

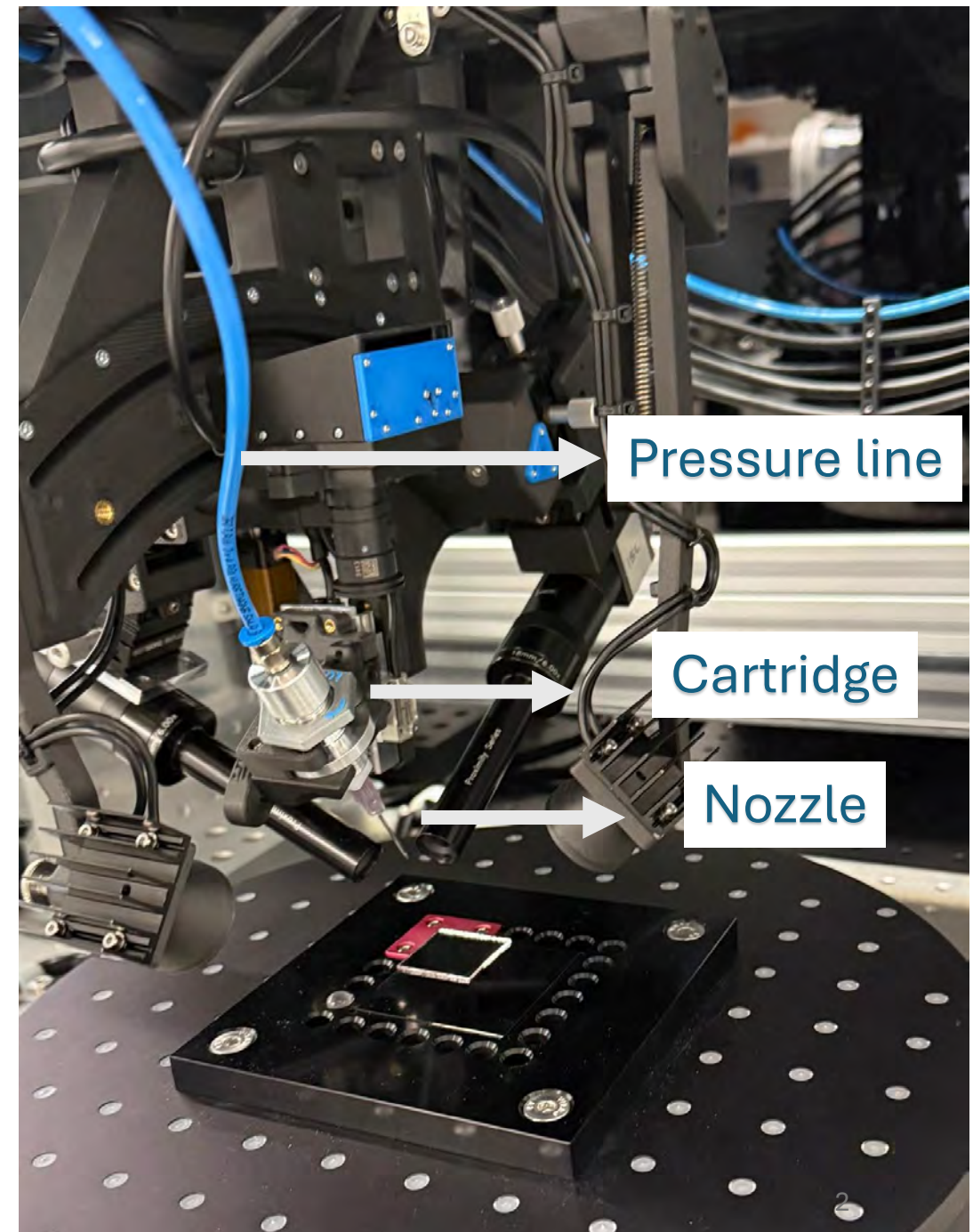
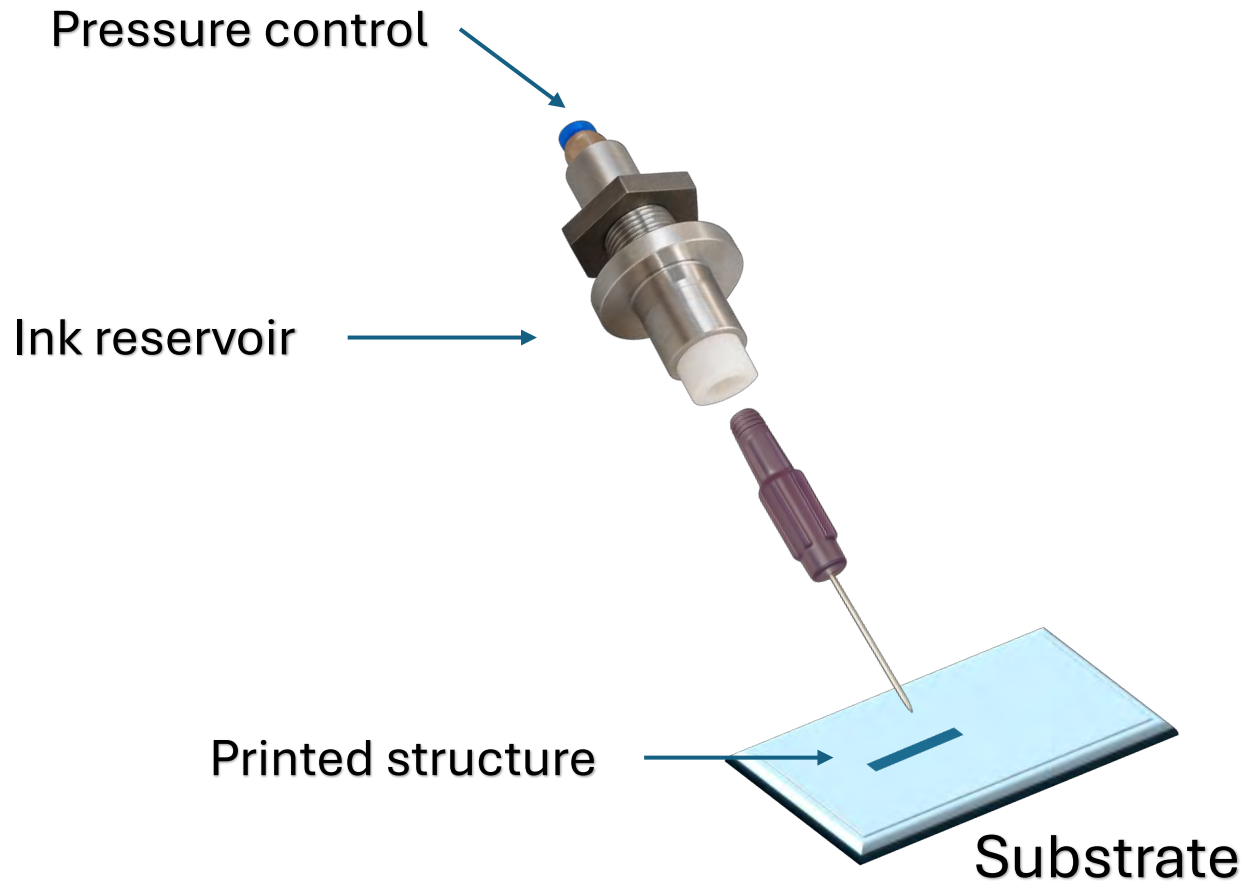
XTPL Delta Printing System

