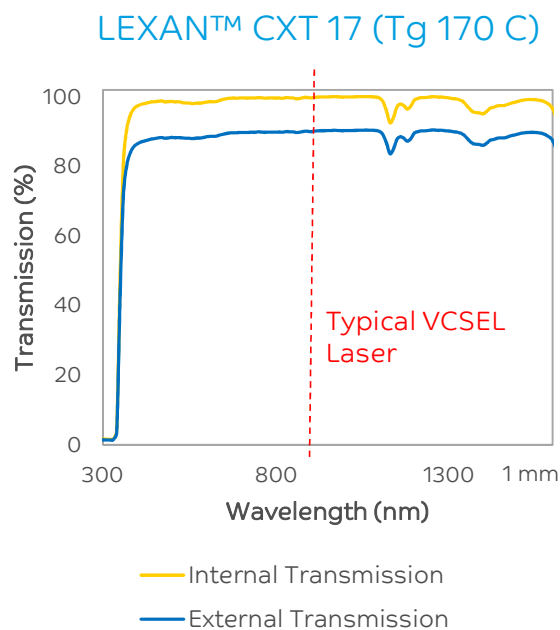


## PORTFOLIO OF THERMOPLASTIC RESINS

SABIC offers a wide range of solutions for applications that use soldering for mounting of parts and modules onto PCB's. Crystal clear LEXAN™ CXT resins for low temperature soldering, and IR transparent ULTEM™ and EXTEM™ resins for more demanding solder processes, incl. lead-free-reflow-soldering

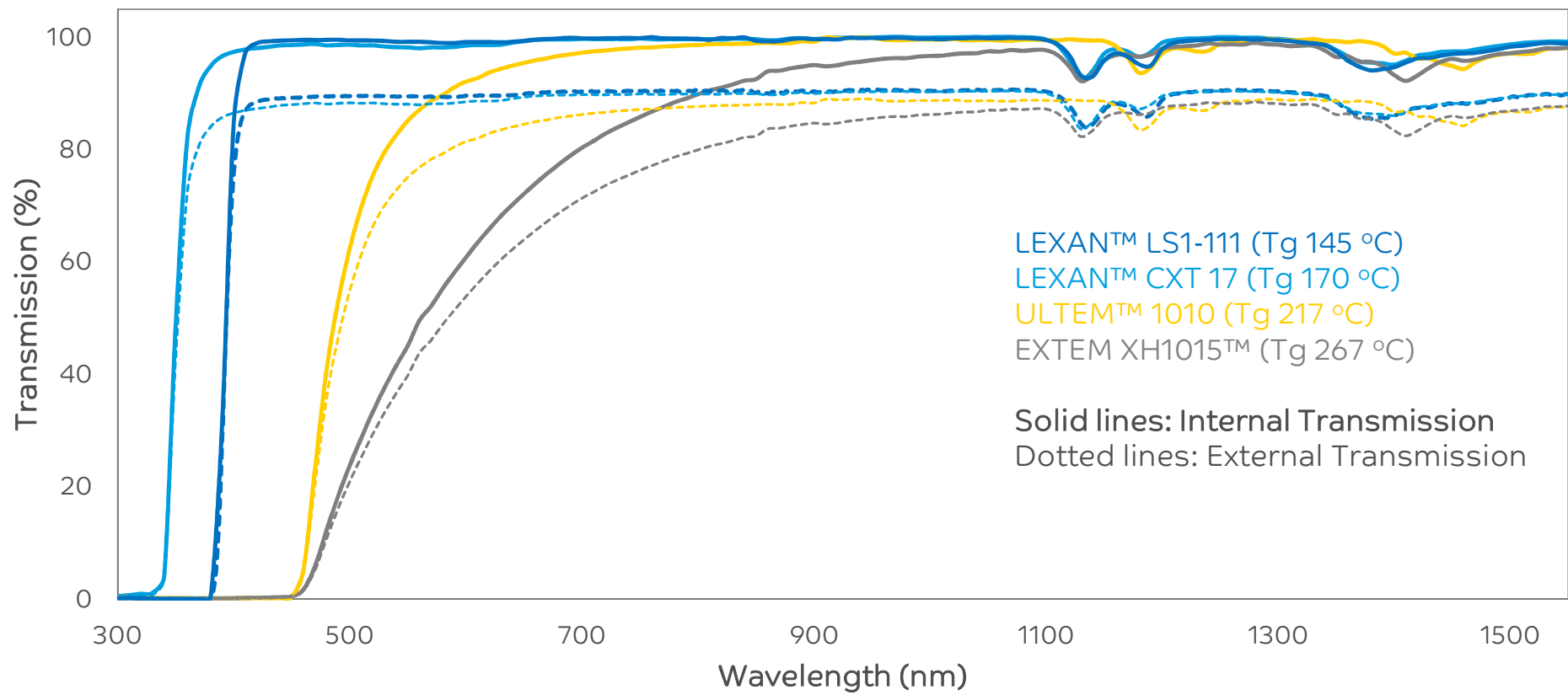


## SPECTRAL TRANSMISSION



High transmission in the Infrared transmission region  
Anti reflective Coatings can be used to even increase transmission

