



HUMMINK

DREAM SMALLER

Additive manufacturing at the nanoscale

REVOLUTIONARY NANOPRINTING

 [Video link](#)



PATENTED BREAKTHROUGH TECHNOLOGY

Spun-off from world-renowned physics labs

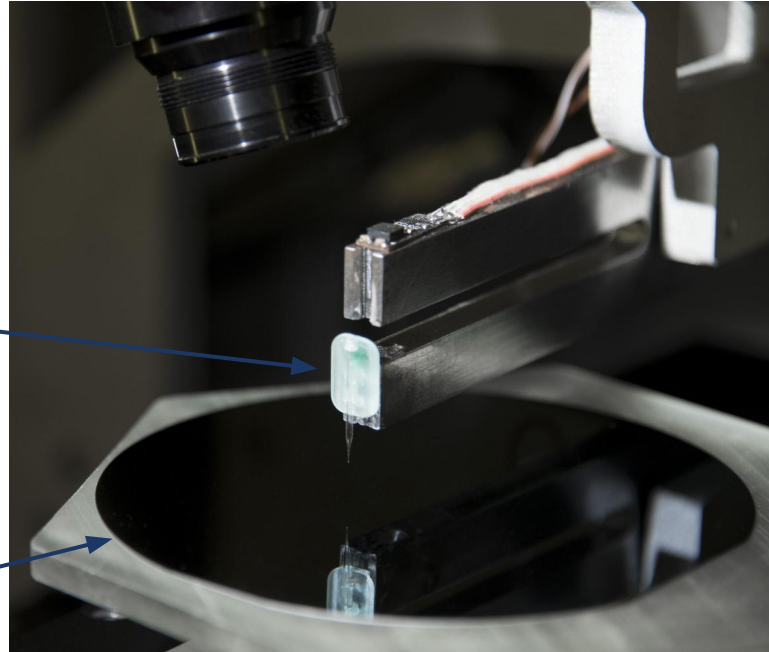
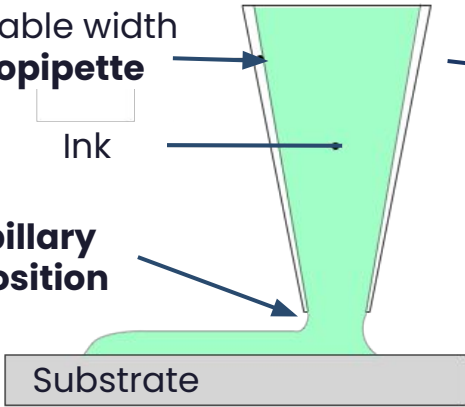


Adaptable width
nanopipette

Ink

**Capillary
deposition**

Substrate



Competitive edge:

