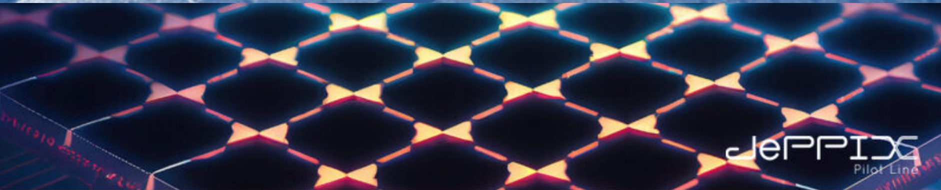
onics.com June 2022

PHOTONICS spectra®

The Race to Package PICs



18 September 2023. 15:00 - 17:00 CEST

EPIC Online Technology Meeting on Hybrid Photonics Integration

vanguard AUTOMATION

bright connections

Next Generation Photonic Integration and Packaging Solutions with Photonic Wire Bonding (PWB) and Facet-Attached Micro-Optical Elements

Thorsten Mayer, CEO

Photonics Integrated Circuits are Growing at ≈ 25% CAGR

Tele and Data Communications

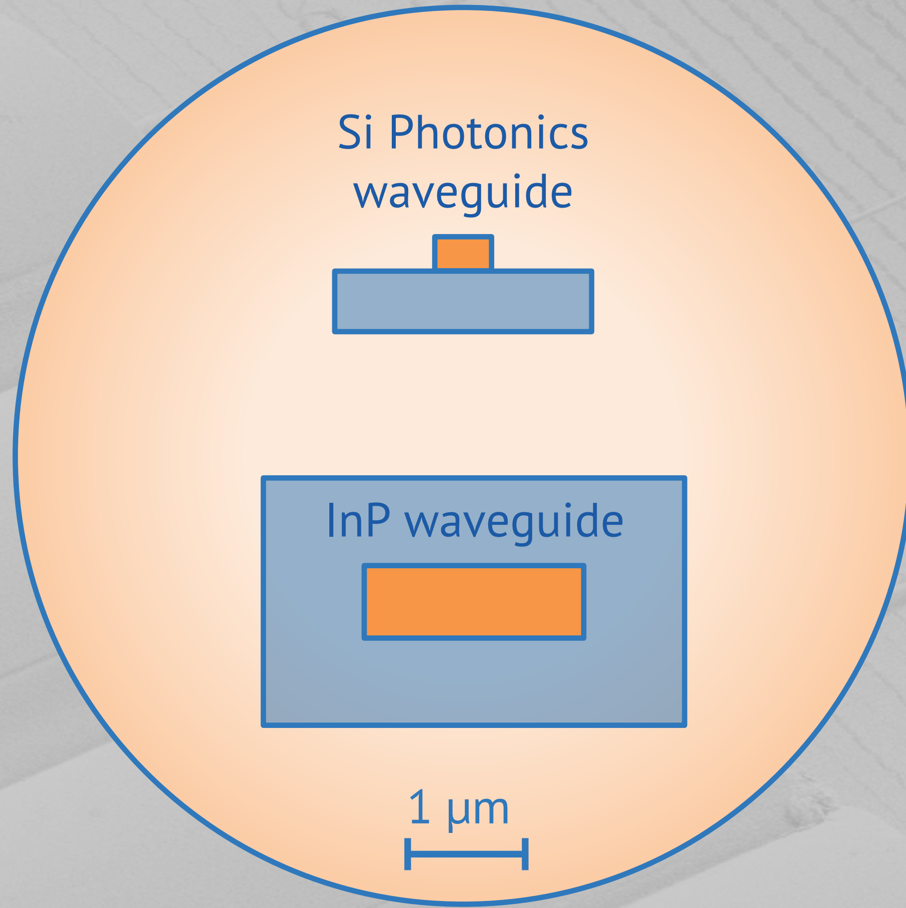
3D Sensing

Quantum Applications

Packaging of Photonic Systems from Discrete Chips still Represent a Technical and Commercial Challenge.

Today's Packaging and Assembly Challenges

Different Mode Field Sizes and Heterogenous Material Platforms



→ Mode field matching.

→ High-precision assembly alignment.

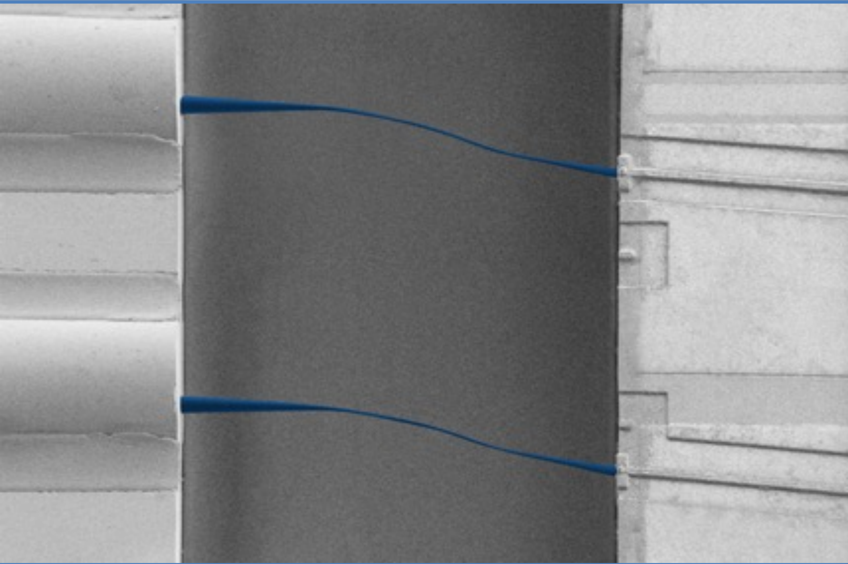
→ Fast and reproducible packaging.

