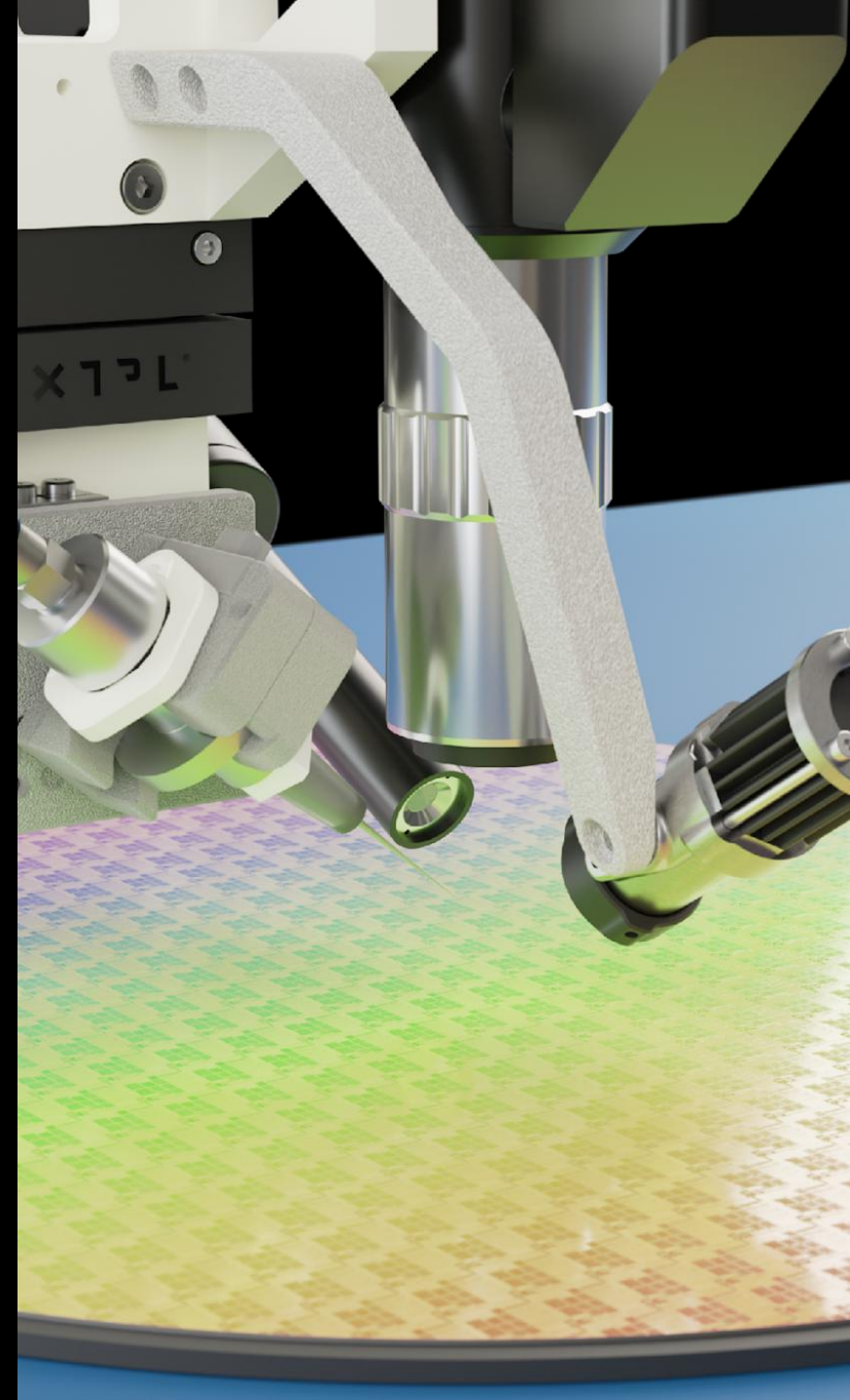




Additive Manufacturing for **Next-Generation Microelectronics**

Witold Nawrot, PhD | Portfolio Manager



rapid.tech 3D, May 14th, 2025, Erfurt, Germany

Agenda



1. Technology and products
 - a. Delta Printing System
 - b. Modular Printheads
 - c. High Performance Materials
2. Groundbreaking applications
 - a. Microbump dispensing
 - b. Ultraprecise interconnections
 - c. Edge interconnections
 - d. Multilayer printing
 - e. Open defect repair
 - f. Redistribution layers
 - g. Transparent electrodes
3. Summary
4. Q&A

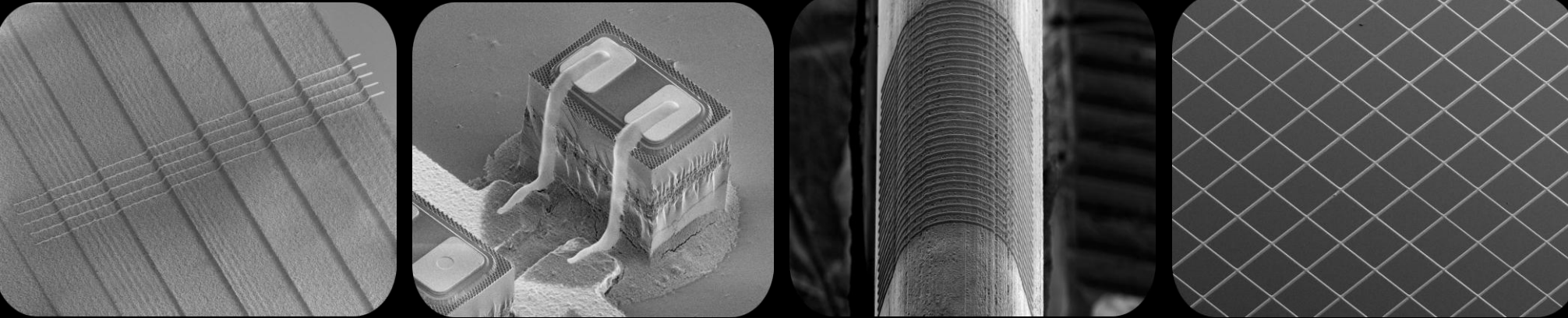
01

XTPL

Technology & products

Game changer: Ultra-Precise Dispensing

X P L[®]



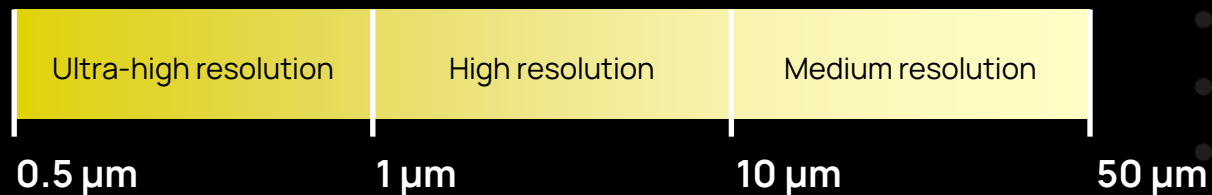
UPD technology sets a new standard in terms of resolution,
viscosity and size of conductive structures