Versatile

Any material
Any surface

High Resolution

From 100 nm
to 50 μm

High Precision

20 nm XY
precision

Speed

Deposition rate
up to 10 mm/s

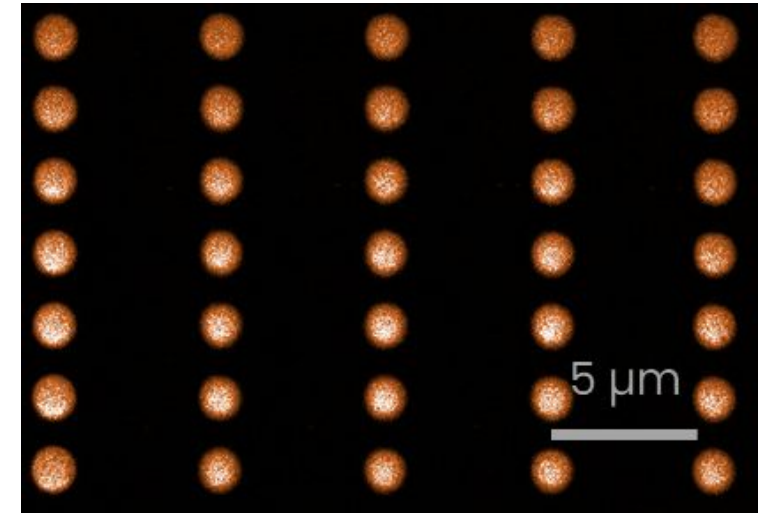
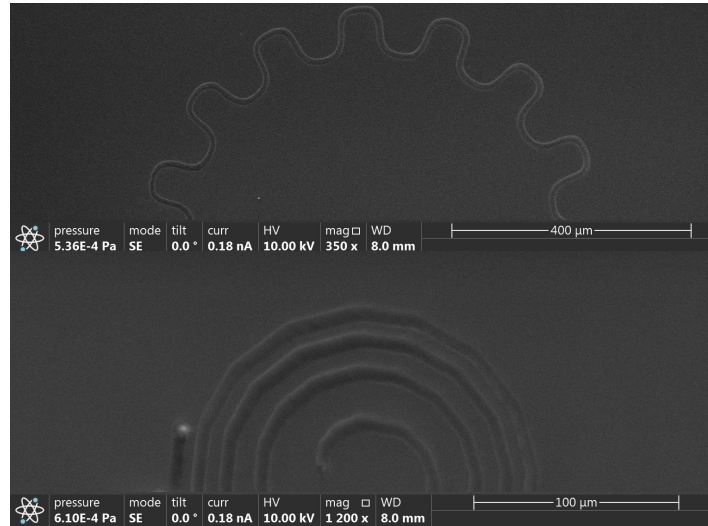
UNIQUE FREEDOM OF DESIGN

Any Material

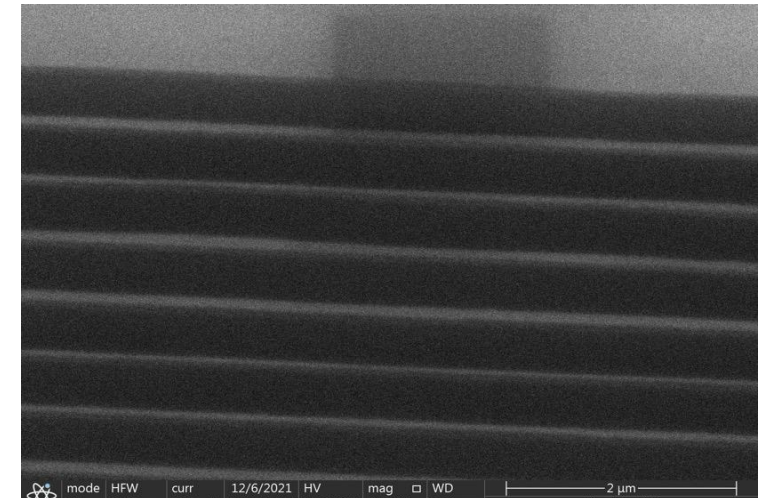
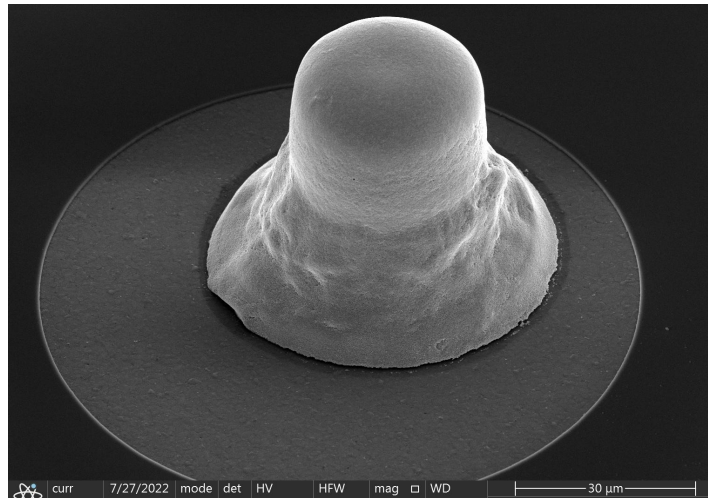
- 👉 Silver
- 👉 Copper
- 👉 Gold
- 👉 Graphene
- 👉 Polymers
- 👉 Quantum Dots
- 👉 Etc.