→ Reliable under various conditions.

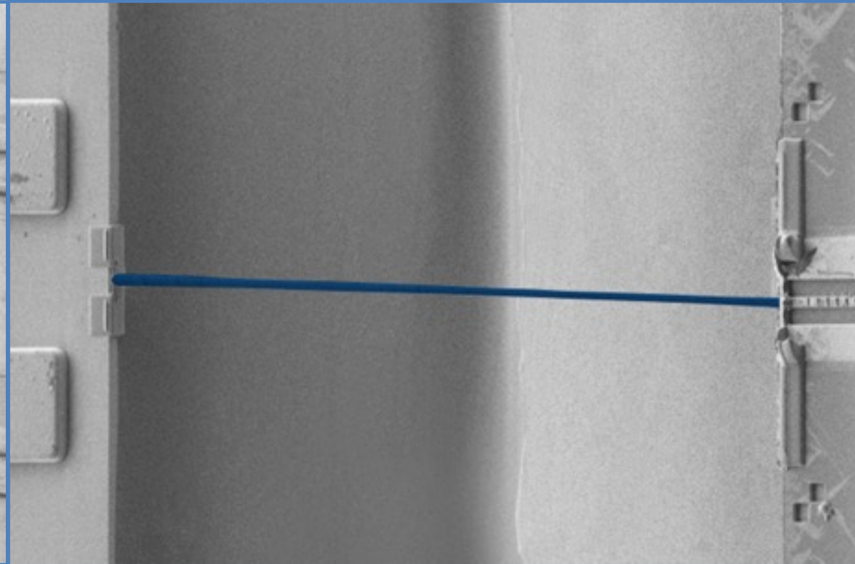
→ Over 70% of cost of photonic integrated systems are caused by the packaging process

Enabling next Generation Photonic Integration and Packaging Solutions with 3D Laser Lithography Solutions

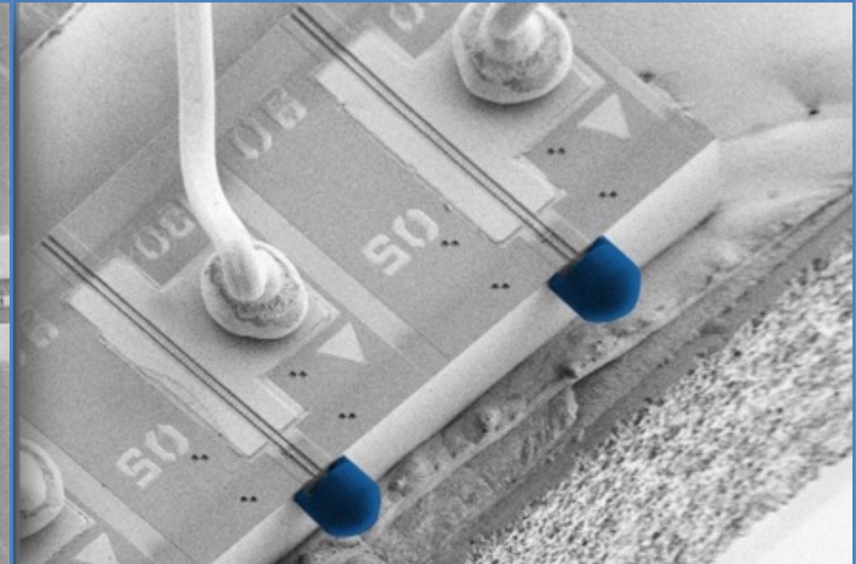
Laser by Freedom Photonics LLC



Samples bx PIXAPP (Photonic Packaging Pilot Line)



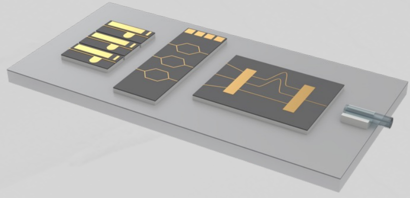
Samples bx PIXAPP (Photonic Packaging Pilot Line)



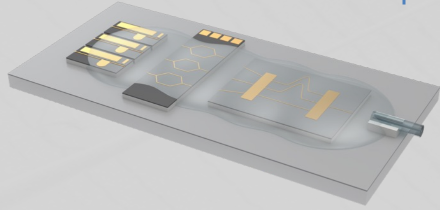
Photonic Wire Bonding and Micro Optical Lenses

