



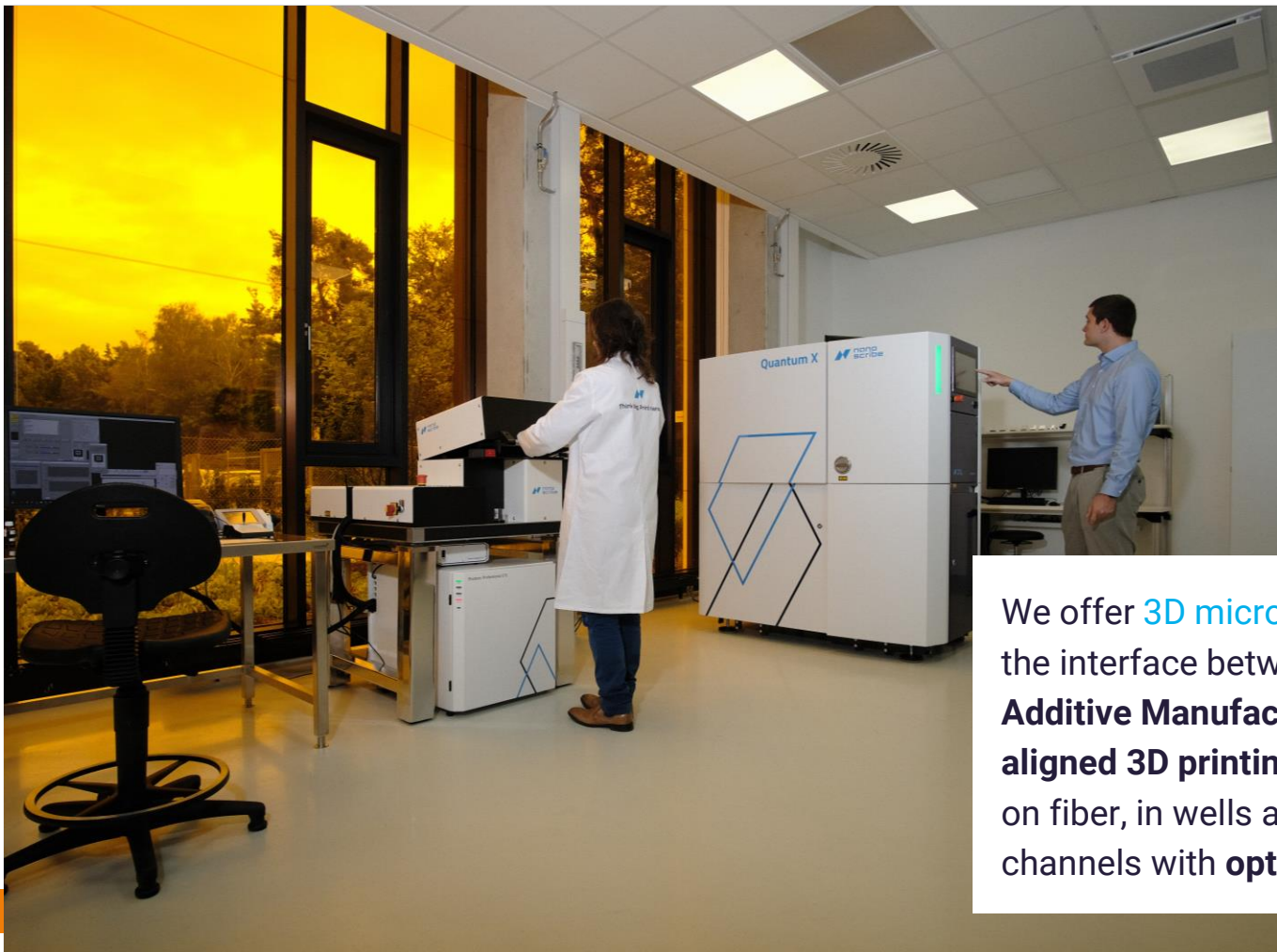
# Nanoprecise Aligned 3D Printing of Microoptical Couplers for Integrated Photonics

Martin Hermatschweiler, CEO & Co-Founder

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ECOC, Frankfurt am Main, Germany

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We offer **3D microfabrication solutions** at the interface between **Lithography** and **Additive Manufacturing**. This results in **aligned 3D printing** capabilities e.g. on chip, on fiber, in wells and in microfluidic channels with **optical quality surfaces**.