Any Surface

- 👉 SiO₂ Wafers
- 👉 Glass
- 👉 Flexible substrate
- 👉 Etc.

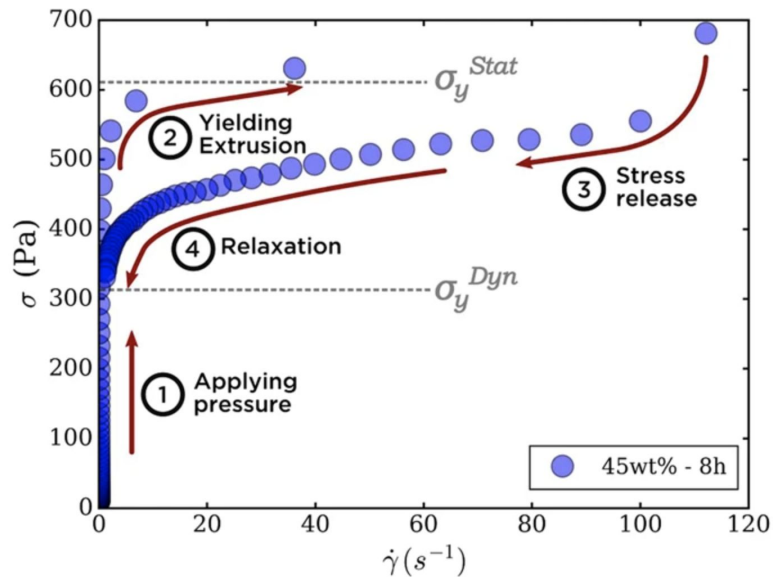


Any Shape



COMMON SENSE PHYSICAL LIMITATIONS

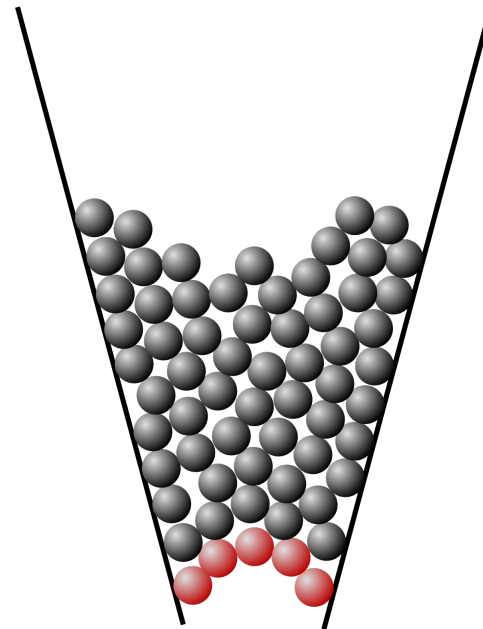
Rheology



Too high viscosity, gelifying solutions (etc.) will impact the liquid flow through the pipette

