SUSS\_MicroOptics

# **MICRO-OPTICS FOR AUTOMOTIVE LIGHTING**

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#### CONTENT



#### confidential

- + Introduction SUSS MicroOptics SA
- + Why Micro-Optics in Automotive Lighting ... and for MicroLEDs



## SUSS MICROOPTICS – WE SET THE STANDARDS

#### confidential

- + World leading supplier of high-quality Micro-Optics
- + Refractive and Diffractive optical elements
- + More than 200 active customers worldwide
- + We are part of **SUSS MicroTec** group



8" Wafer Cleanroom Fab



IATE 16949



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**Microlens Array** 



Nipkow Disk



**MO Exposure Optics** 

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### **CORE COMPETENCES IN MICRO-OPTICS**

#### •

- Imaging and physical optics
- System Simulation and tolerancing (MC)

#### **Fabrication**

**Optical Simulation** 

Cleanroom facilities

**Ray Tracing** 

- Microfabrication for precise features (sub-µm to wafer level)
- Imprint technology and classical microoptics fabrication (etching)
- Lens arrays on wafer level
- Wafer-level assembly with μm-alignment (Wafer-level optics)
- Polymers qualified for automotive lighting

#### Measurements, inspection and characterization

- Wafer level (200 mm) nanometric precision
- Characterization by optical and mechanical tools
- Calibration and qualification
- Artificial intelligence concept for high throughput testing











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# **MLA – CONCEPTS AND POSSIBILITIES**



# **CLASSICAL PROJECTOR**

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### **Advantages**

- + Inexpensive
- + Compatible with injection molding
- + Well established and broad field of applications



### Limitations

- + Short depth of field
- + No multichannel mixing
- + Limited homogenization
- + Large size



#### **MLA – MULTI-CHANNEL OPTICS AND HOMOGENIZING**

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- + Hans Christoph Eckstein from *Lucid Motors* at Lighting Design for Mobility Online 2020 event
- + <u>https://www.automotive-iq.com/events-autoadvancedlighting-online/agenda-mc</u>

Slides	ICITING DECICN
Efficiency and flux vs. package size [for headlamps SOLUTION: MICRO-OPTICS AND MULTIPLE SOURCES Micro-optical projectors do not grow in the z-direction	
1000lm	
2000lm Low – integration depth (x-direction) Scalable form factor (design freedom – e.g. ultra slim headlight) Unique look and appearance	
Lucio Dr. Hans-Christoph Eckstein	LUCID CONFIDENTIAL
	CN24

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#### HOW MICRO-OPTICS CAN HELP MICROLEDS

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## **MICRO-OPTICS FOR MLAs – SINGLE CHANNEL**



- onfidential
- + Very small in size
- + Large depth of field  $\rightarrow$  Microlenses image to infinity
- + Strong light (beam) homogenization → Fixing "bad" mixers
- + Multichannel mixing
- + Technology based on wafer level optics  $\rightarrow$  compatible with MicroLEDs technology
- + Polymers are qualified for automotive lighting



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#### MLA FABRICATION AND CONCEPTS







+ And other combinations of these examples are possible

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#### Short and slim

Miniaturization (short focal distance) and multiplication 

#### **High efficiency**

Etendue conservation through multichannel

#### **Functionality**

- Precise definition of light distribution (contrast, highlights, projections)
- Long depth of field (DoF)
- High homogeneity (illumination, appearance, color mixing, ...)

#### **Freedom of design**

- Modular construction
- Less weight compared to conventional systems
- Combination of modular construction, slim design and less weight

#### **Extremely precise**

- Combination of illumination and imaging
- Alignment (< 3 micron) and shape (< 50 nm)





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#### **HIGH EFFICIENCY + FUNCTIONALITY**

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#### NEW CLEANROOM FAB FOR WAFER-LEVEL OPTICS SUSS IMPRINT EXCELLENCE CENTER

**IATF 16949** 

**Automotive Qualified** 



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800m<sup>2</sup> additional clean room surface for fabrication under construction and ready for 2021

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of Micro-Optics FAB Experience



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Thank you

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