Fully Automated 3D Lithography – vanguard SONATA 1000

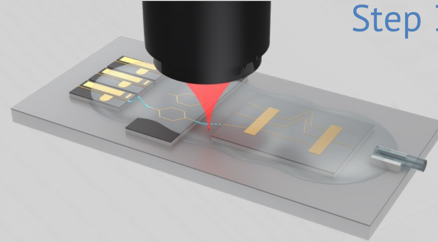
Step 1



Step 2



Step 3



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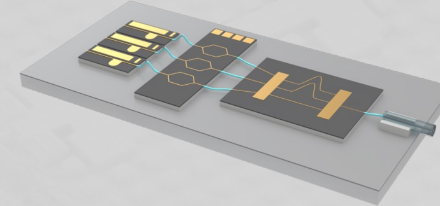
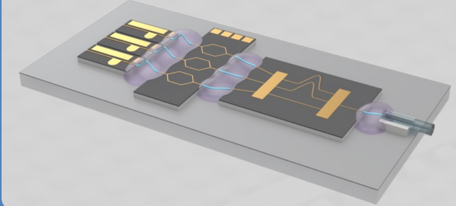
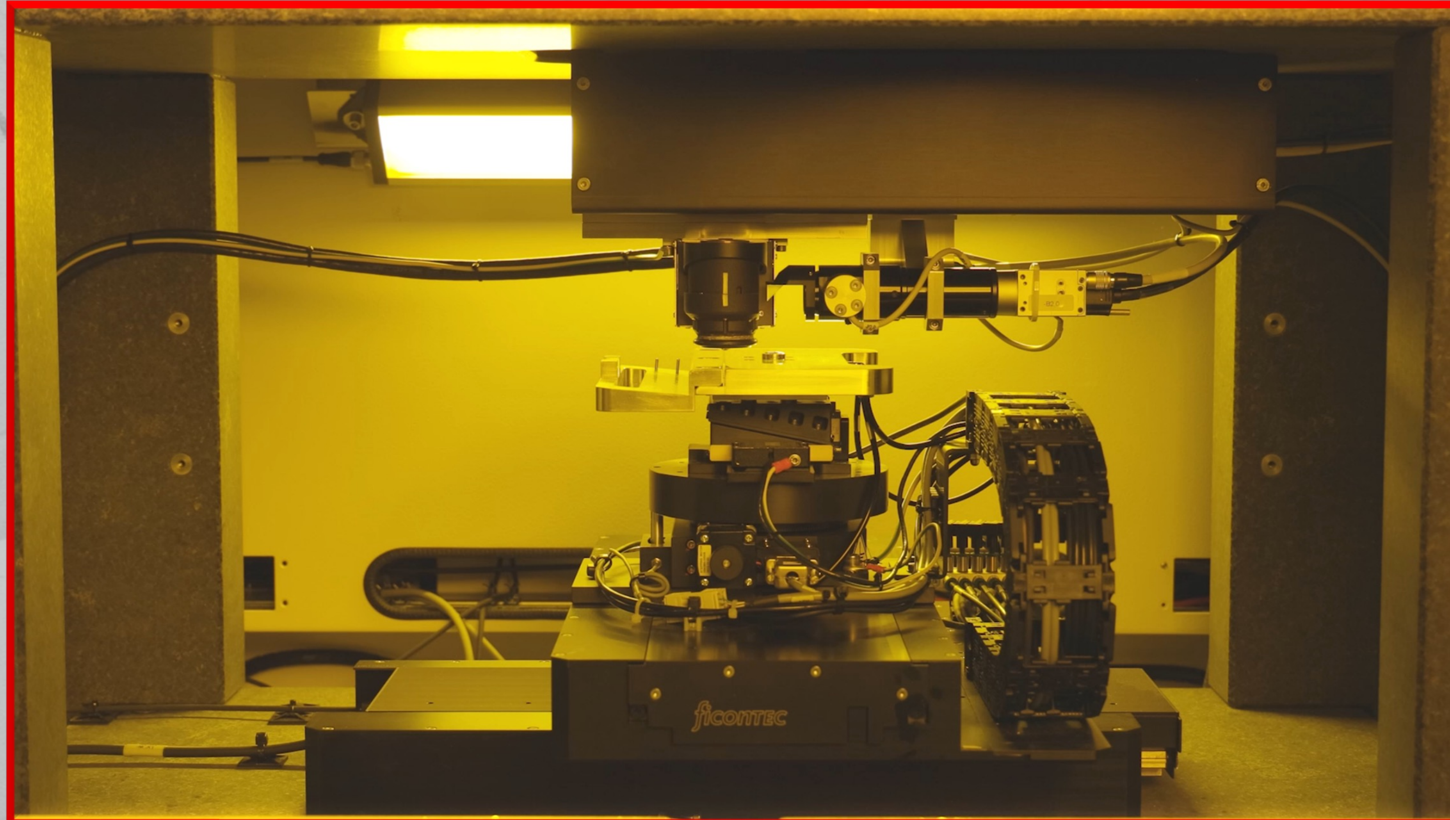


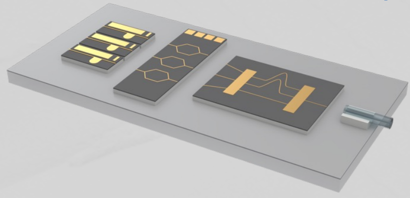
Step 5



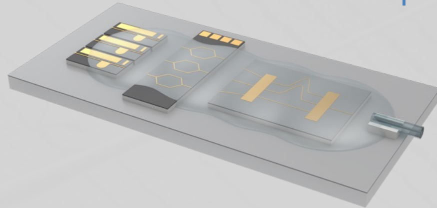


Fully Automated 3D Lithography – vanguard BrightWire3D

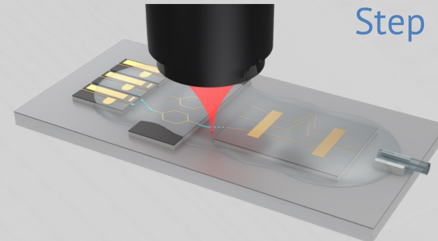
Step 1



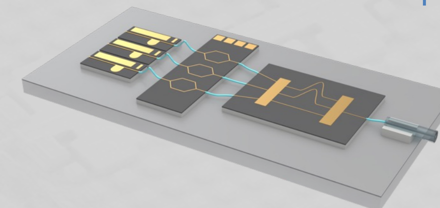
Step 2



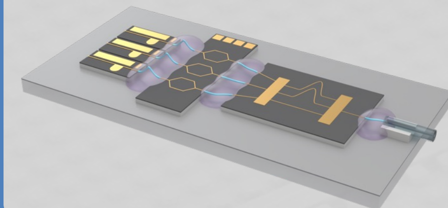
Step 3



Step 4



Step 5



writeOCB
Action
Process
New Process
Load Process
Save Process
Close Process
Row
Row
Operation
Insert Row
Delete Row
Apply Values

9 focusOnSample
10 Numeric Calculation
11 Set Current Taper
12 Check if 44
13 If (TRUE) Then
14 [Y1]
15 Numeric Calculation
16 End If
17 Check if 53
18 If (TRUE) Then
19 [Y1]
20 Numeric Calculation
21 End If
22 Set Current Taper
23 Set Power and Center Offset
24 Shape Detection left side
25 Compare Strings
26 subtract 1 µm in Y
27 Calc X offset
28 add 20 µm
29 Shape Detection right side
30 Compare Strings