Dispensing down to 1 μm feature size

High resolution

Material viscosity range 10–1 000 000 cP

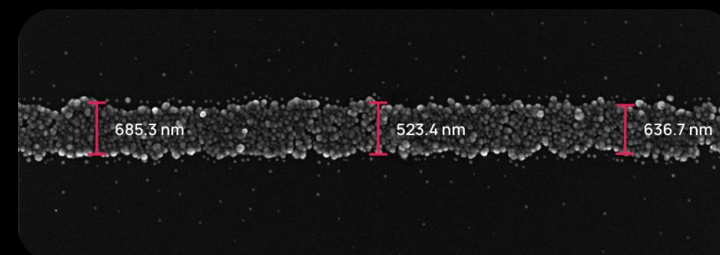
Unprecedented range of feature sizes

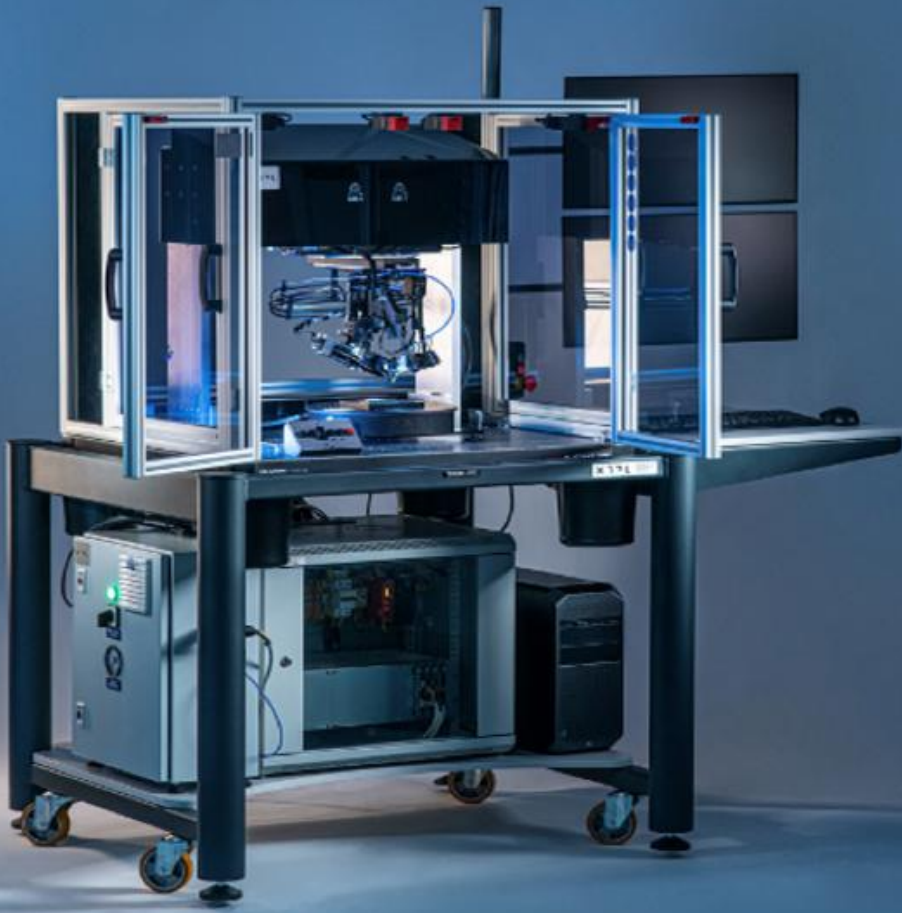


No overspray = no short circuit

No electric field required

Complex and various substrates: polyimides, glass,
flexible foil, silicon wafers etc.





Delta Printing System

A proven one-stop-shop in R&D and commercial settings

- Stand-alone, open platform
- Prototyping and small-volume/nest production
- Freedom of control over printhead
- Flexibility of User Interface: manual mode, CAD import, advanced scripting
- Fast and easy changeover of nozzles and cartridge

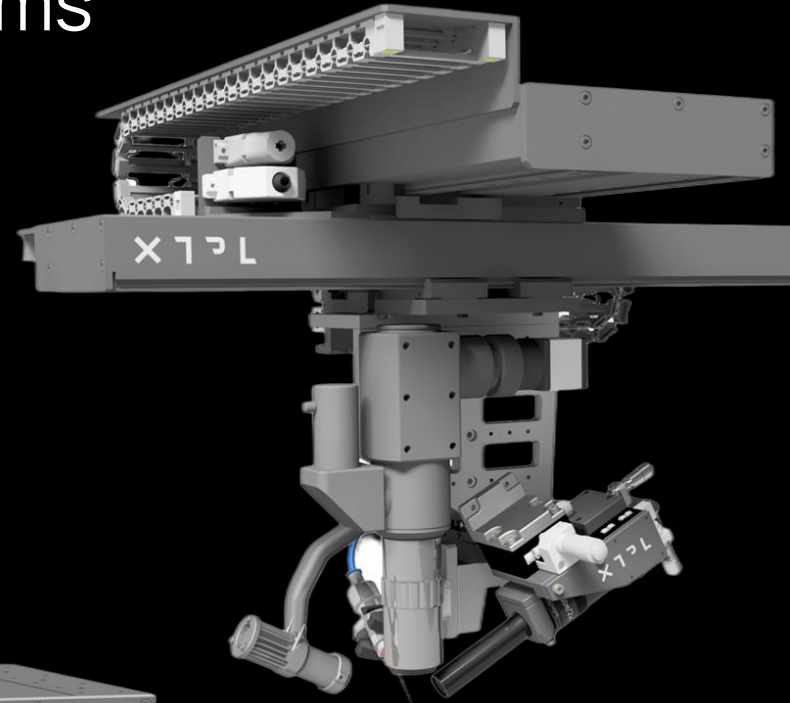
XTPL products | Printing Systems

XTPL®

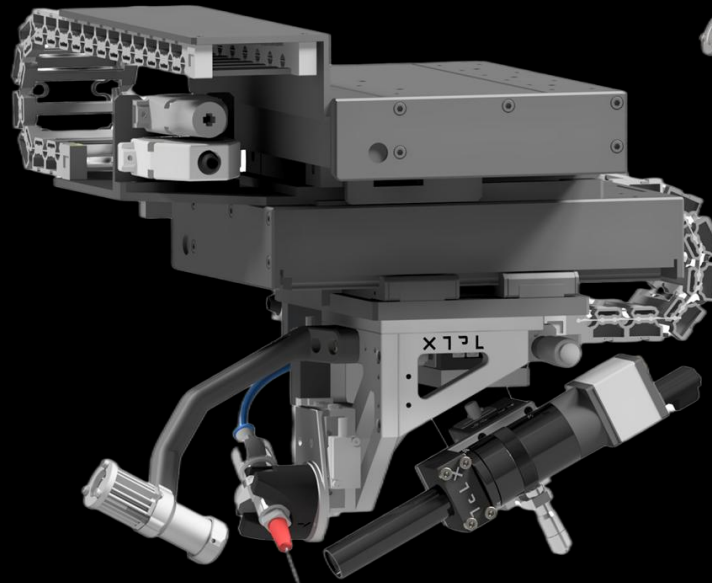
Modular solutions tailored to customer needs

Dispensing engine for industrial integration

- Seamless integration with manufacturing processes via an API
- Suitable for continuous/flow line production
- Small to high-volume production
- Sustainable technology – no material waste
- Easy changeover of cartridge and nozzles



Pro



Core+



Core

XTPL products | Materials

XTPL®



3rd party materials:

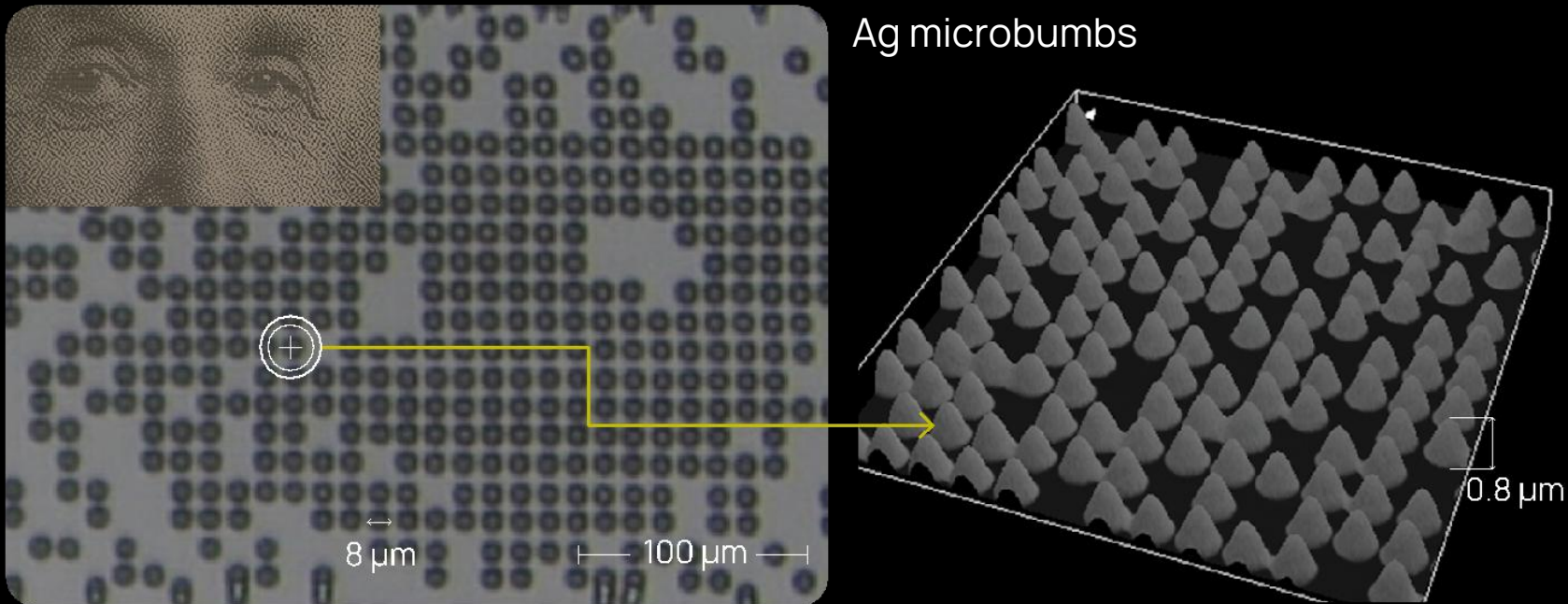
- Epoxies
- Dielectrics
- Conductive adhesives
- Solder pastes
- Quantum Dots

Inkjet
Aerosol jet
LIFT
Microdispensing
XTPL® UPD



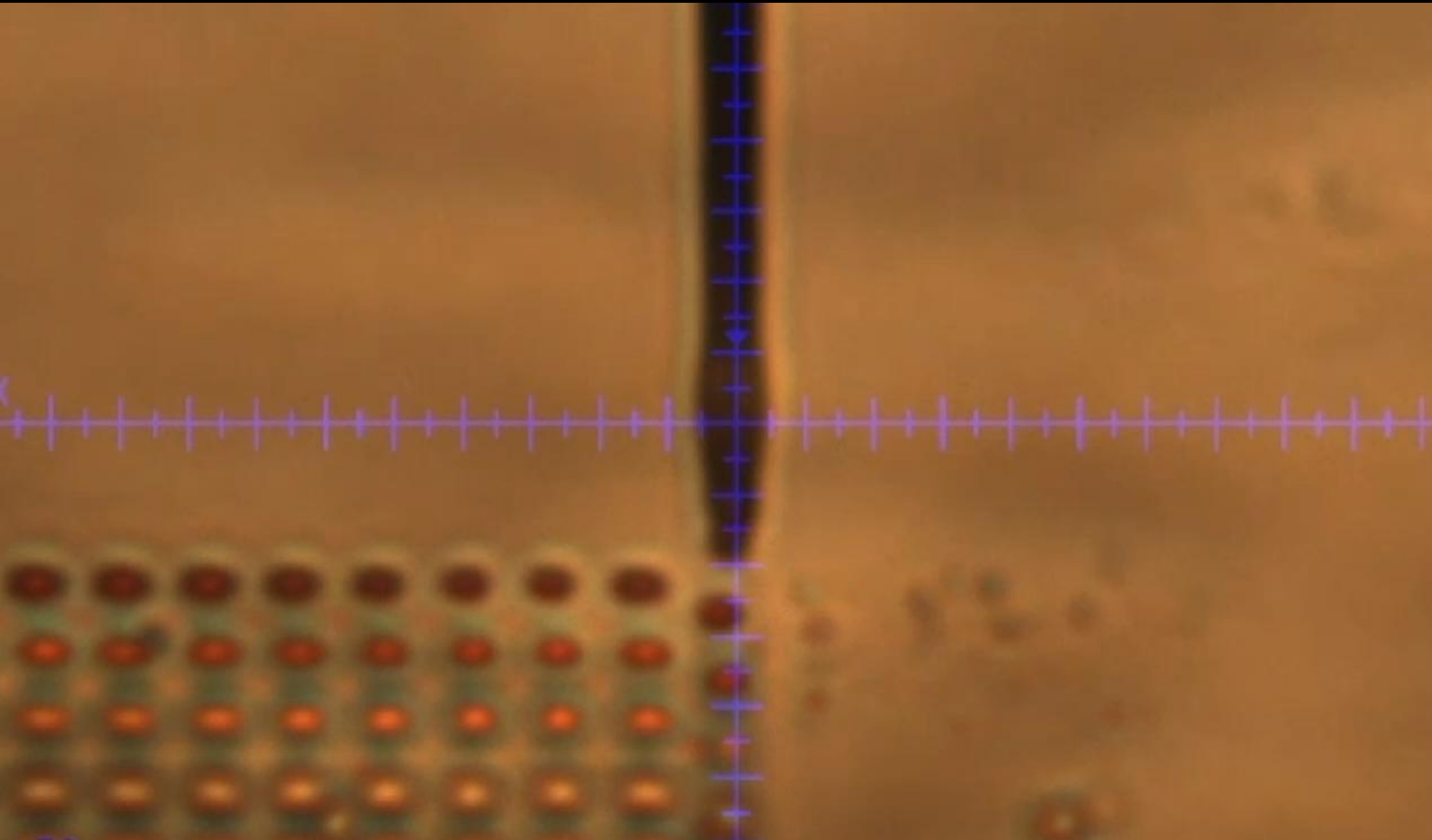
Technology demo I Microbumps deposition

XTEL[®]



Technology demo I Microbumps deposition

XFL[®]



02

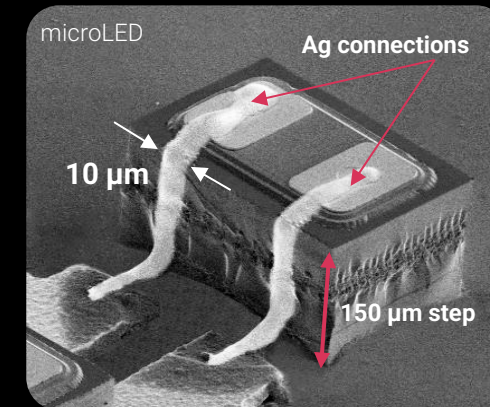
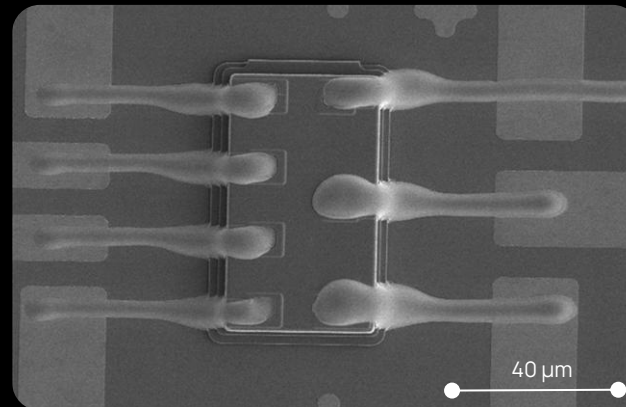
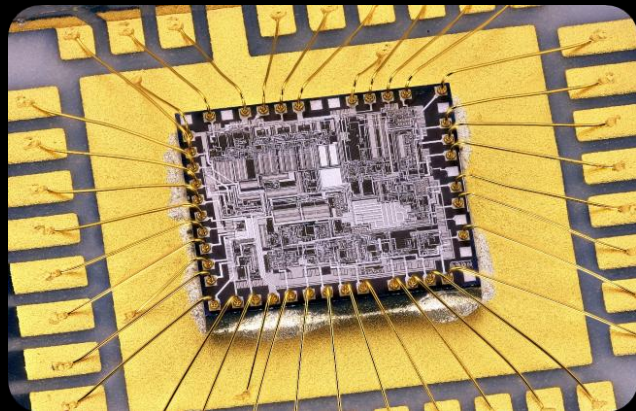
XTPL