**15**  
YEARS Think big.  
Print nano.



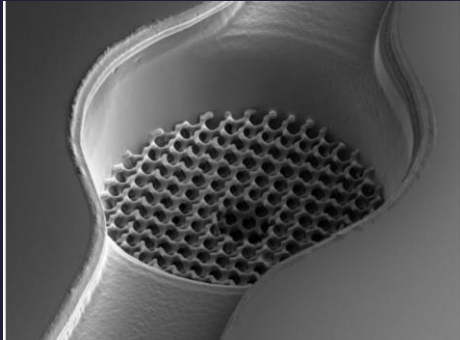
## Company Facts & Figures

- ▶ 100+ employees
- ▶ 35% R&D intensity
- ▶ 4,000+ users
- ▶ 2,000+ publications
- ▶ HQ in Karlsruhe, Germany with >4,200 m<sup>2</sup> space
- ▶ Subsidiary Boston, US
- ▶ Subsidiary Shanghai, CN
- ▶ 15+ years of success

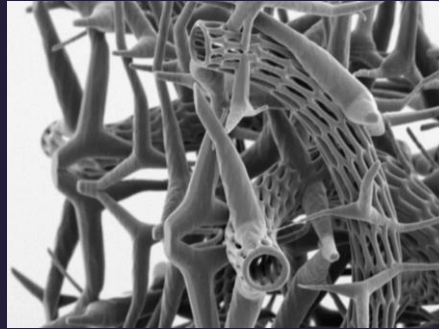
# We empower cutting edge science & drive industrial innovations