Goto: 9
No Filter
Enabled
Wait for Execution
Machine Specific
Log Row
On Error 0
Next 10
Call Depth 0
Next Return 0
Row Name focusOnSample
Row Comment
Visu Preview
Contrast Mode
Hide Panels
Run Process
Stop Process
Single Step
Cancel Step
Connections: Row-Element
0 Result Position [um]

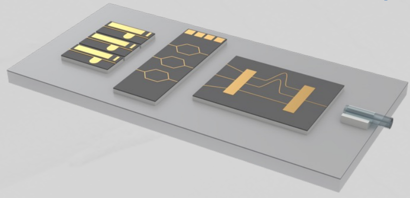
ImageDisplay

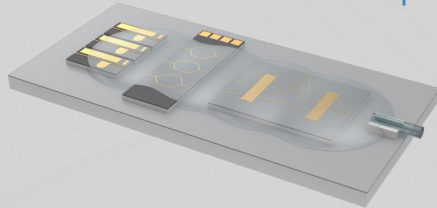
Score: 0.916
Score: 0.915
Detection OK. SI surface at -1.80 µm
Detection at 0.20 µm

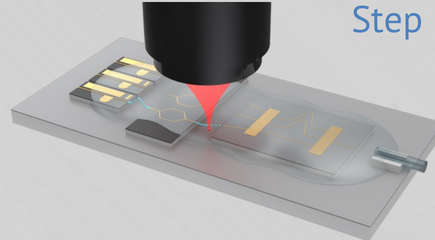
Cursor [µm] X / Y 2269 / 2131.9 (-.-)
Channel 1
Crosshair
Save Image
FPS: 10

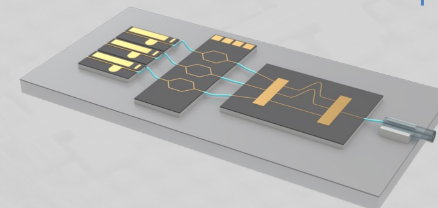
Cursor [µm] X / Y 117.9 / 5.5 (-.-)
Channel 1
Input
Output
Crosshair
Save Image

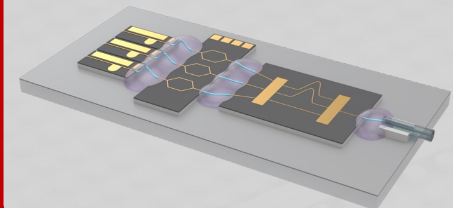
Fully Automated Post Processing – vanguard REPRISE 1000