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Printing mechanism

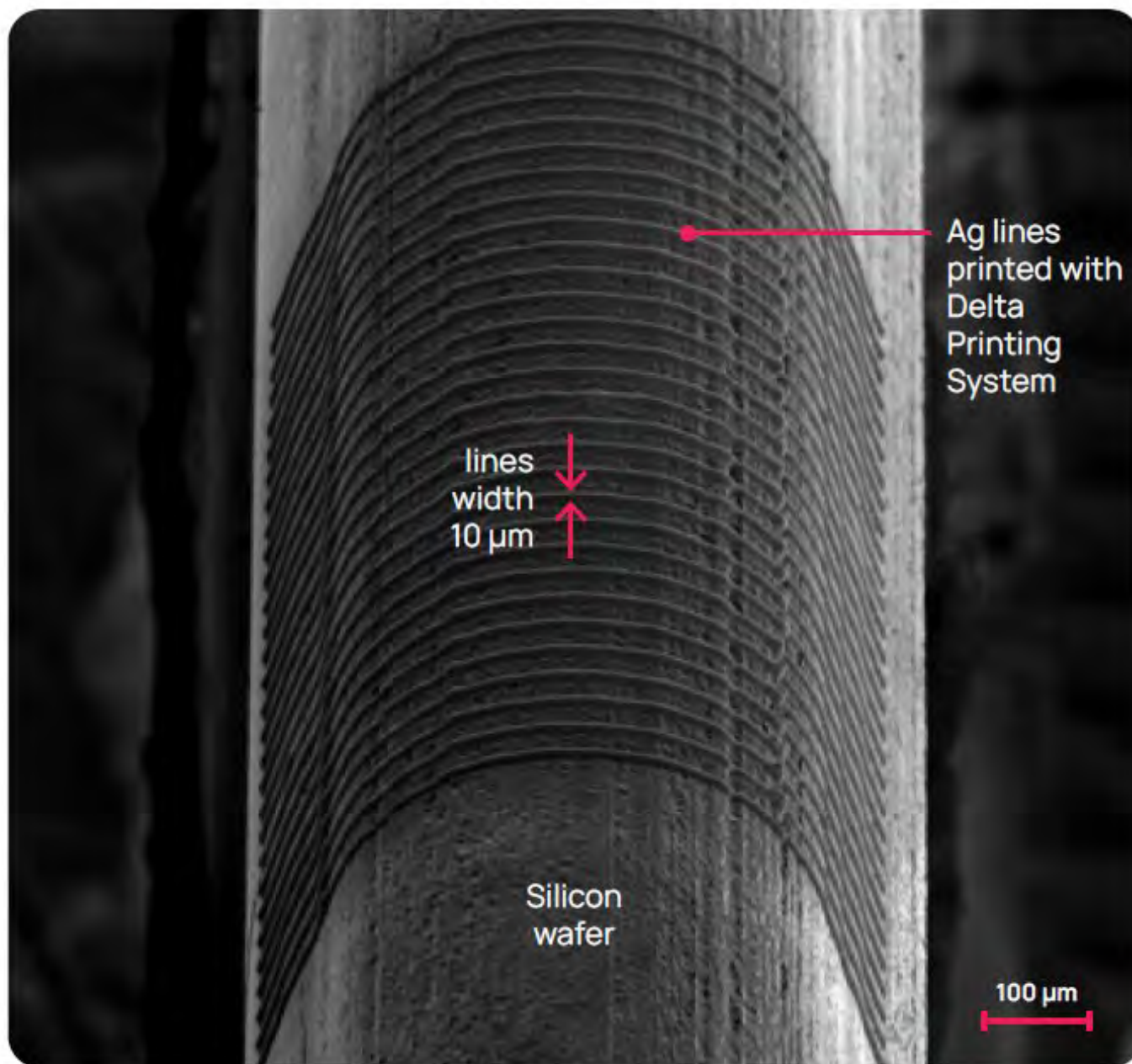
- A pressure-driven micro-dispensing method using a micron-scale nozzle.



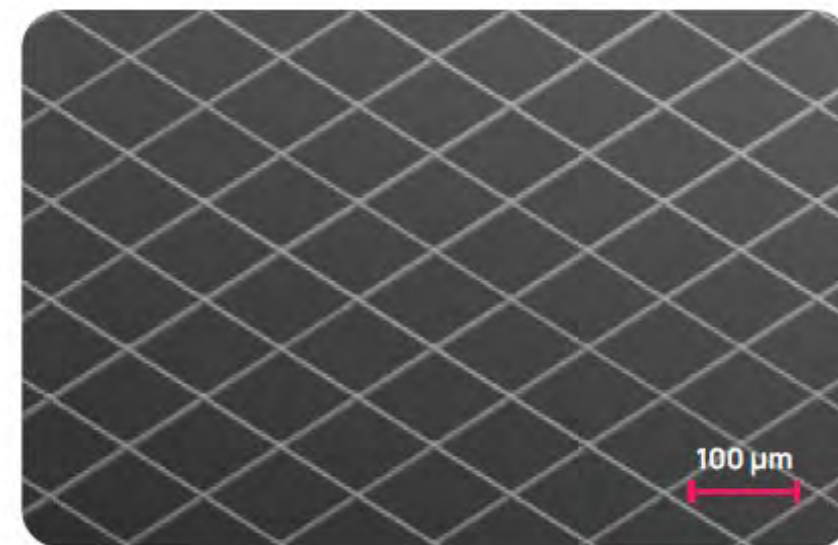
Ultra-Precise Dispensing (UPD) technology

- Wide range of printable materials: metallic nanoparticle inks and pastes, quantum dot inks, dielectrics, polymers, photoresists, organic, liquid metal alloys and more
- Feature sizes down to (sub)micron scale
- 3D Printing on heterogeneous substrate
- Uniform and clean feature geometries: no overspray, high linewidth homogeneity
- Fast and easy exchange of cartridges and nozzles
- Only 100 µl of ink required to start printing