but Hummink can manage viscosities
up to 100,000 cP

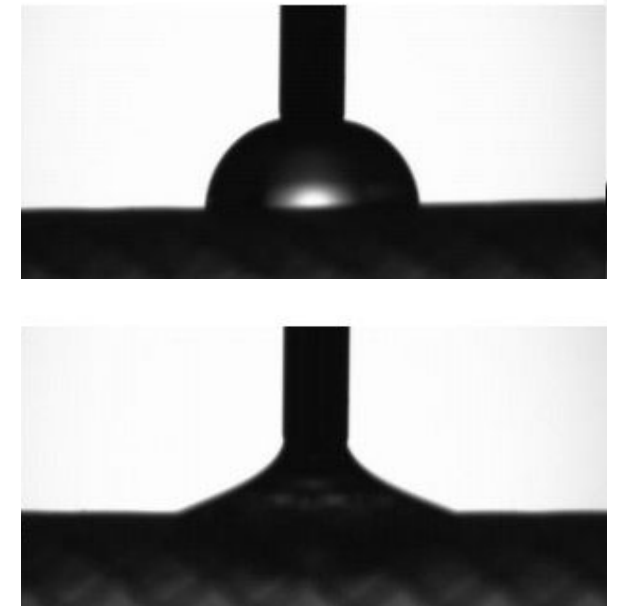
Particle size



Particle size $< 10\%$ of tip diameter
to avoid jamming

Hummink also develops **particle-free inks** to avoid such constraints

Surface energy



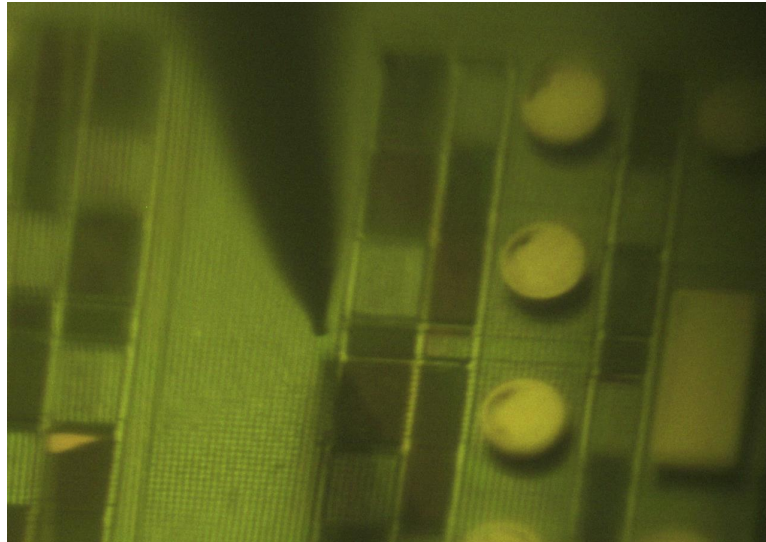
Deposition of hydrophilic solutions on hydrophobic / super-hydrophobic surfaces will impact resolution

ENABLING NANO-ELECTRONICS OF TOMORROW

On-demand interconnects

Pain

Impossible to build soldering connections between miniaturized components



Hummink provides
Breakthrough positioning **precision**
& manufacturing **resolution**

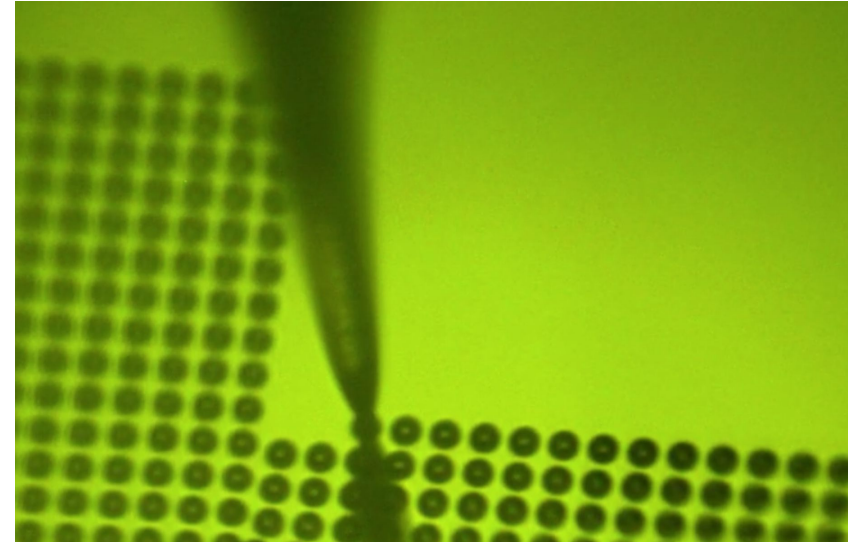
Inks used

Silver, Copper, Gold

Surface Patterning

Pain

Impossible to draw patterns with specific materials at micronic & sub-micronic resolutions