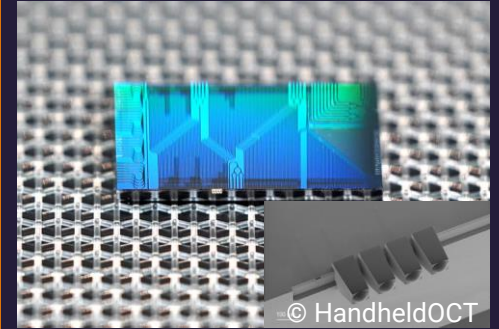
## Life Sciences



## Microfluidics



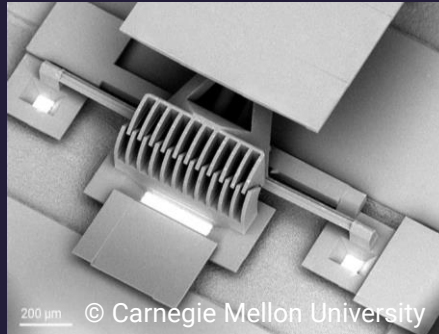
## Photonic Packaging & PIC



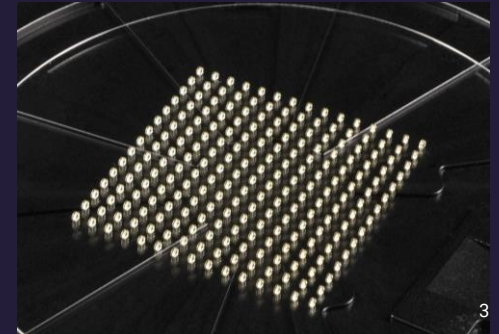
## Microneedles



## Materials Engineering & MEMS



## Microoptics





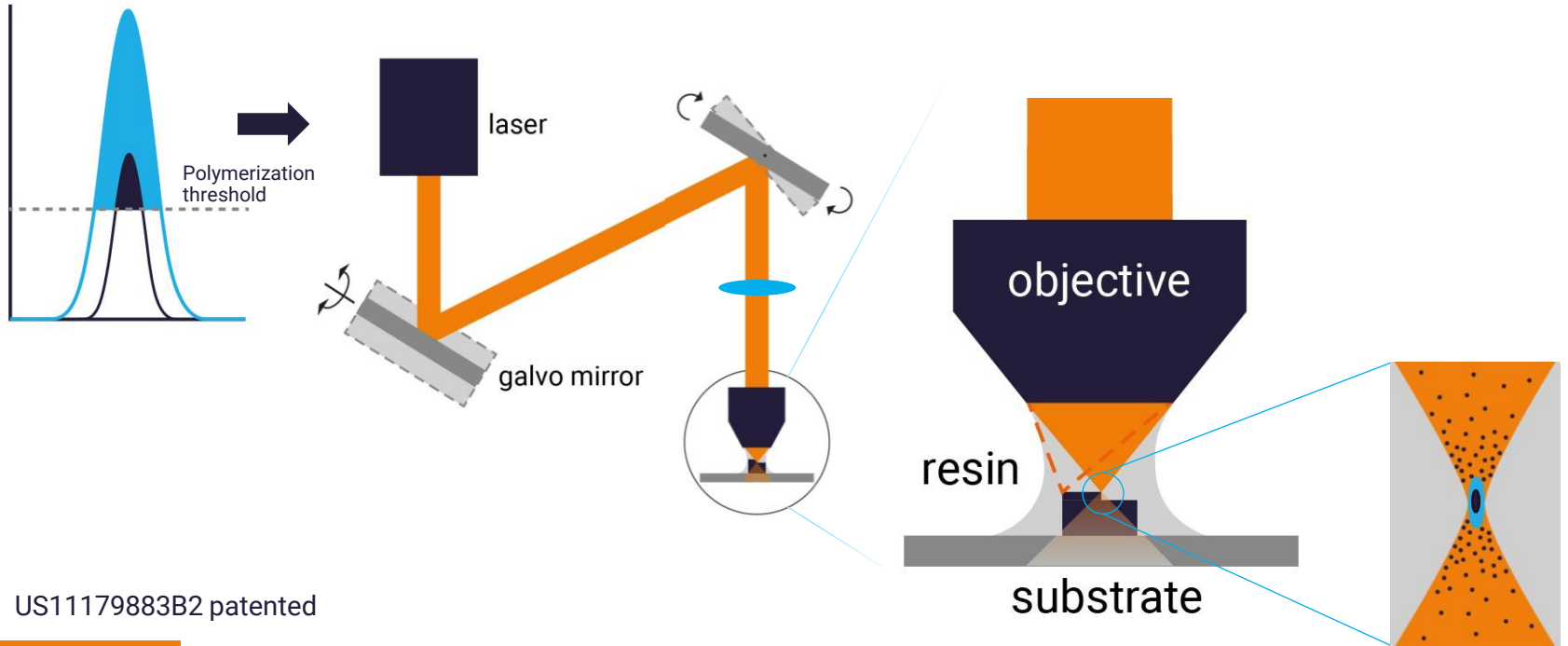
# The Key Enabling Technology

Read our Whitepapers

- 1) Two-Photon Polymerization (2PP)
- 2) Two-Photon Grayscale Lithography (2GL®)
- 3) Industrial Scale-up: Mastering & Replication