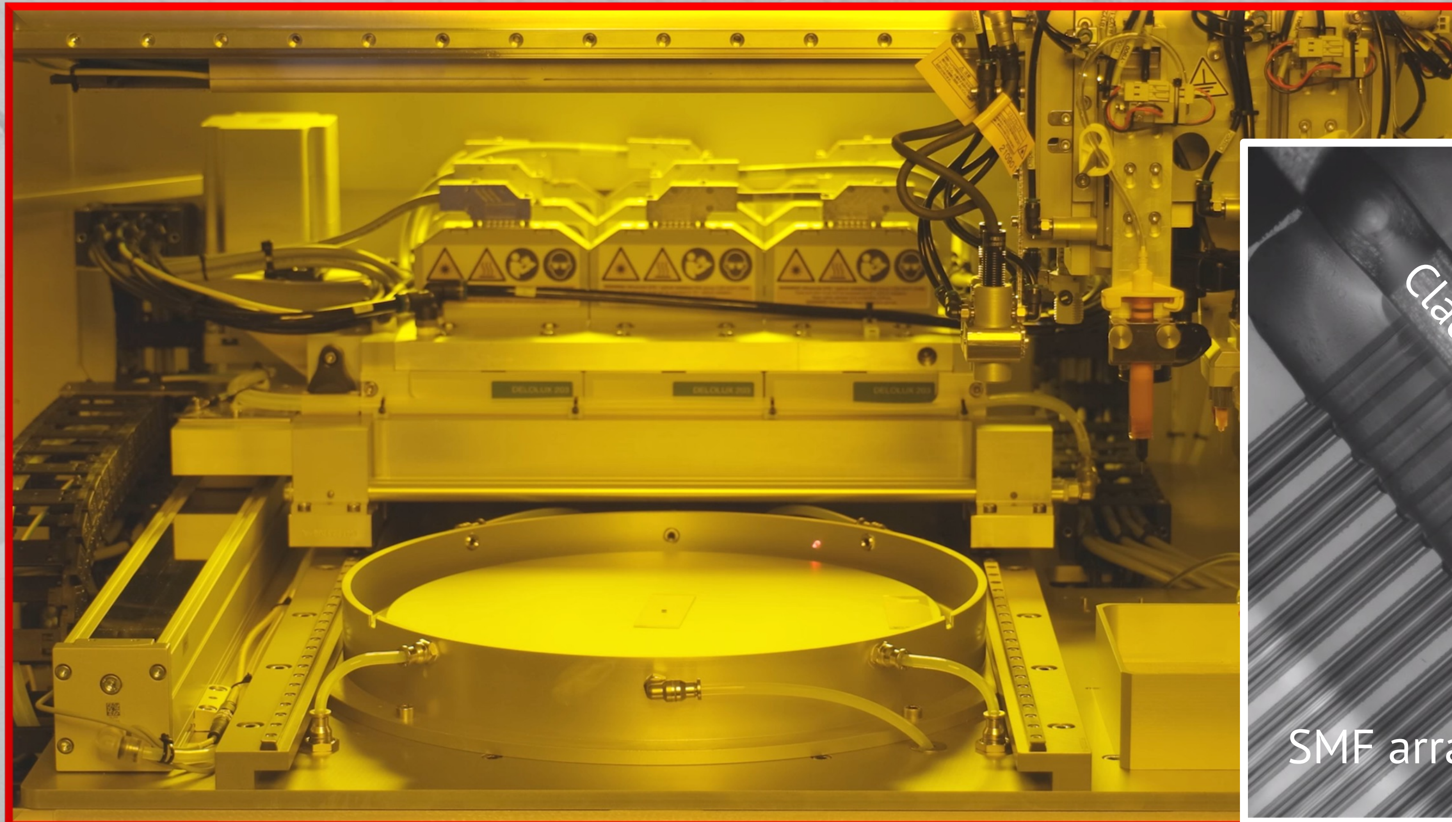


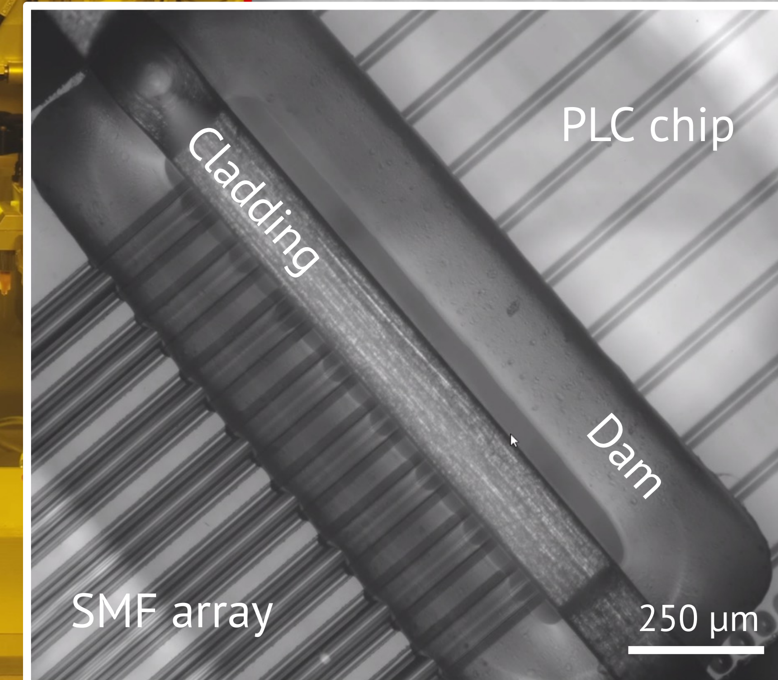








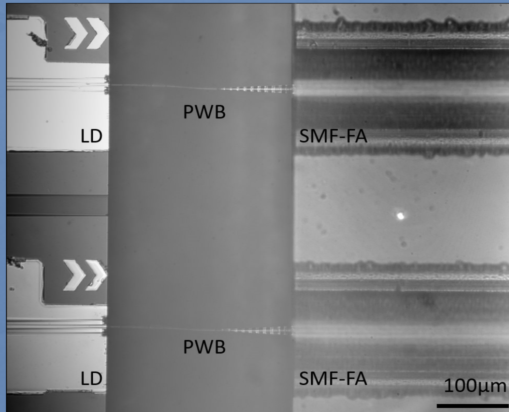


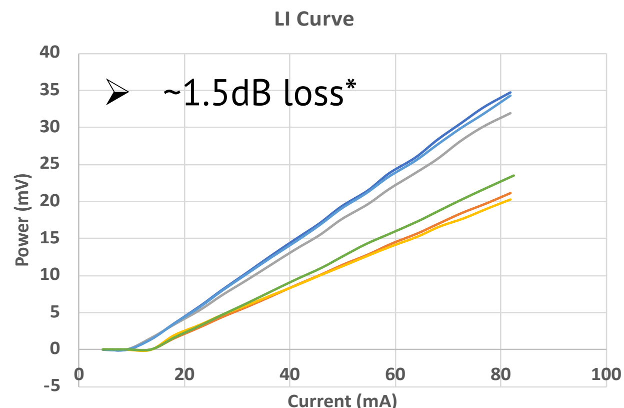


Compatibility with Material Platforms/Foundries

InP Lasers (mentech, China)

- ~1.5dB Loss

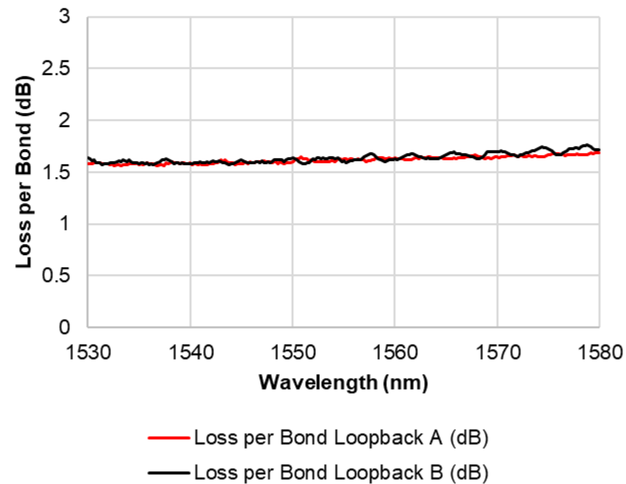




*published at FPIC 2023 (Xiamen, China)

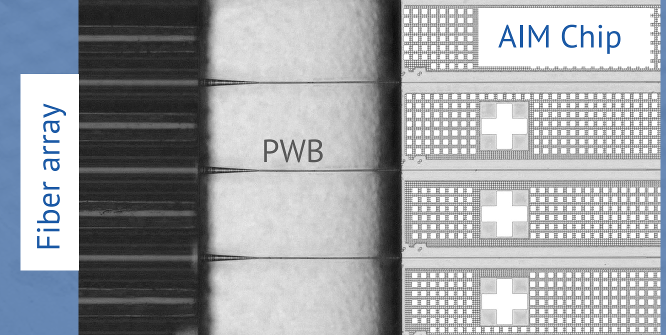
Silicon (AMF, Singapore)