Hummink provides
Unique **versatility** (any material)
& sub-micronic **resolution**

Inks used

On-demand



NAZCA

ONE TOOL TO RULE THEM ALL



- 👉 16 cm travel range
- 👉 100 nm printing resolution
- 👉 20 nm XY precision
- 👉 **Integrated AFM** for *in situ* characterization
- 👉 High magnification camera for **live feedback**
- 👉 Dedicated **user-friendly software**
- 👉 **Relative positioning assistance**
- 👉 **Compact** (table top machine, 70cm cube)
- 👉 No clean room needed

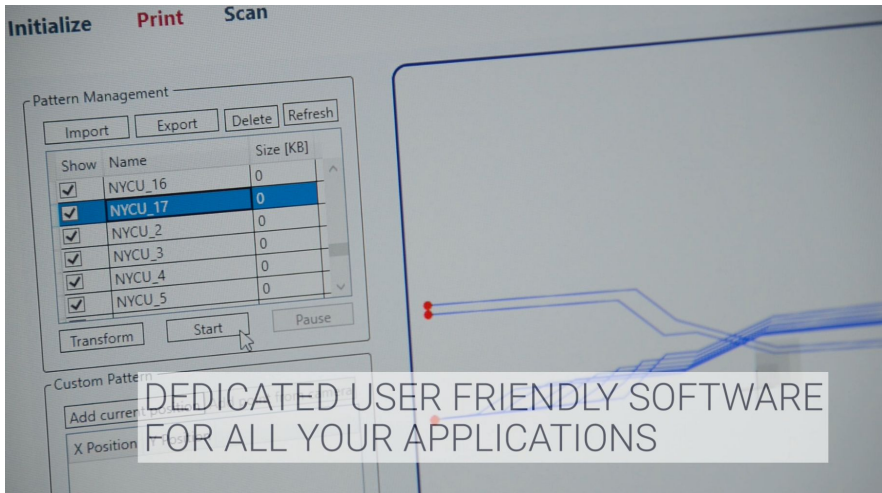
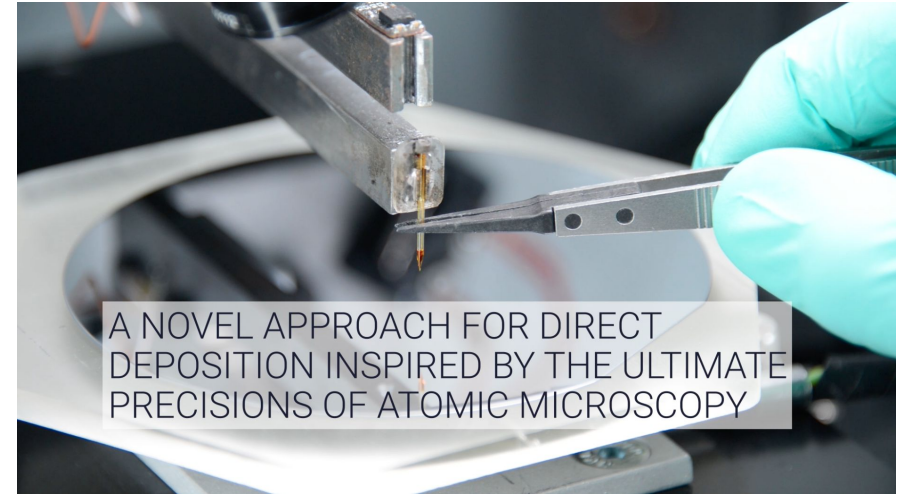
WE PROVIDE DEDICATED INKS & PIPETTES

Breaking the compromise between agility and miniaturization

DREAM SMALLER WITH NAZCA



NAZCA
BY
HUMMINK



 [Video link](#)