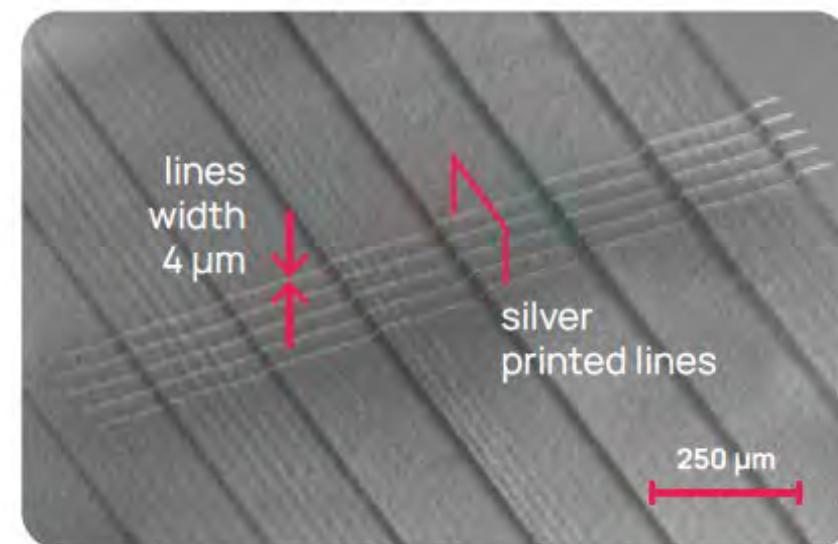
Silicon wafer printed on the edge with silver nanopaste CL85



on the glass substrate



Silver lines printed with silver nanopaste CL85



XTPL specifications

Item	Value
Feature size range	ultra-high resolution from 0.5 μm to 1 μm
	high resolution from 1 μm to 10 μm
	medium resolution from 10 μm to 50 μm
Viscosity	from 10 to over 1 000 000 cP
Substrate alignment	3-point levelling table with rotation error correction
Printing area	200 mm x 200 mm
Maximum printing speed	10 mm/s
Process preview	Video feedback from 2 high-resolution and 1 top view cameras
XY motor movement accuracy / repeatability	2 μm / 0.5 μm
Z motor movement accuracy / repeatability (vertical adjustment)	0.5 μm / 0.5 μm

Important Notes



Approximately 5-10 nozzles are required to train each student.



1.5 μm nozzles are single use (Larger nozzles can last 30 days after filling).



After printing, the substrates were thermally sintered at 250 °C for 30 min (Ag) and 350 °C for 20 min (Au).



The Ag, Au ink maintain initial quality for up to two months. (But it's printable with larger nozzles even after a year.)



Nozzle cleaning is basically impossible for higher viscosity inks.

Printing options (ink):

1. Cartridge from XTPL (Ag, Au)
2. Loading an empty cartridge (own materials)



3. Filling the nozzle (own materials)

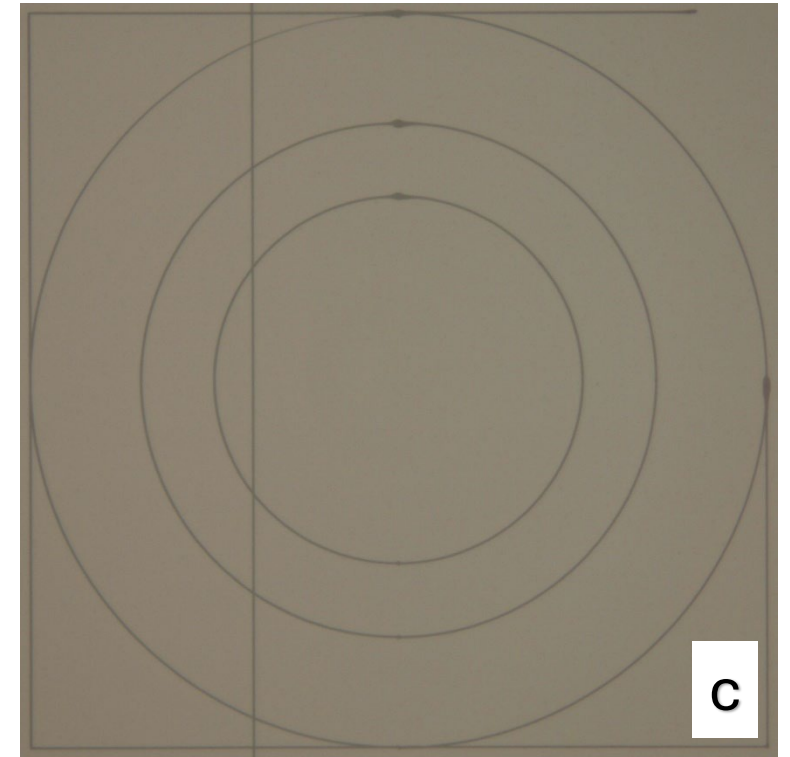
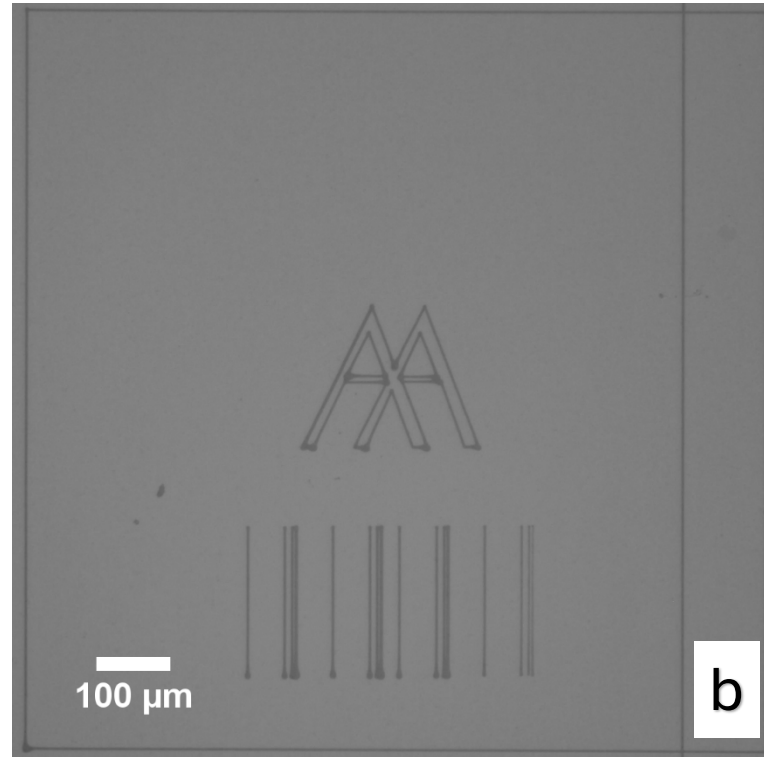
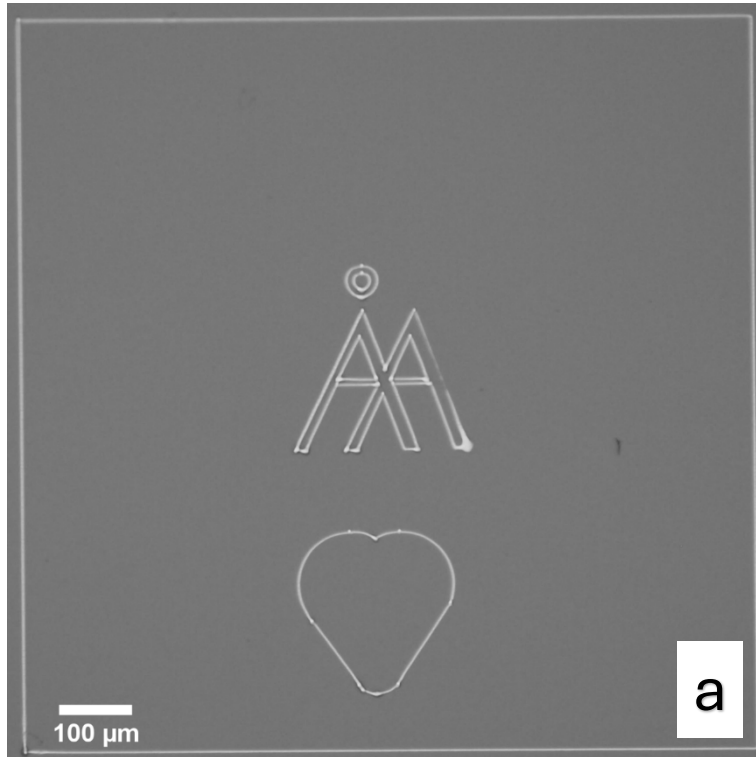