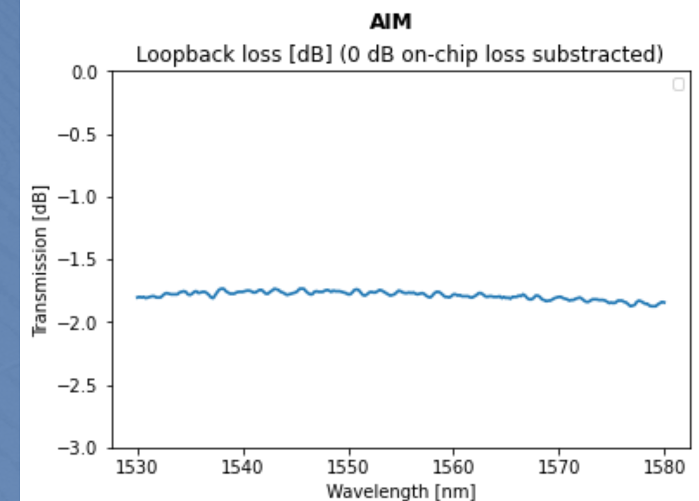
- ~1.5dB loss



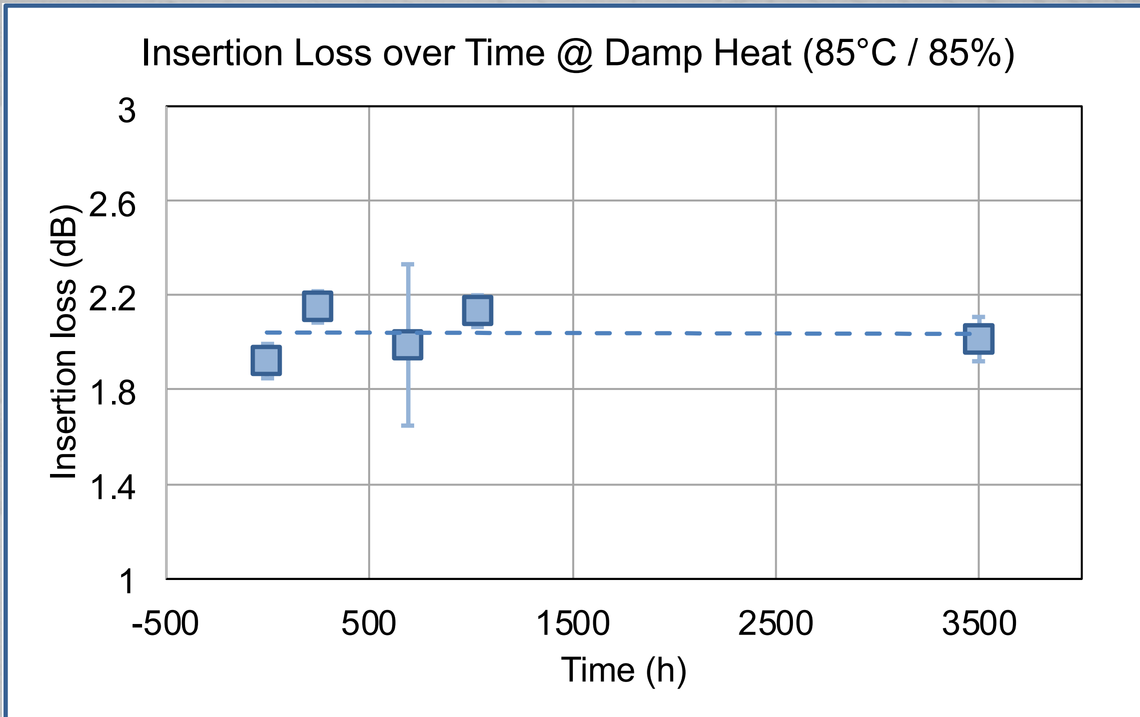
Silicon Nitride (AIM, USA)