# TRANSMISSION





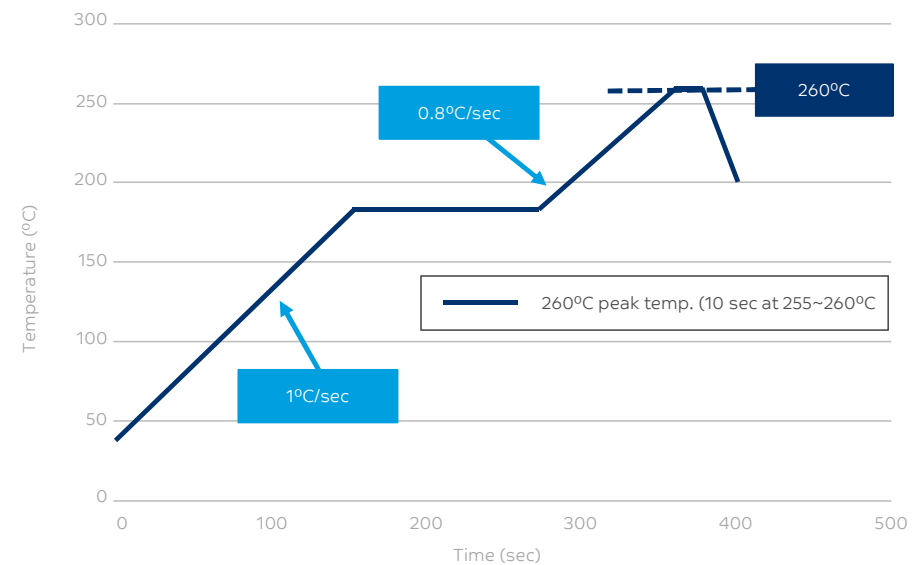
## FUTURE NEEDS - WHY CHOOSE EXTEM™ RESIN?

### Value Propositions of EXTEM™ resin, a thermoplastic polyimide:

- Low and stable coefficient of thermal expansion from -20°C to 250°C results in accurate laser function
- High Tg (glass transition temperature) to potentially allow **lead-free-reflow-soldering** (JEDEC level 3)
- IR transparency
- High Ri (refractive index), 1.64

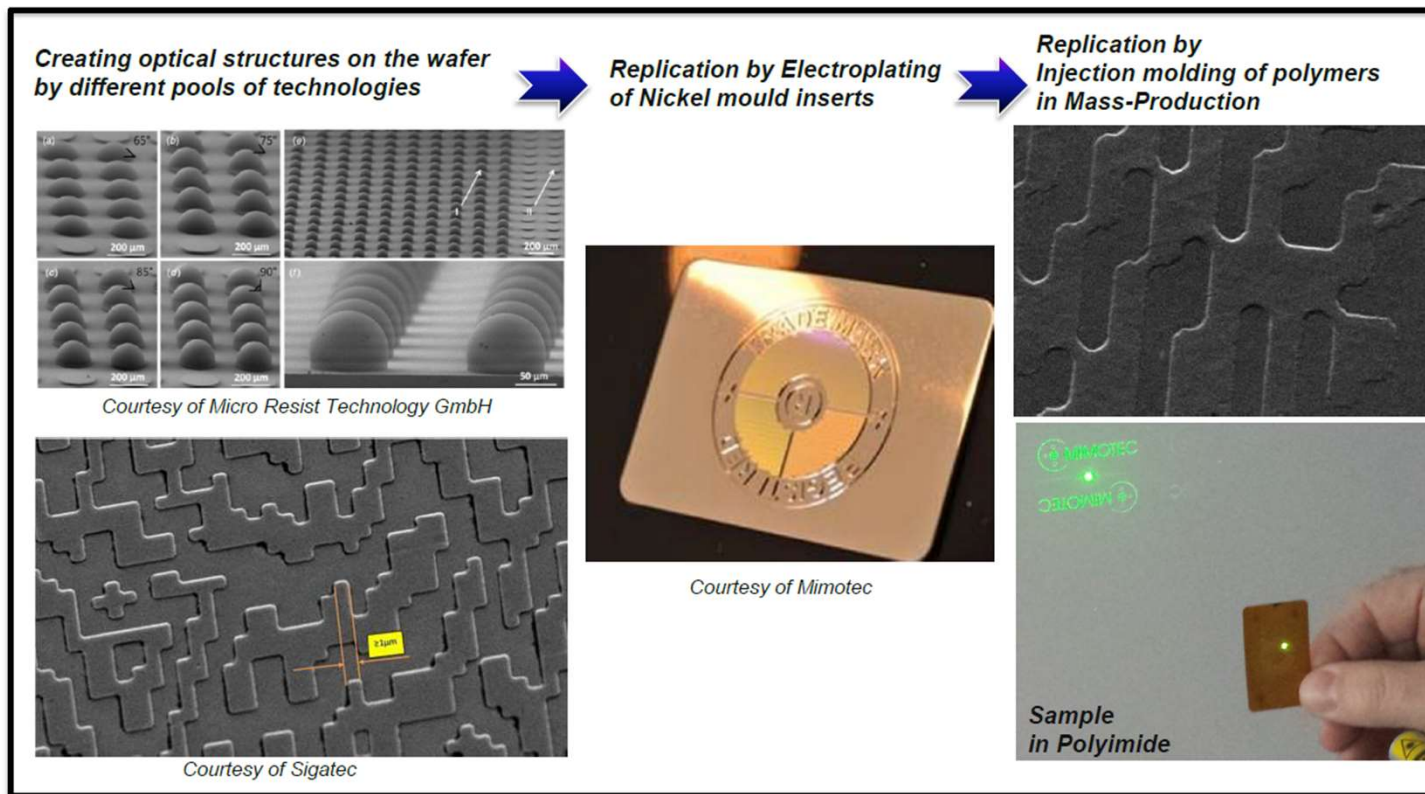
### Potential benefits when using EXTEM™ resin