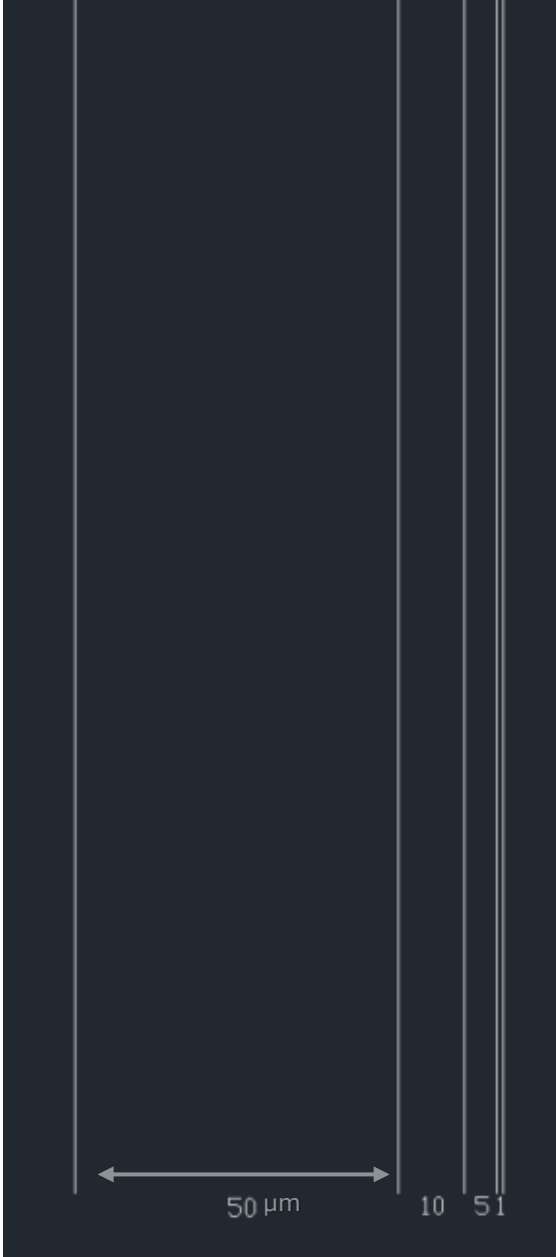
4. Adapter, syringe (own materials and needles)



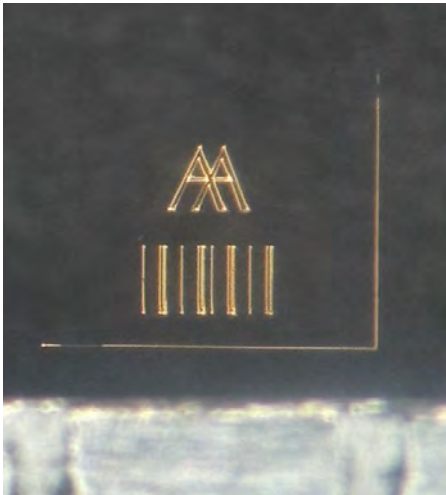
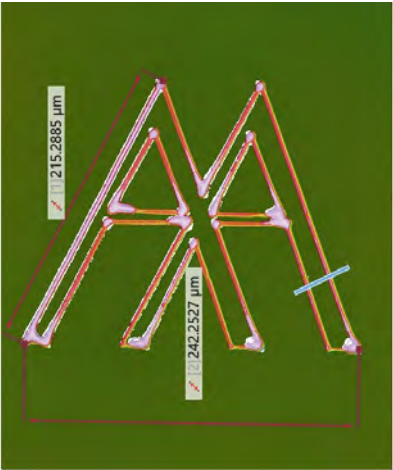
Examples:

Structure name	Size	Nozzle size	Ink
a, b, c	1mm × 1mm	3.5 μm	Silver

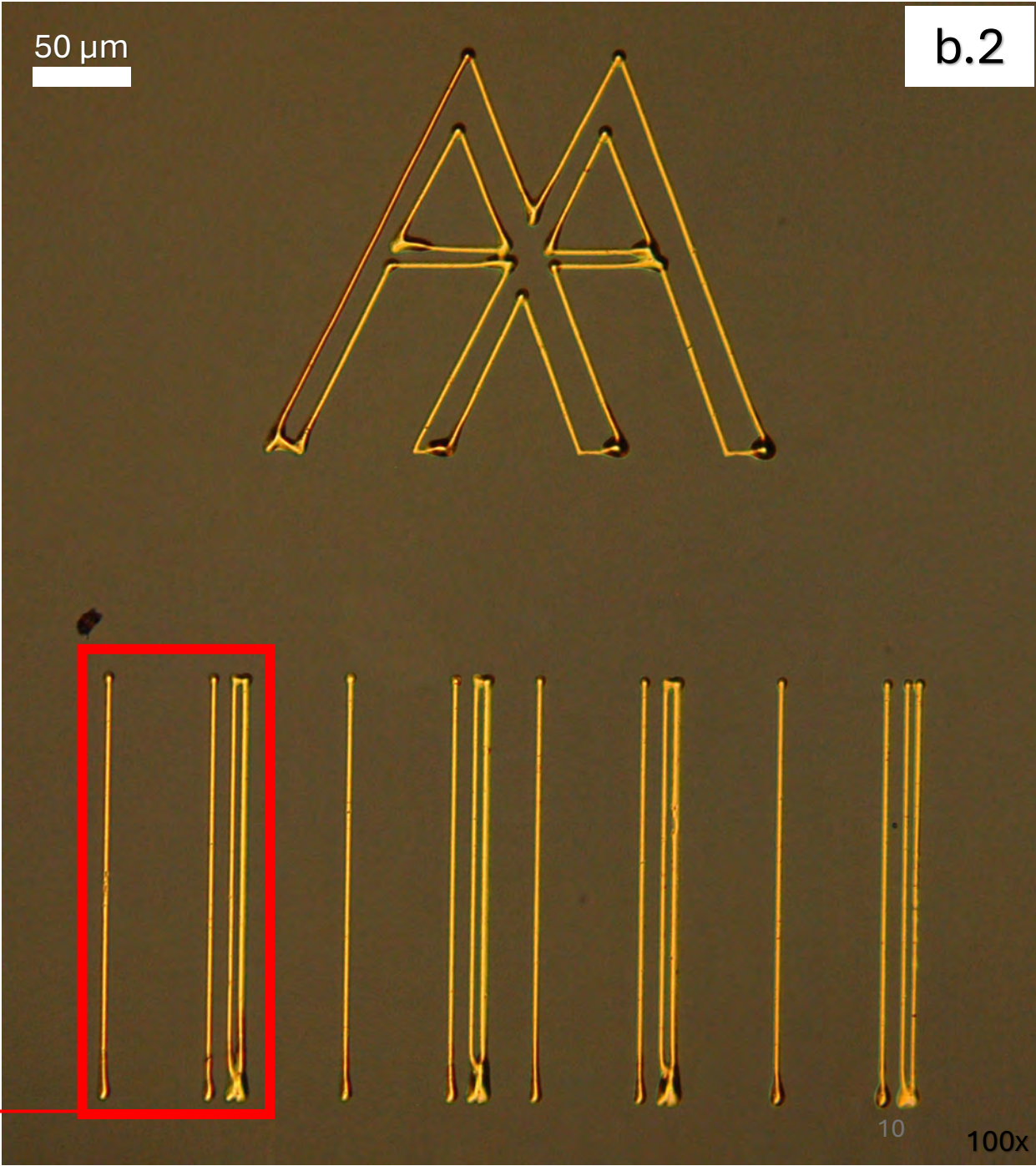


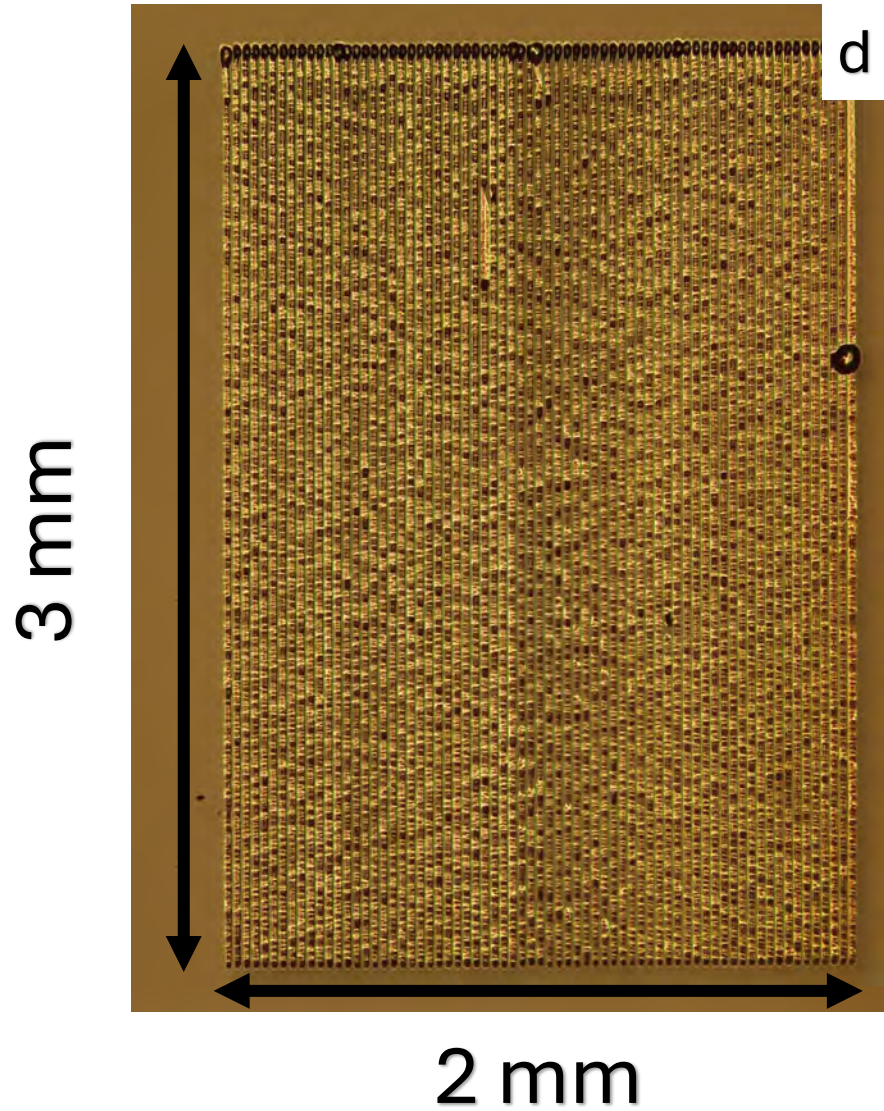


Nozzle size	Ink
1.5 μm	Gold

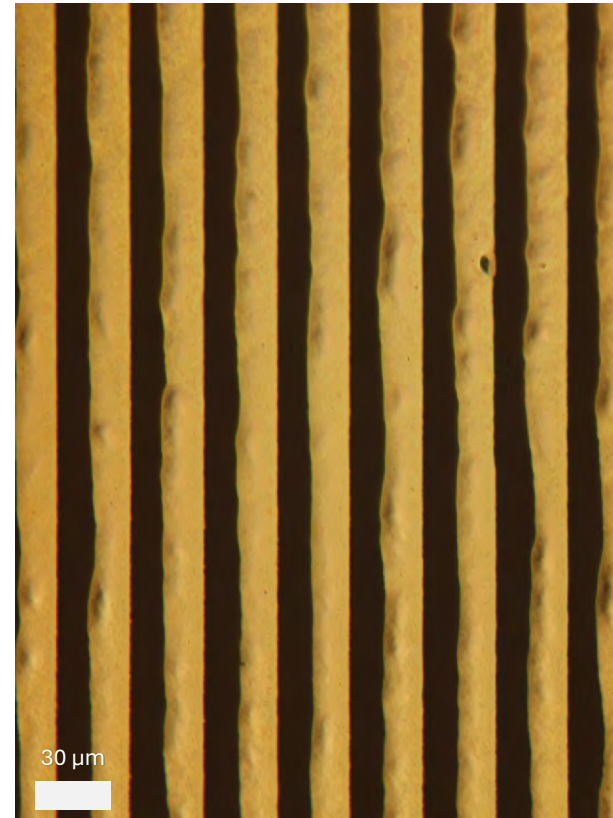


CAD



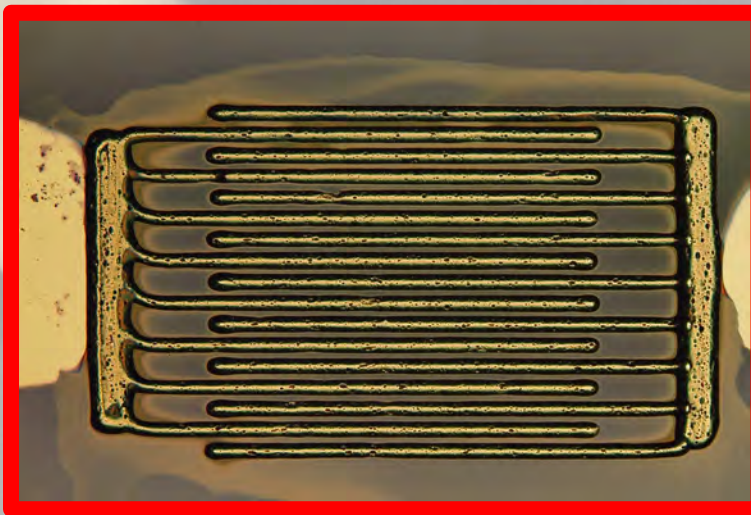


Structure name	Size	Nozzle size	Ink