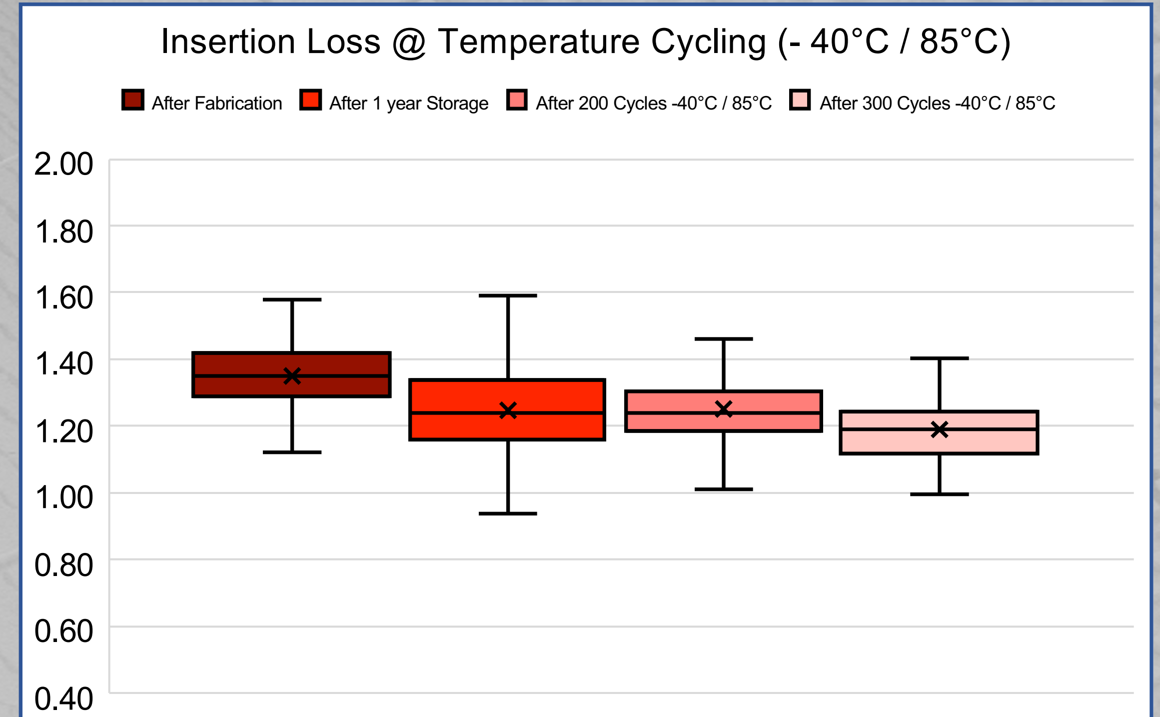
- ~1.7dB loss





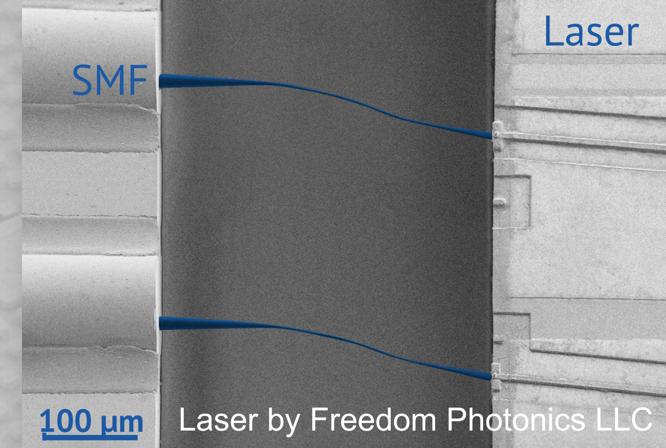
Long-Term Reliability under Industry Standard Testing

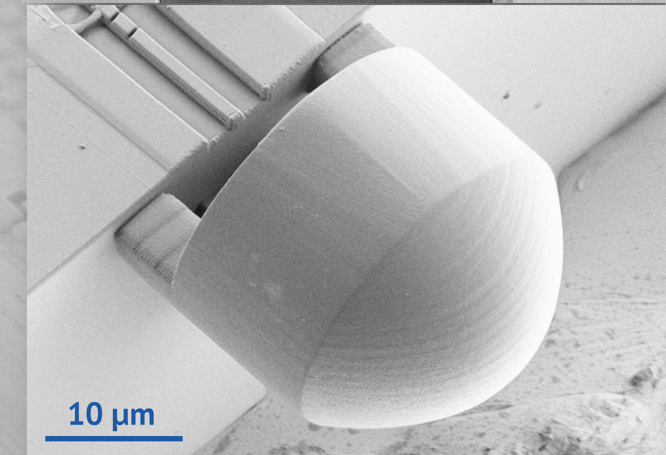


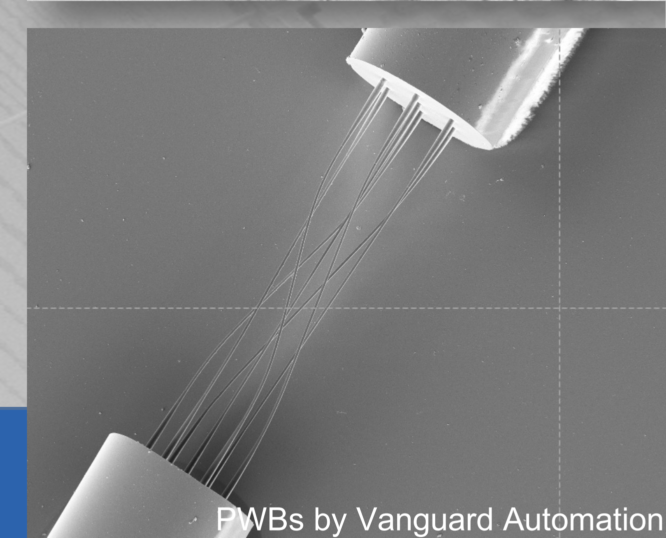


The Benefits

- Low loss connections to arbitrary mode fields of many material platforms.
- Automatable, reproducible and fast processes.
- Significantly relaxed pick & place tolerances.
- Reliable connections under various conditions.
- High interconnect density (PWBs).
- High degree of design flexibility for hybrid multi-chip integration.