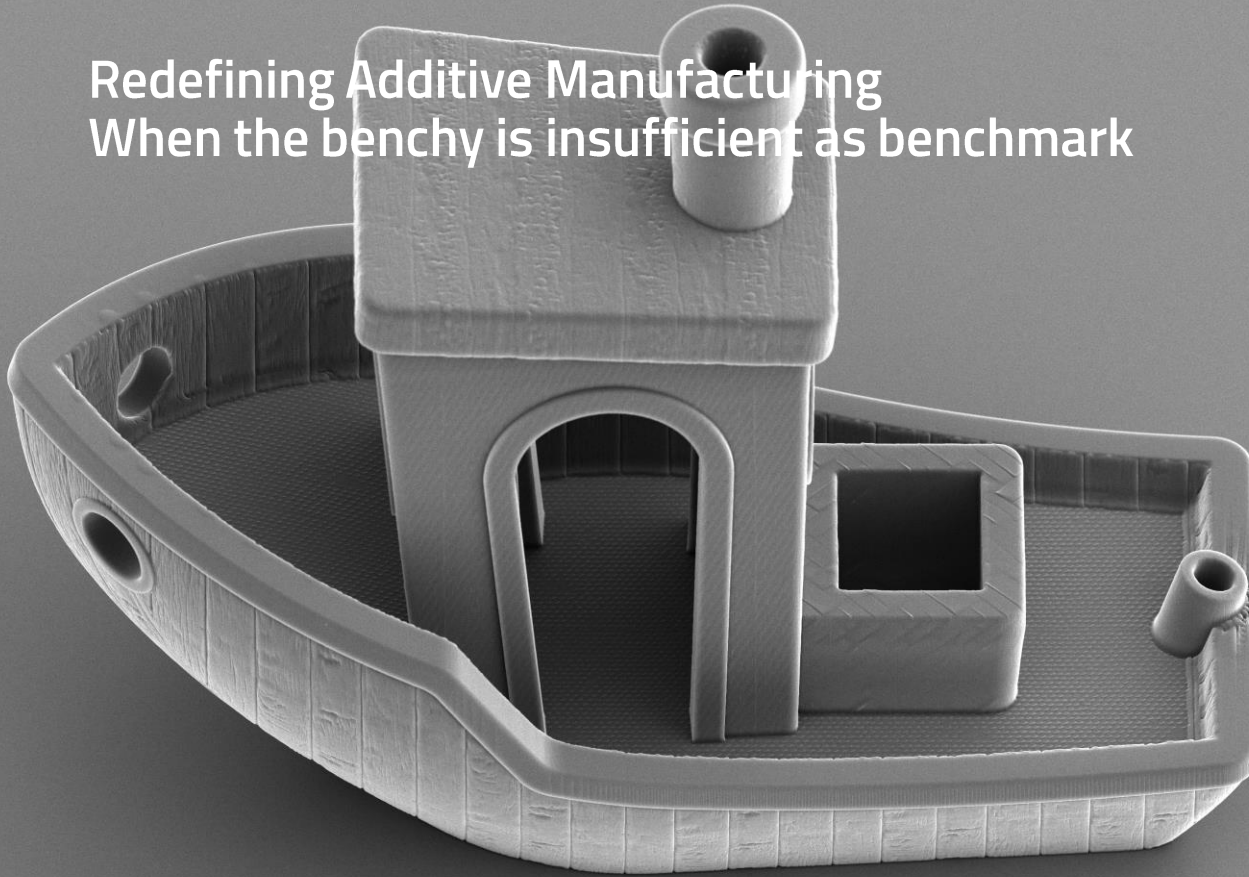


# Technology: Two-Photon Grayscale Lithography (2GL<sup>®</sup>)



US11179883B2 patented

# Redefining Additive Manufacturing When the benchy is insufficient as benchmark



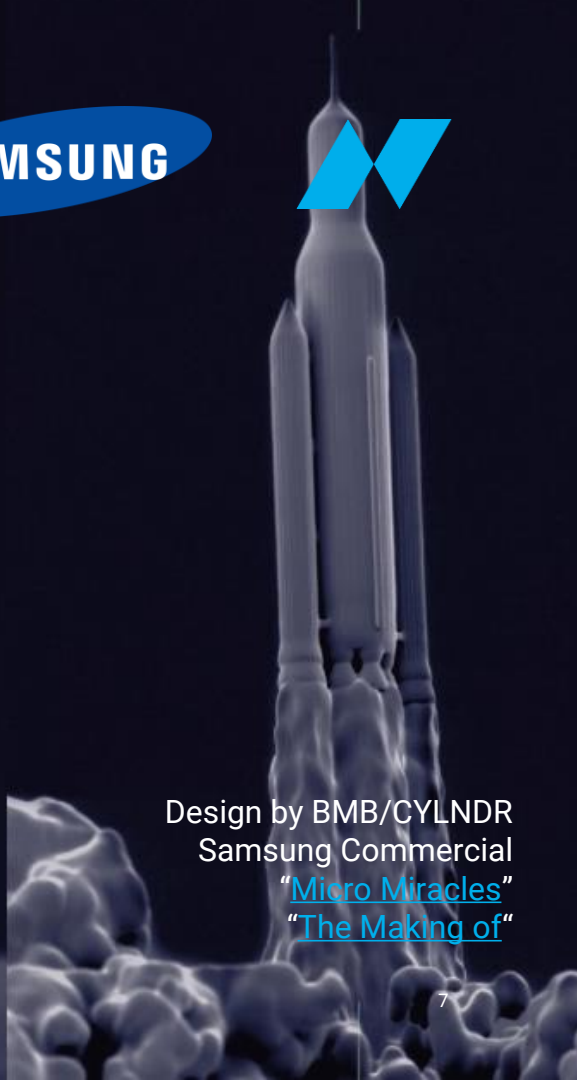


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## 3D Printing by 2GL® Enabler of Micro Miracles

- ▶ Highest throughput
- ▶ Intricate surface details
- ▶ Best shape accuracy



Design by BMB/CYLNDR  
Samsung Commercial  
[“Micro Miracles”](#)  
[“The Making of”](#)