Groundbreaking applications

Ultra-precise interconnections

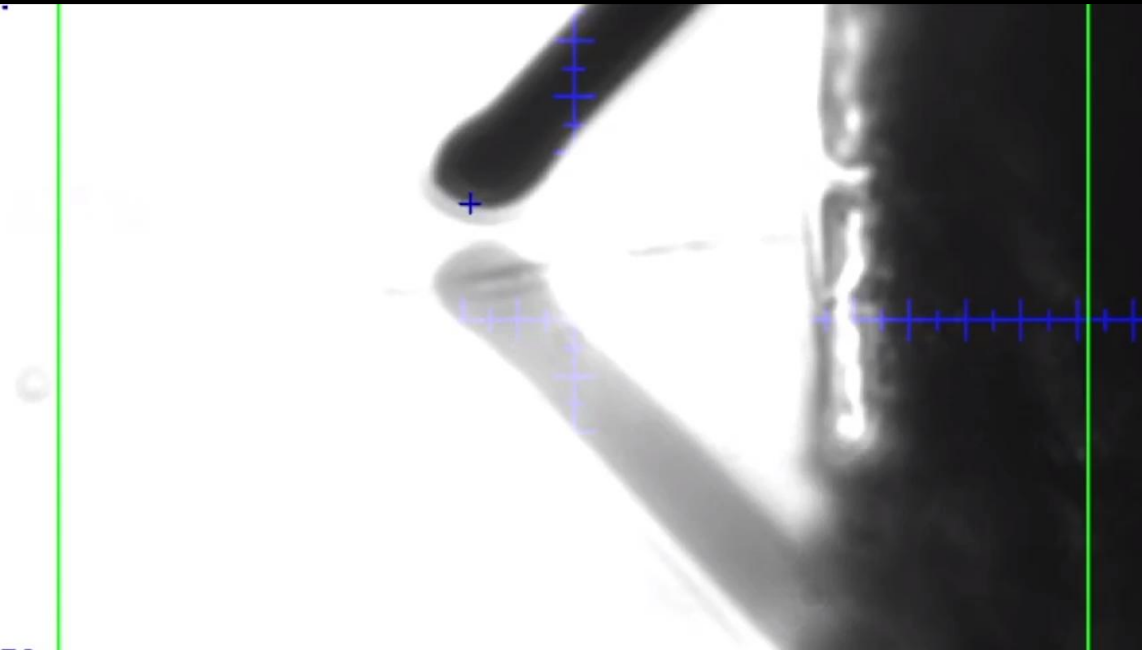
XIPAL®

- Allow for precise deposition of functional material on complex topographies.
- Can be applied on vertical surfaces.
- Enable new resolution in electronics, substituting wire bonding in next-gen devices.



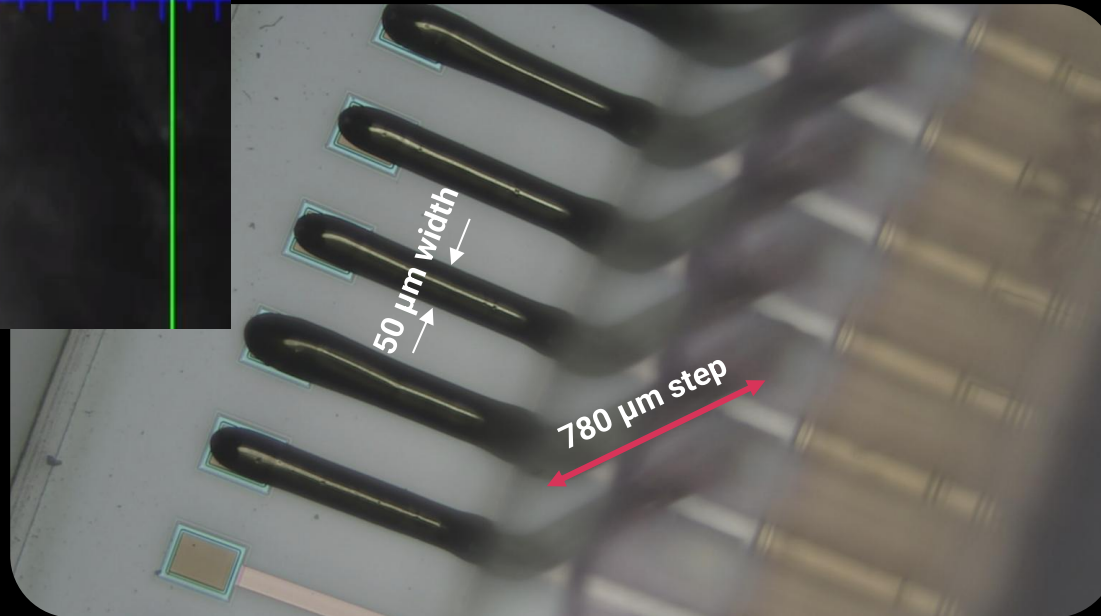
Ultra-precise interconnections

XIP L[®]