d	3 mm × 2mm (70 lines, 30 μm gap)	20 μm	Gold



e

Interdigitated Electrodes:



Printed part



Nozzle size

1.5 μm

Ink

Silver

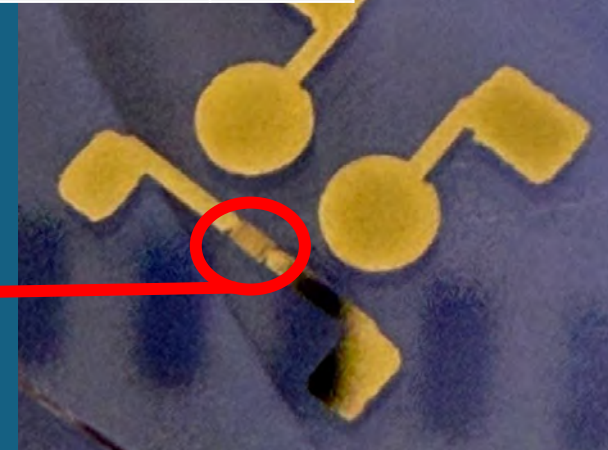
Nozzle size

20 μm

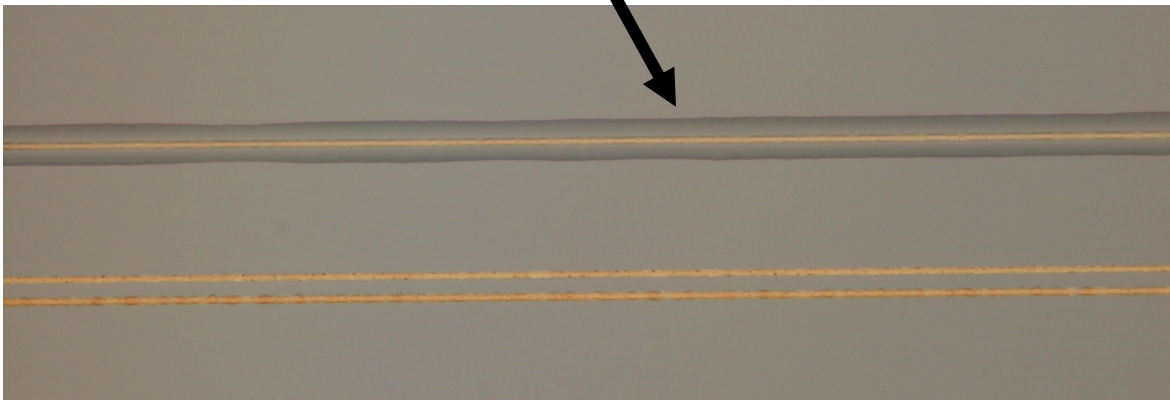
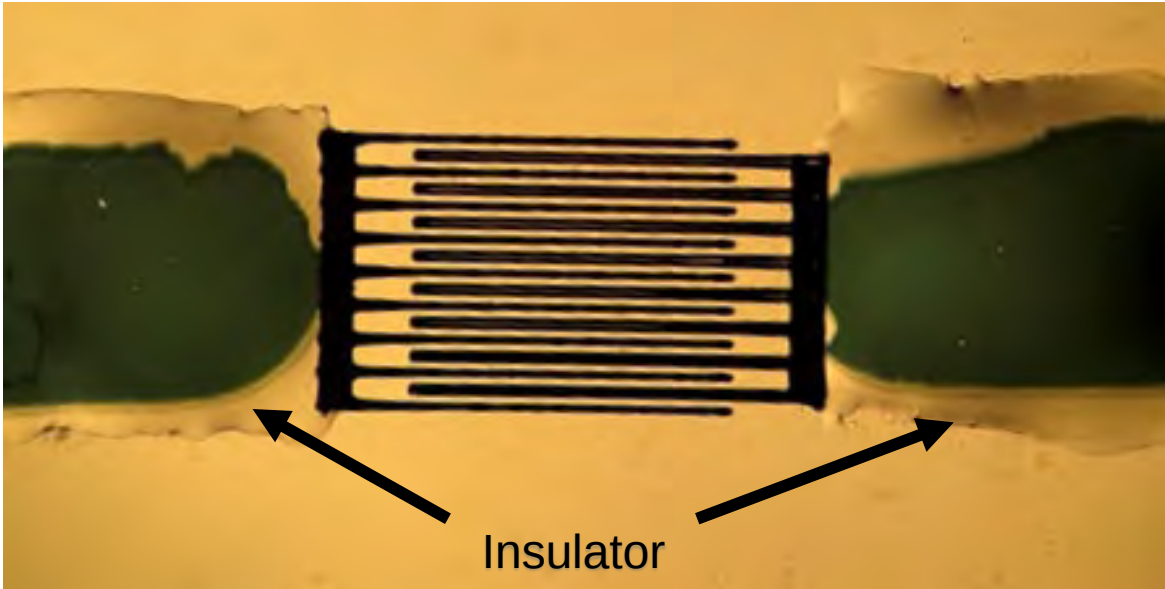
Ink