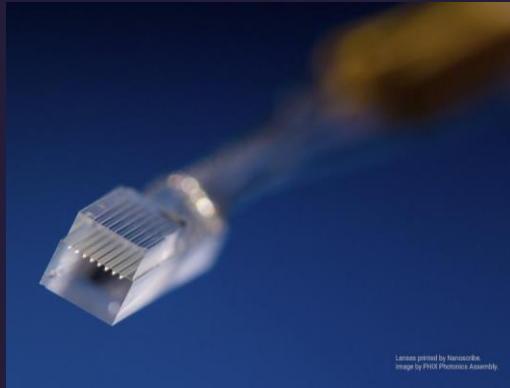


# Free-Space Microoptical Coupling (FSMOC)

## Efficient light coupling solutions

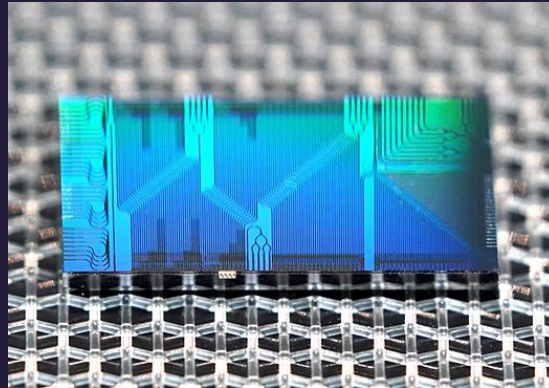


On fiber array



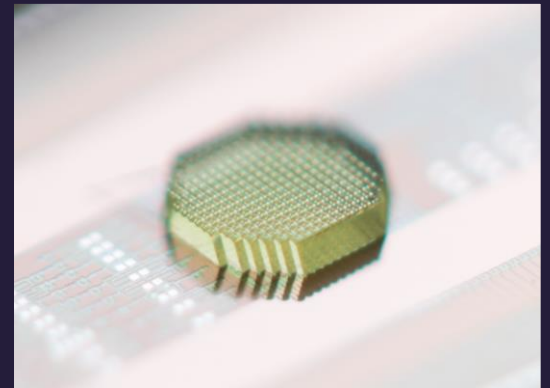
Microoptical elements on optical facet of fibers (fiber array)

On chip edge



Free-space microoptical couplers on chip edge (edge coupler)

On chip surface



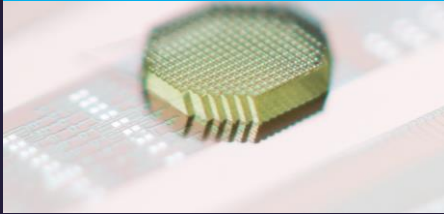
Free-form microlenses for vertical coupling on chip surfaces (grating coupler)

# 3D Printed Free-Form Microoptics by 2GL® \*

## Prototyping, mastering & scale manufacturing



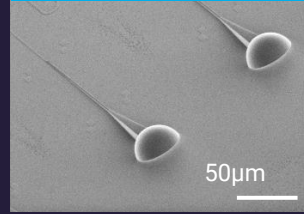
surface coupler  
rapid prototyping



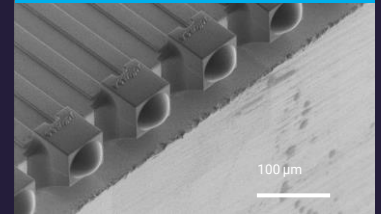
beam shaping optics  
mastering for NIL



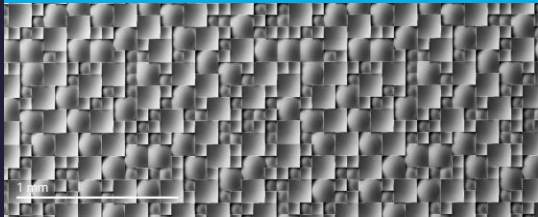
surface coupler  
manufacturing



edge coupler  
manufacturing



Free-form micro lens arrays  
mastering



multilevel microoptics  
manufacturing



lensed fiber arrays  
manufacturing



# Integrated Photonics

## Take home messages



- ▶ We offer a comprehensive solution for **low-loss optical coupling interfaces** in the field of **Integrated Photonics** and **Photonic Packaging** comprising
  - Additive manufacturing of microoptics based on 2PP
  - Hardware solutions and application proven accessories for PIC
  - Industry-ready optical grade photoresins
- ▶ **Quantum X align** offers
  - Simple workflows and effective software solutions
  - Automatic high precision alignment to predefined structures
  - Superior print quality at unrivaled speed enabled by 2GL<sup>®</sup>
  - Clean room compatibility down to ISO4



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Web: [nanoscribe.com](http://nanoscribe.com)

## Thank you for your attention!

As the pioneer in 3D printing solutions for optics and photonics, we push the limits of photonics packaging. We deliver smart solutions to optical coupling challenges for best-in-class optical engineering and industrially mature innovations.

**Validate our aligned 3D Microfabrication technology**

**Get to know Quantum X align**

- ▶ Schedule an online / on-site demo
- ▶ Check the feasibility of your project