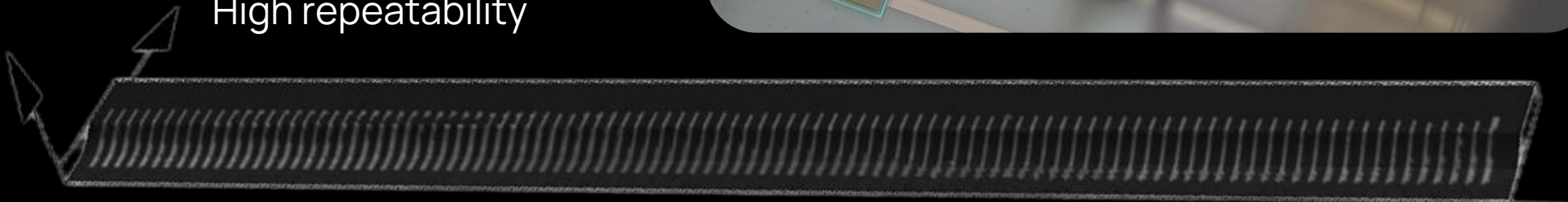


High printing speed

High vertical paths



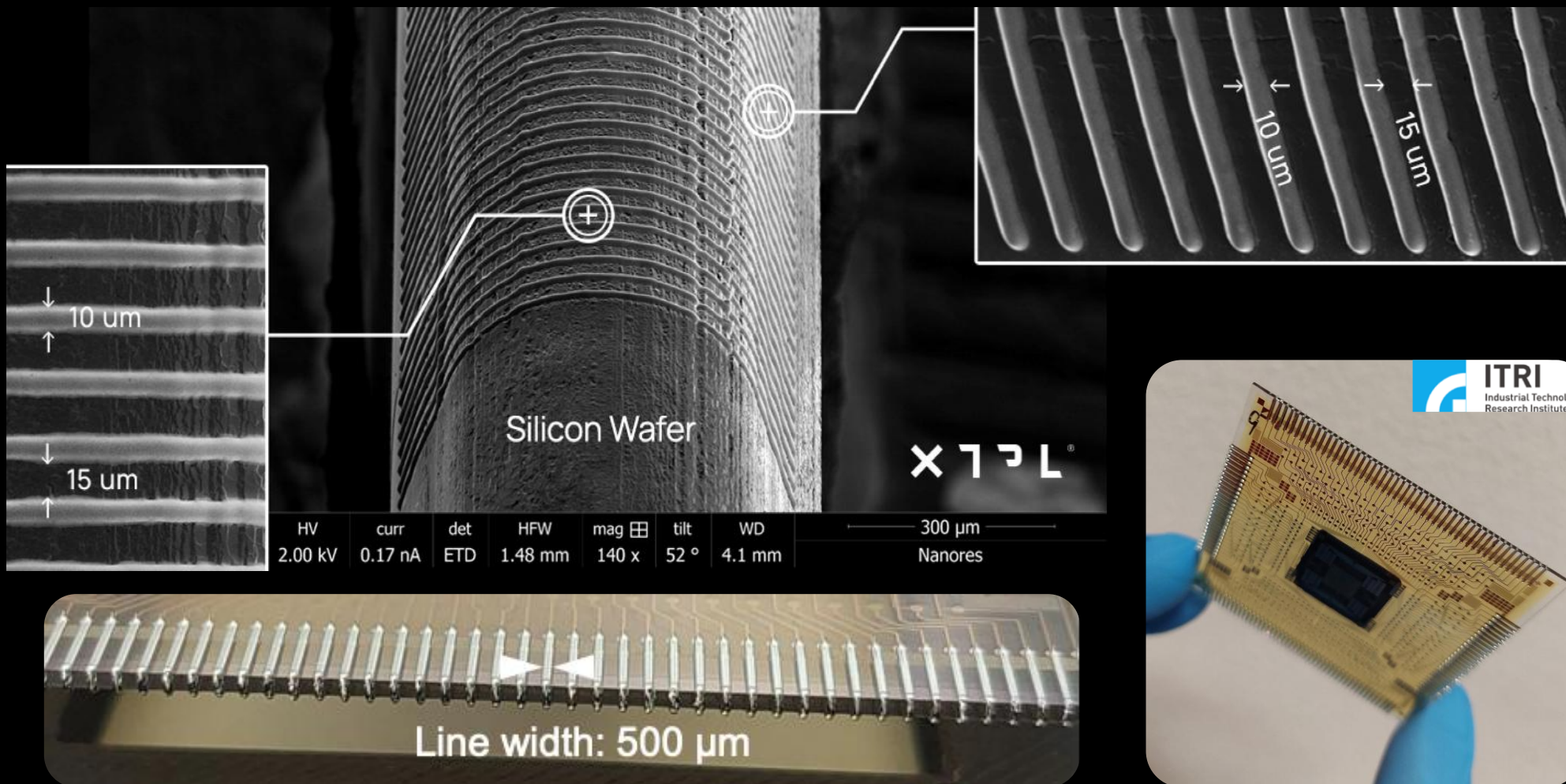
High repeatability



Edge interconnections

XTEL[®]

Very fine interconnections for high packaging density in next-gen semiconductor devices.



Thick edge interconnections for high current stability, up to 10 A, in automotive applications.

Multilayer printing

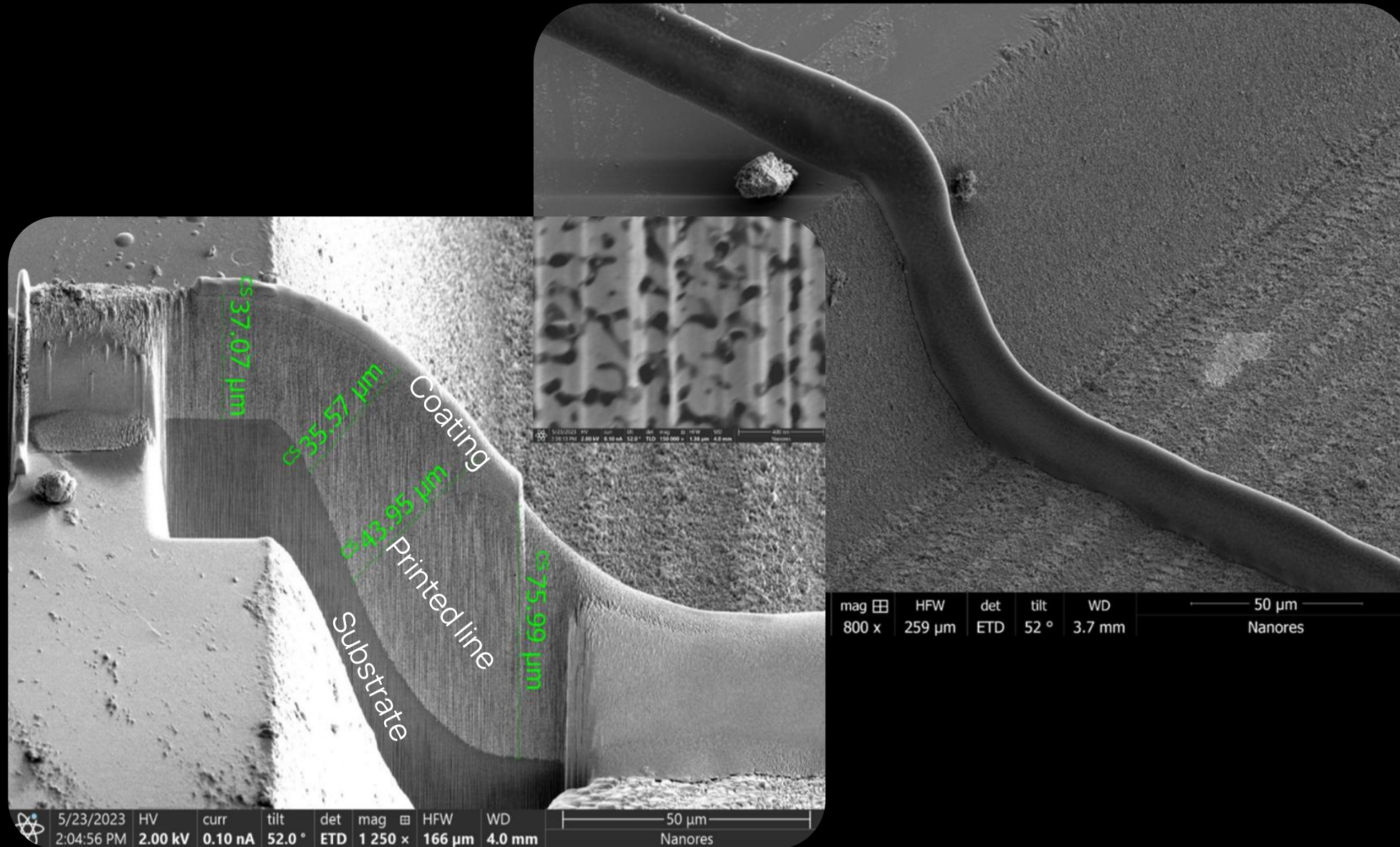
- Allows to achieve aspect ratio > 2
- Homogeneous structure (no visible layer after sintering)
- Enables higher cross section with small footprint
- Combined with XTPL's high material density, delivers low electrical resistance and high current stability