Gold

f



Printing of insulators:



Norland Optical Adhesive NOA 81

General				
	Size (oz):	16	Norland Number:	81
	Shelf Life:	4 months	Type:	Bottle
	Typical Applications:	Extra fast curing adhesive for tacking Spot bonding or centering		
Optical Properties				
	Index of Refraction (n _d):	1.56 @ 589nm	Absorption Range (nm):	320 – 380
Material Properties				
	Glass Bonding:	Excellent	Metal Bonding:	Excellent
	Plastic Bonding:	Fair	Viscosity (cps):	300
	Bonding Type:	Glass to Glass/Metal	Energy for Full Cure (J/cm ²):	2

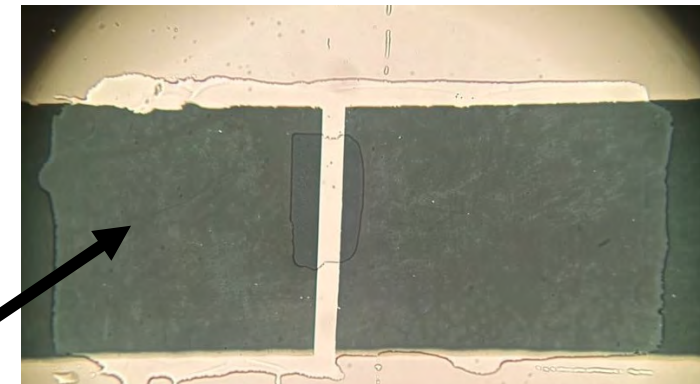
Nozzle size

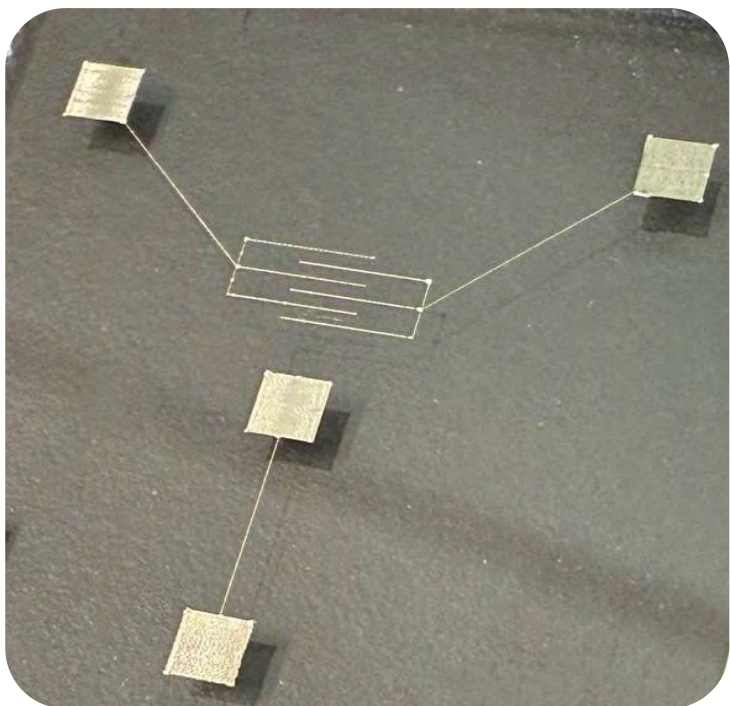
5 and 8 μm

Ink

NOA81

Insulator





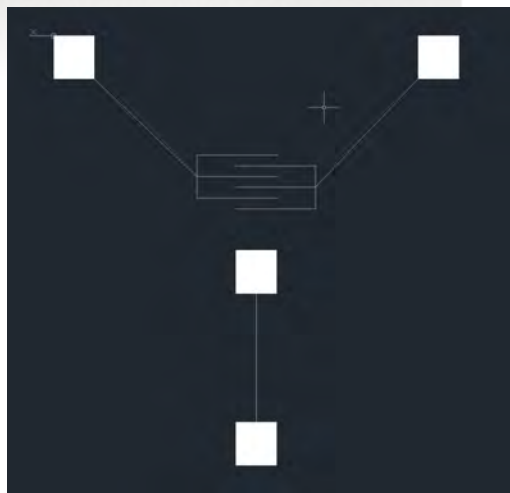
1 cm

Nozzle size

Ink

20 μm

Silver

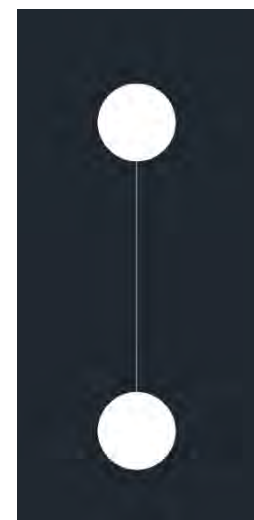


Nozzle size

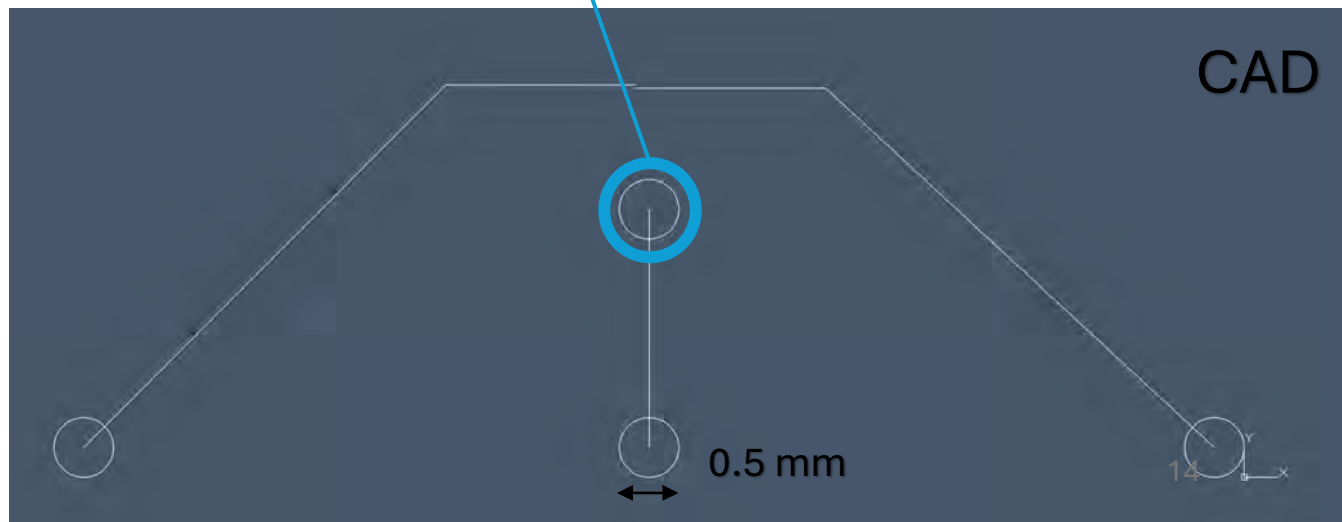
Ink

20 μm

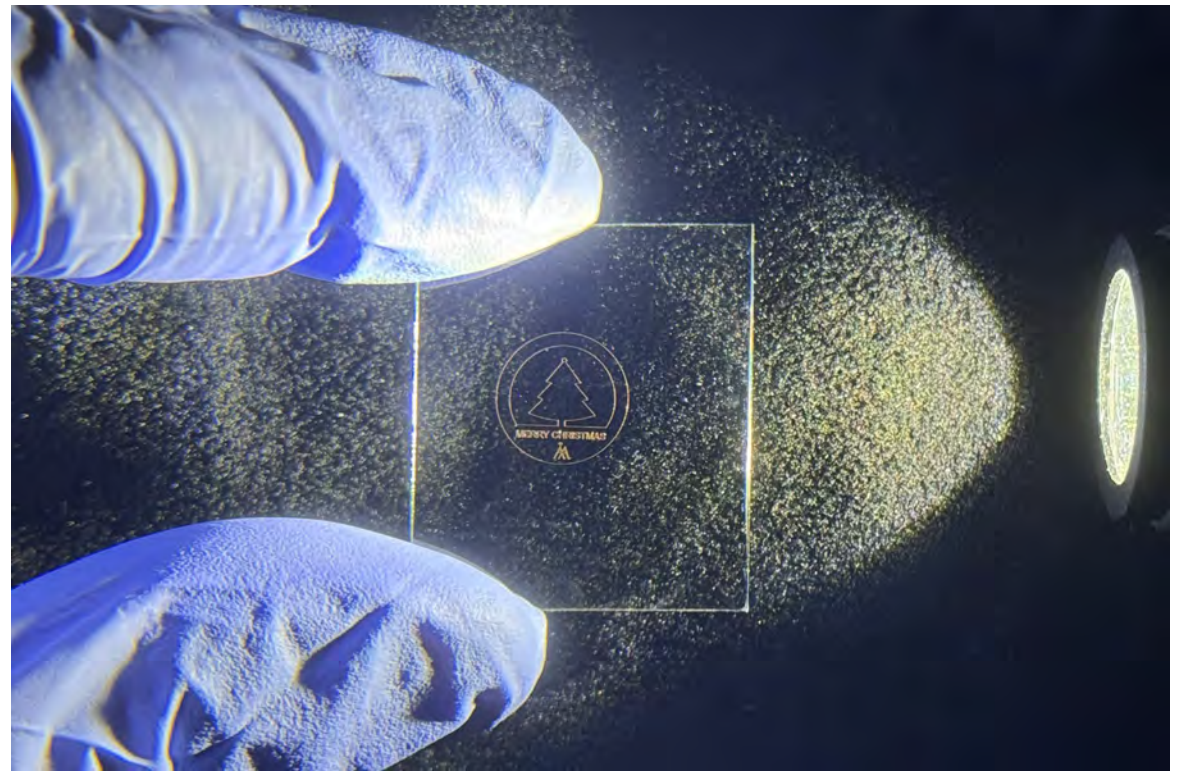
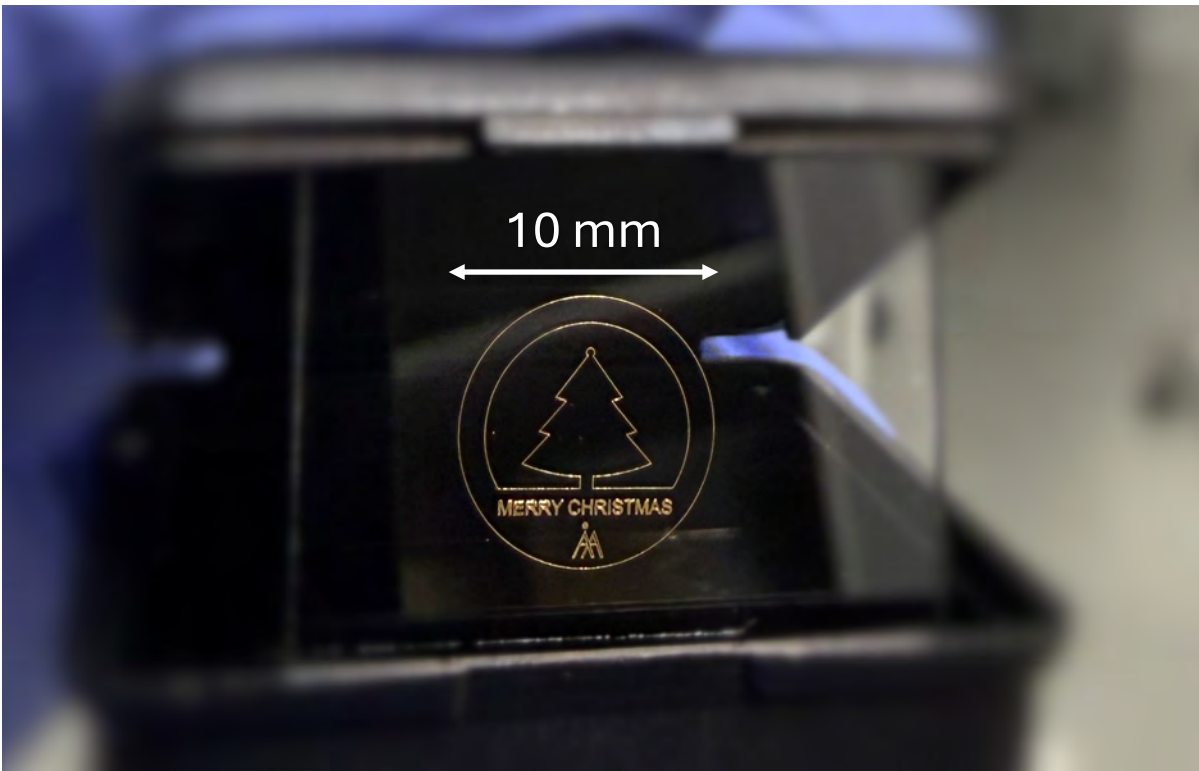
Gold



CAD



0.5 mm



Nozzle size	Ink
20 μ m	Gold