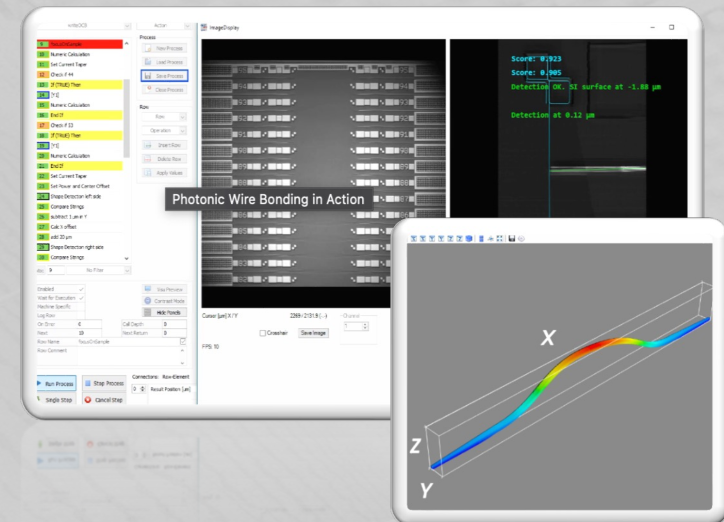






vanguard SYMPHONY 1000

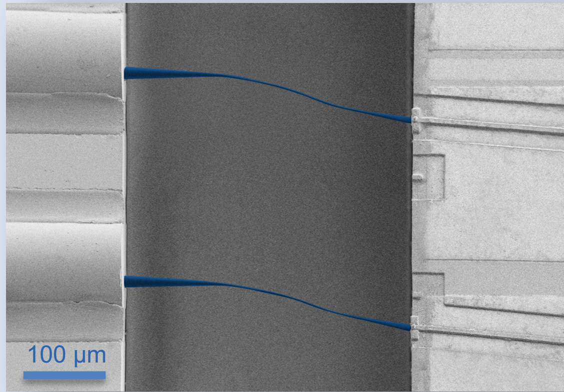
Software-Defined Fabrication of PWBs and Micro-Optical Lenses

Automated 3D Lithography Based Nano Fabrication	Automated Pre- and Postprocessing (Development and Encapsulation)	Software for Machine Control, Process Development and Management
		
SONATA 1000	REPRISE 1000	Composer and BrightWire3D

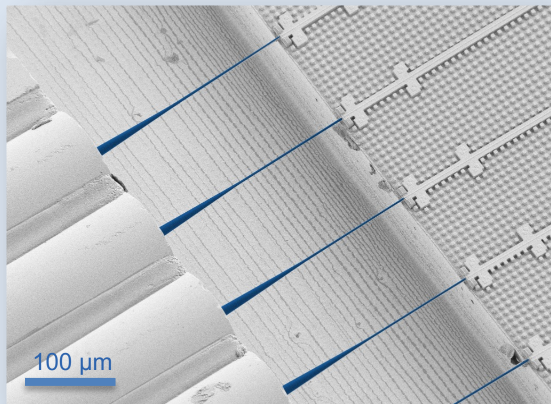
Standard Fabrication Processes | Material | Product Support and Services

Next Generation Photonic Integration and Packaging Solutions

Photonic Wire Bonds

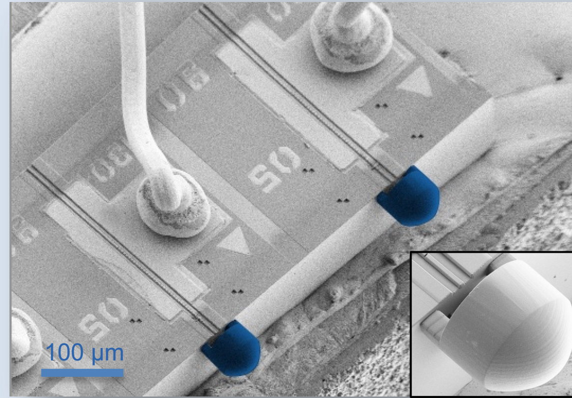


Laser by Freedom Photonics LLC

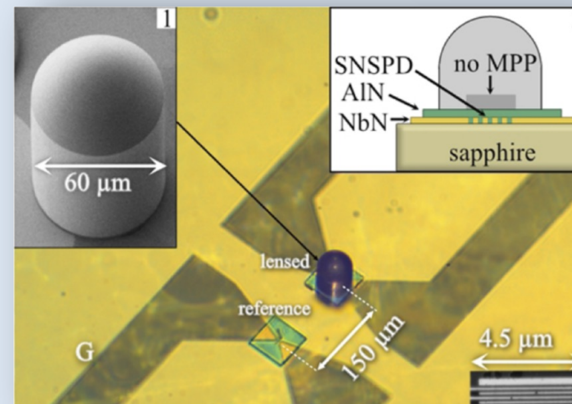


PIC by Institut für Mikroelektronik Stuttgart

Micro-Optical Elements

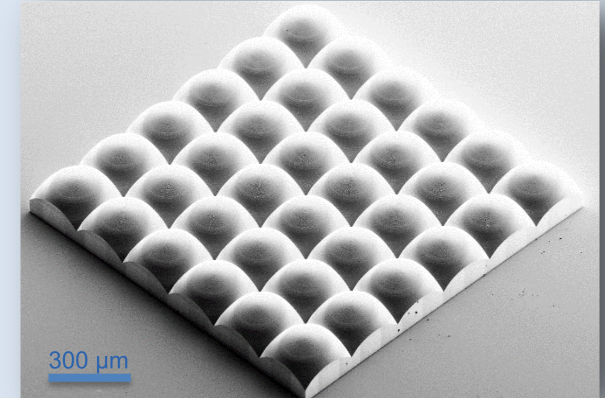


Samples by PIXAPP (Photonic Packaging Pilot Line)

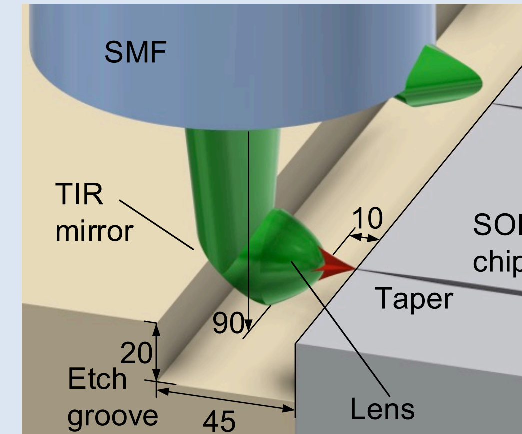


Xu et al., Superconducting nanowire single-photon detector with 3D-printed free-form microlenses, Opt. Expr. 29, 27708-27731 (2021)

Write Field Extension



Design by Moveon Technologies Pte Ltd.



Wafer-Level Probing

End-Users and Ecosystem Partners