XTPL®



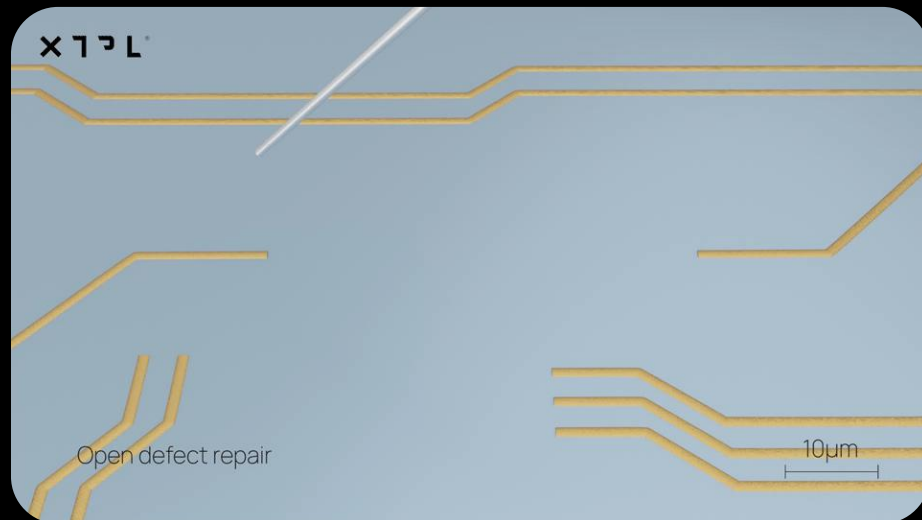
Multilayer printing on structured surfaces

XTEL®

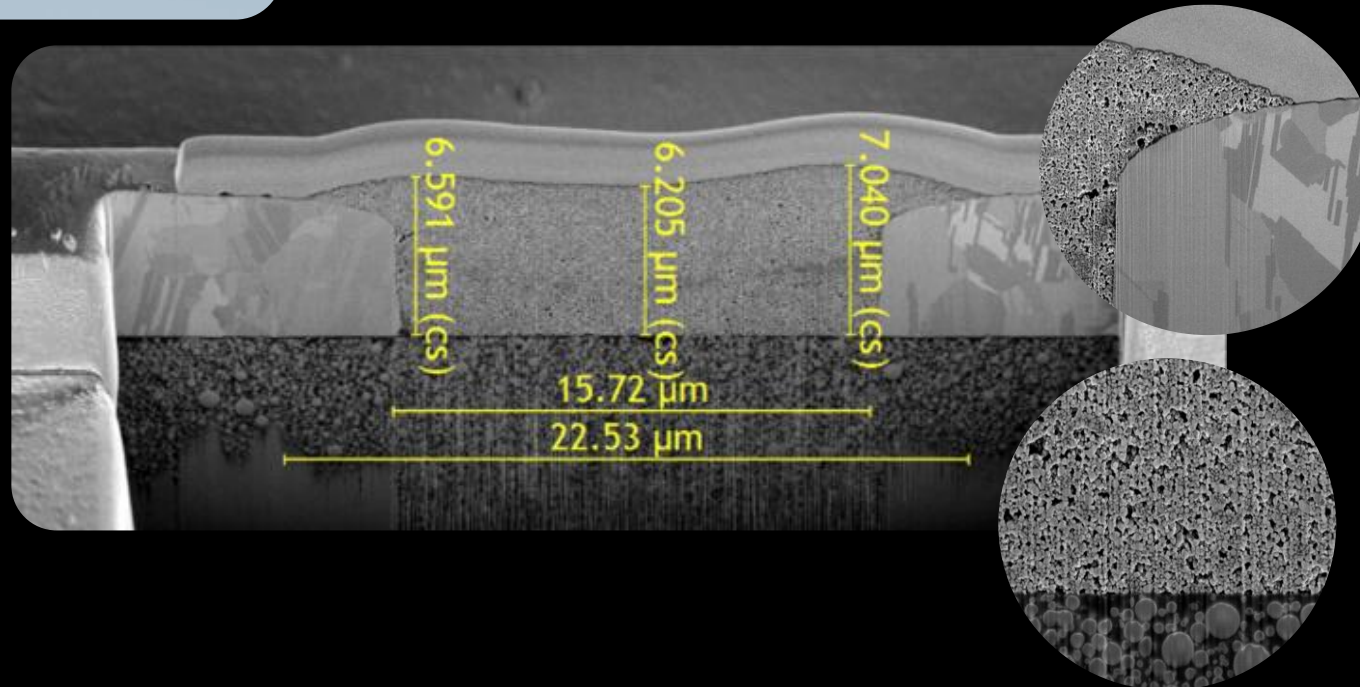


Defect repair

XFL[®]

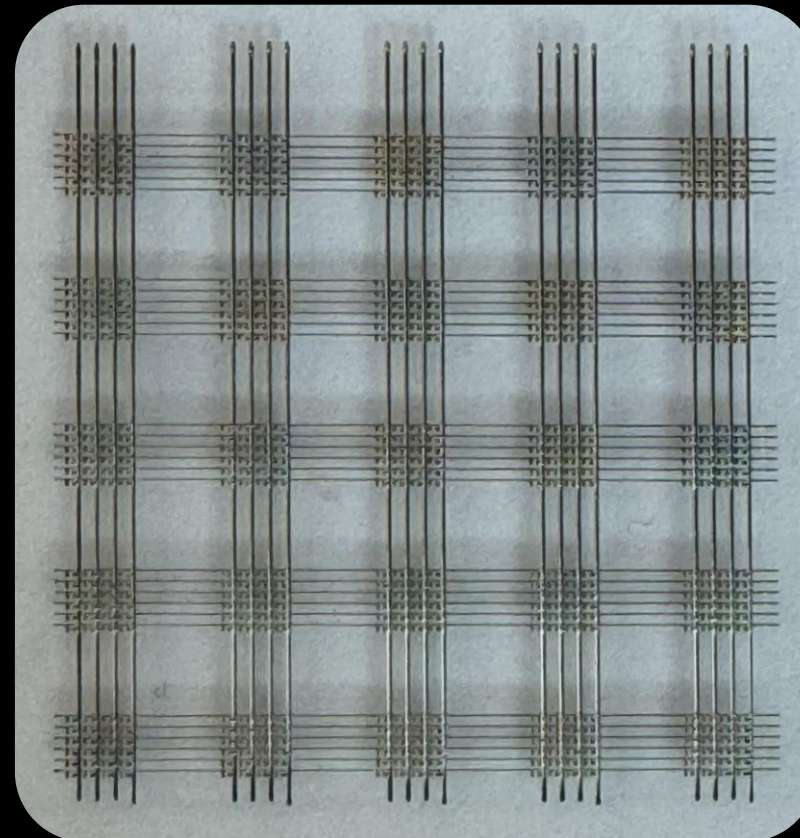
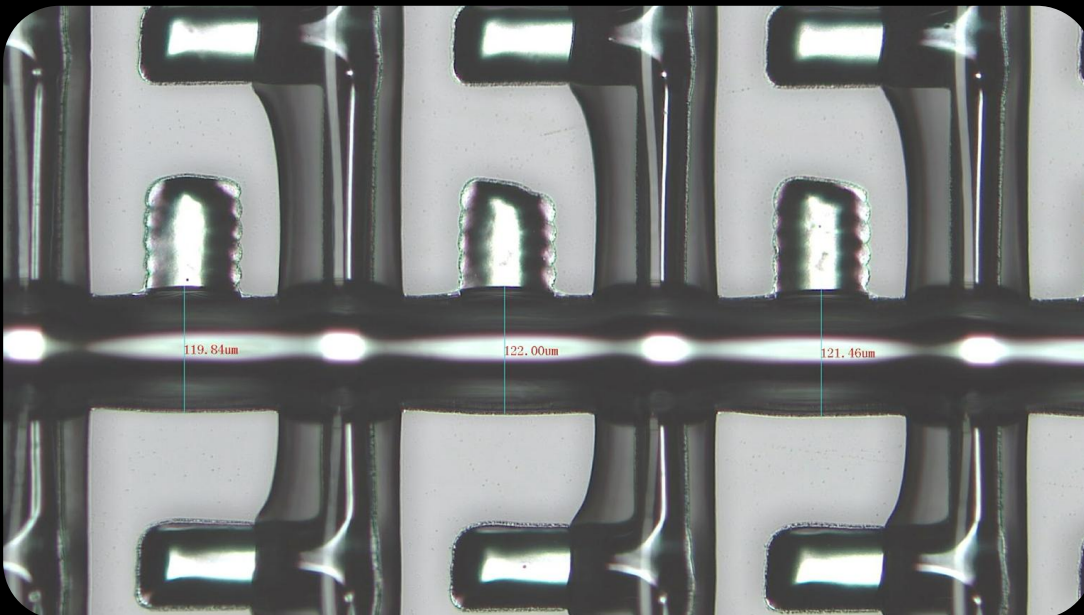
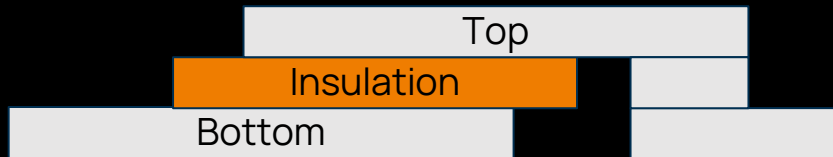