- Productivity improvement through injection molding
- Low CTE causes less stress in soldering process
- Overmolding capability, ability to mold lens and housing in two shots on same machine/tool
- Design freedom supporting miniaturization of lens geometries, no stacking
- Recyclability



## NANOSTRUCTURATION - MICROMOLDER SOPROD

- Principle of replication in mass-production on polymers surfaces



## NANOSTRUCTURATION - MICROMOLDER SOPROD

- Technologies available for Lighting and Optical Sensors Packaging

### Micro-lenses

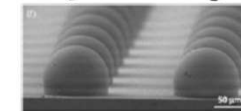
- **Various geometries of Lenses possible  $\varnothing \geq 900\mu\text{m}$**

Ultrasonic diamond machining of inserts – Mass Production achieved



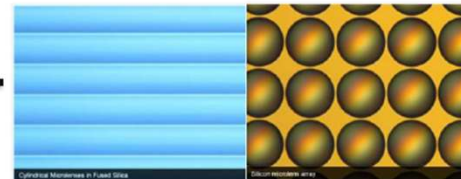
- **Spherical Micro-Lens Arrays**

Ink-jet Printing of Photoresist – Validation of the Process ongoing



- **Various geometries possible of Micro-Lens Arrays**

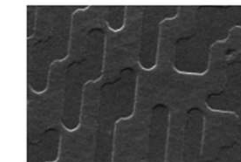
Thermal Reflow + DRIE – Validation of the Process ongoing



### Diffractive structures

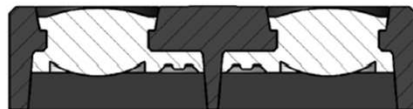
- **Diffractive Pattern  $\geq 2\mu\text{m}$**

Deep Reactive-Ion Etching (DRIE) – Process Validated



- **Diffractive Pattern  $\geq 30\text{nm}$  – multi-levels possible**

E-Beam + DRIE – Validation of the Process ongoing



All Combinations are possible  
Top – Bottom Side



## FOR YOUR CONVENIENCE: OPTICAL AND ENGINEERING DATA AVAILABLE

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EXTEM™ resin, and other applicable SABIC materials, are added to the materials database of the Zemax OpticStudio® and SYNOPSYS® Code V, the industry-standard in software for designing optical systems

SOFTWARE FOR ANALYSIS, SIMULATION AND OPTIMIZATION OF THEIR OPTICAL COMPONENTS AND SYSTEMS





## WHY CHOOSE SABIC AS YOUR PARTNER?

# SABIC IS A GLOBAL LEADER

From making cars and planes more fuel-efficient, to contributing towards water conservation, and helping enable colorful smartphone cases, we find solutions to the challenges of today to help our customers achieve their ambitions and build a better tomorrow.



# SABIC AT-A-GLANCE



1976

Company  
established



34,000

Employees  
around the world



50

Countries  
of operations



3<sup>rd</sup>

Largest global  
chemical company\*



120<sup>th</sup>

Largest public  
company in the world\*

3.7

US\$ bn

Estimated  
Brand Value\*\*

86

US\$ bn

Total  
assets

4.9

US\$ bn

Net  
income

39.9

US\$ bn

Annual  
revenue



≈ 150

New products  
each year



11,534

Global patent  
filings



64

World-class  
plants worldwide





THANK YOU

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