- Improves yield in electronics production
- Low repair resistance
- Selective laser sintering
- High uniformity with most native materials



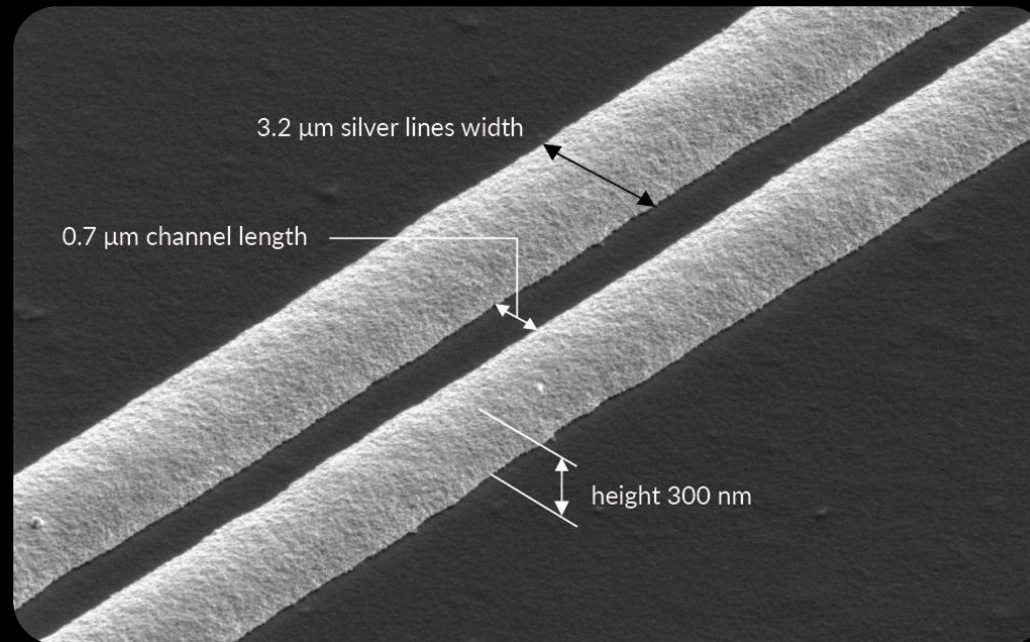
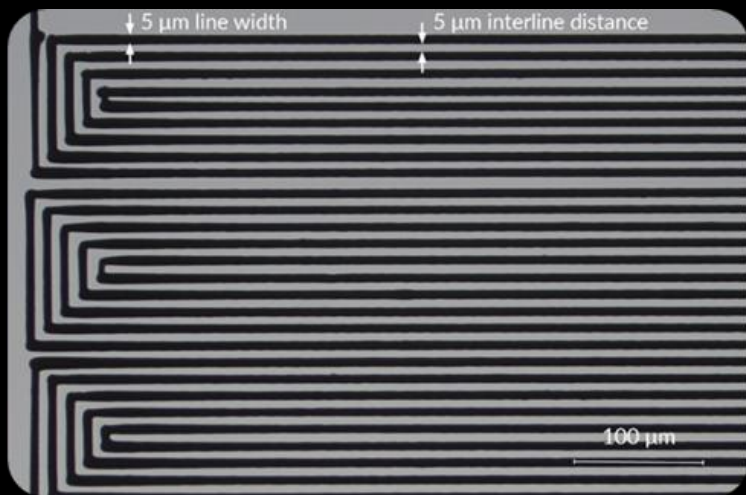
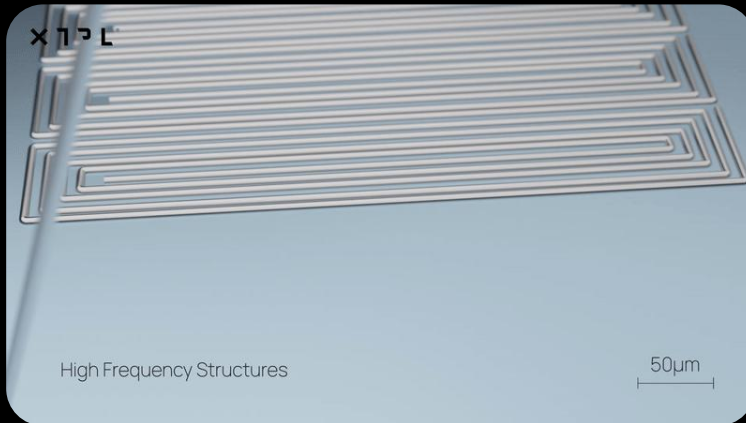
Redistribution layers

- UPD allows to combine high performance conductive materials with dielectrics and other functional materials to print full electronic circuits on various surfaces.
- XTPL technology can be combined with other AM methods for integration of electronic functionalities within 3D printed structures.
- High resolution allows for variety of applications, e.g. microLED arrays.



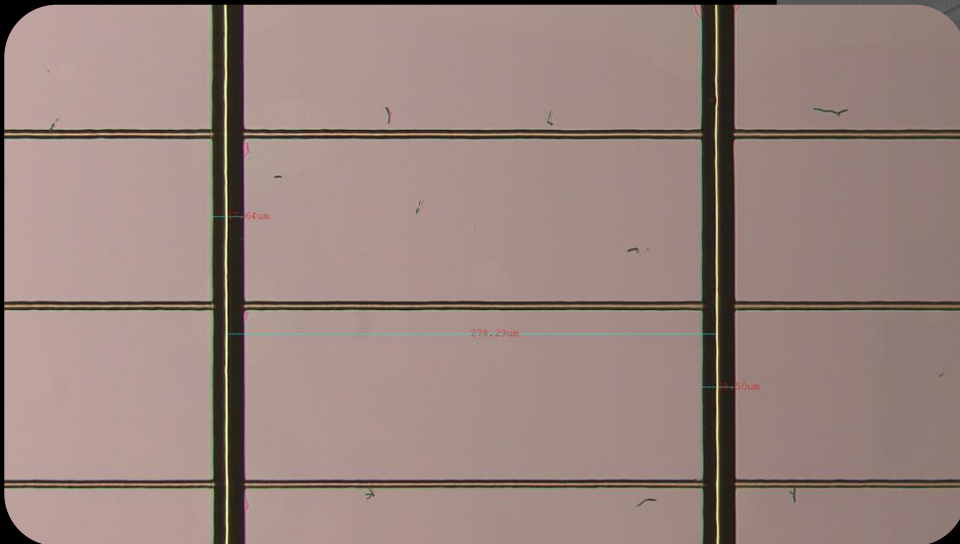
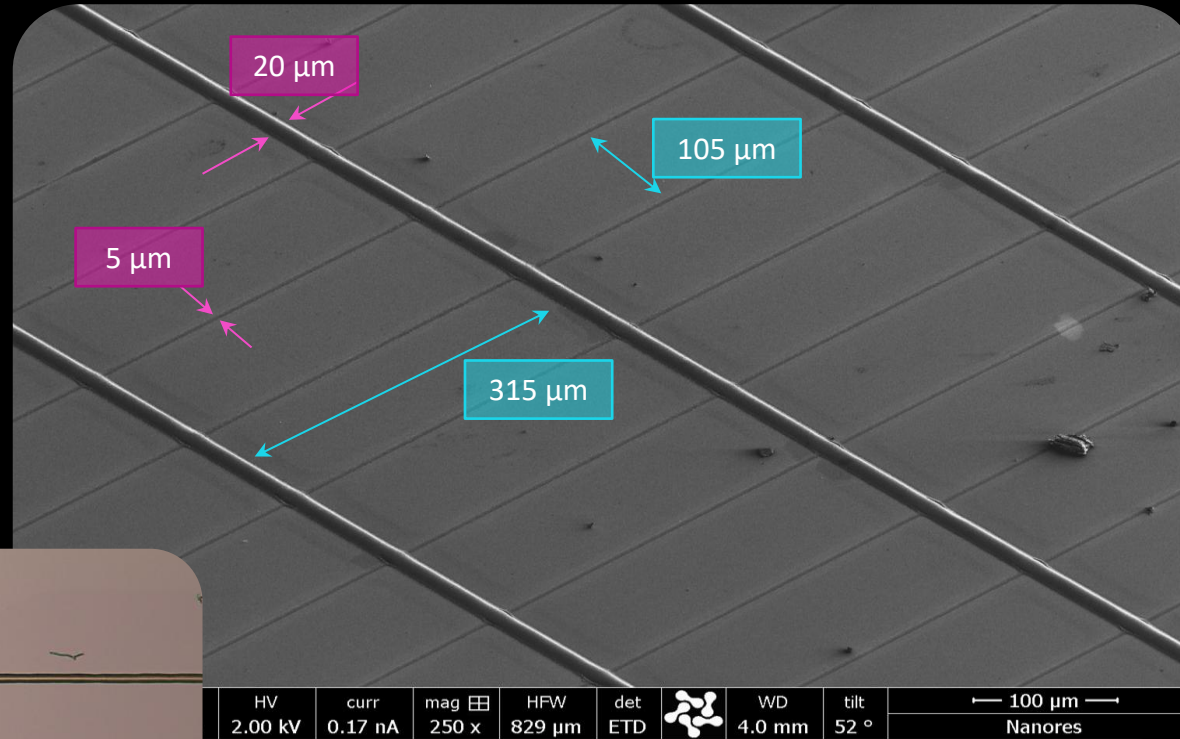
Microwave circuits

XTEL[®]



Transparent electrodes for PV and OLED

Ag electrode on ITO (right)
Sheet resistance reduction
from $7,81 \Omega/\square$ (bare ITO)
to $0,49 \Omega/\square$ (ITO + Ag mesh)

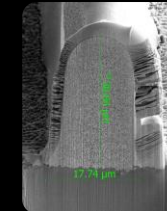
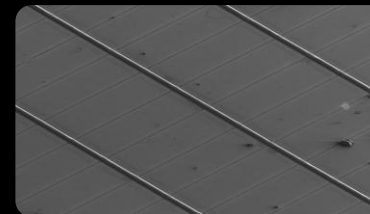
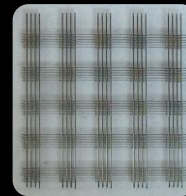
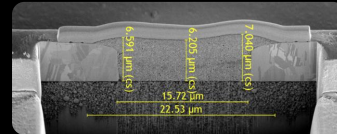
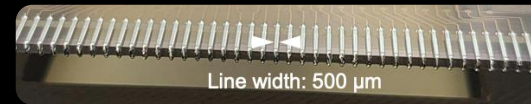
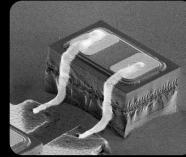
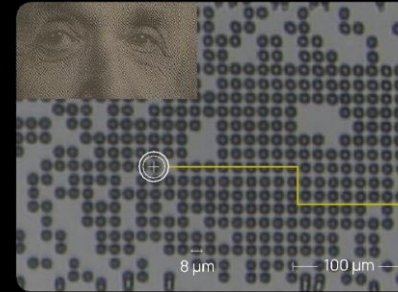
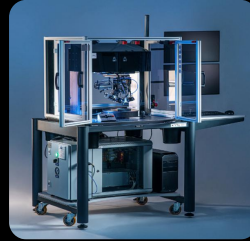


Ag electrode on TE OLED (left)
Sheet resistance: $< 2 \Omega/\square$

Summary

X7 L[®]

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 - d. Technology demo I Microbump dispensing
2. Groundbreaking applications
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Thank you!
Q&A

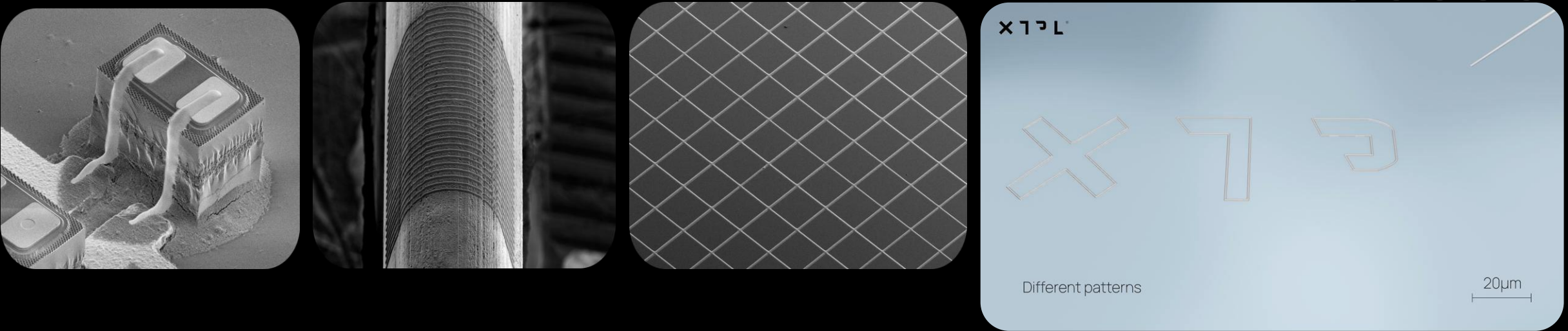
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Q&A | Game changer: Ultra-Precise Dispensing

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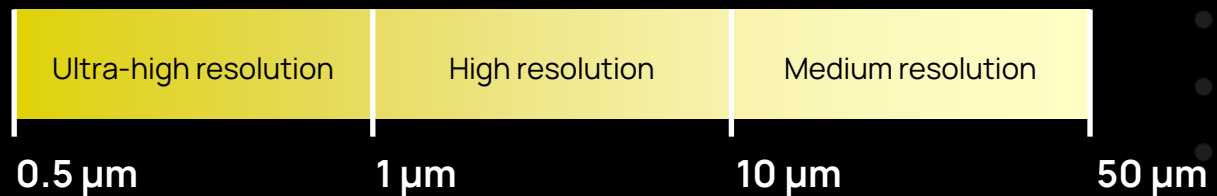
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