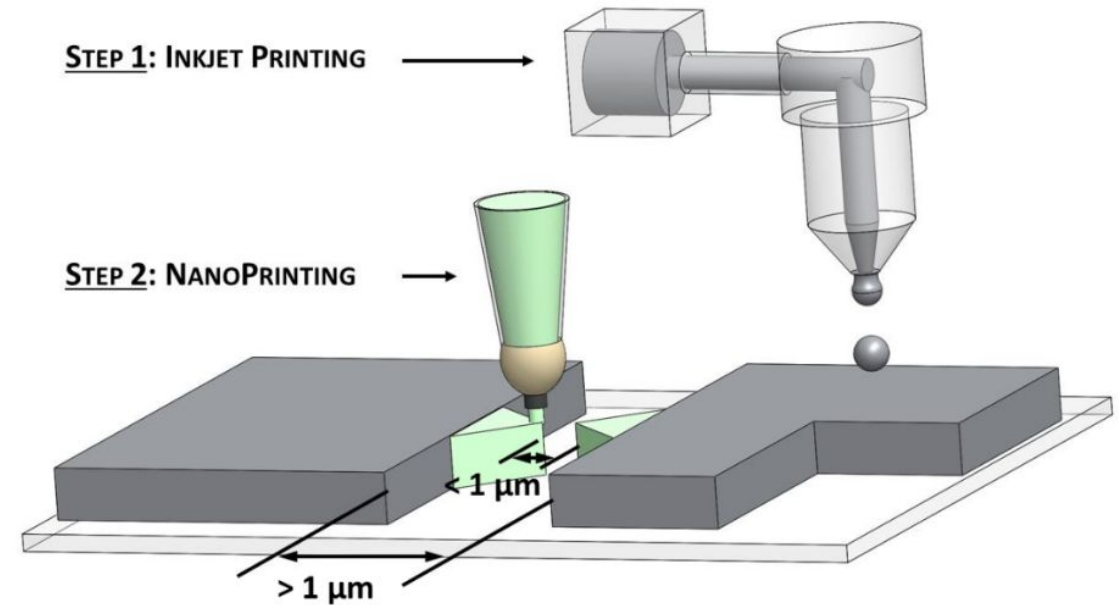
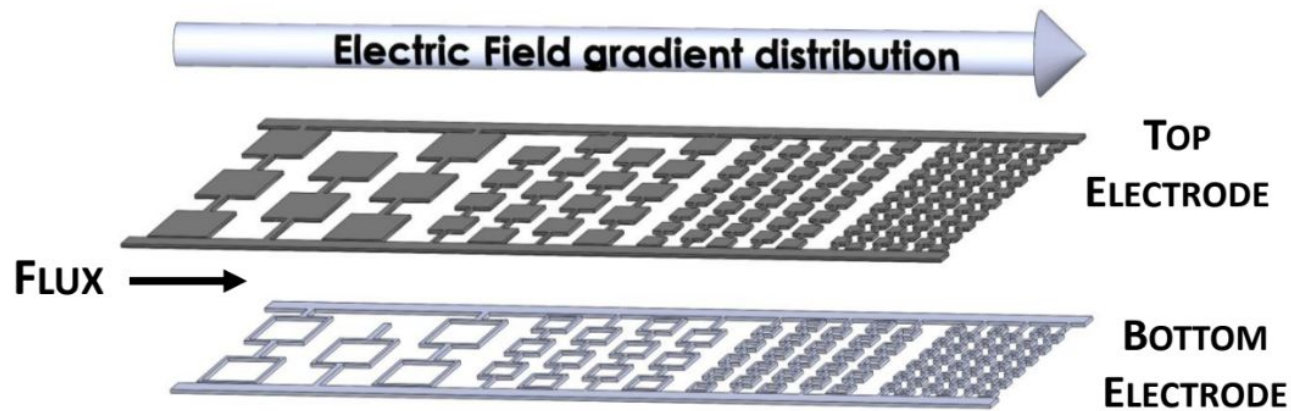
PLACING A NEW PIPETTE



USE CASES

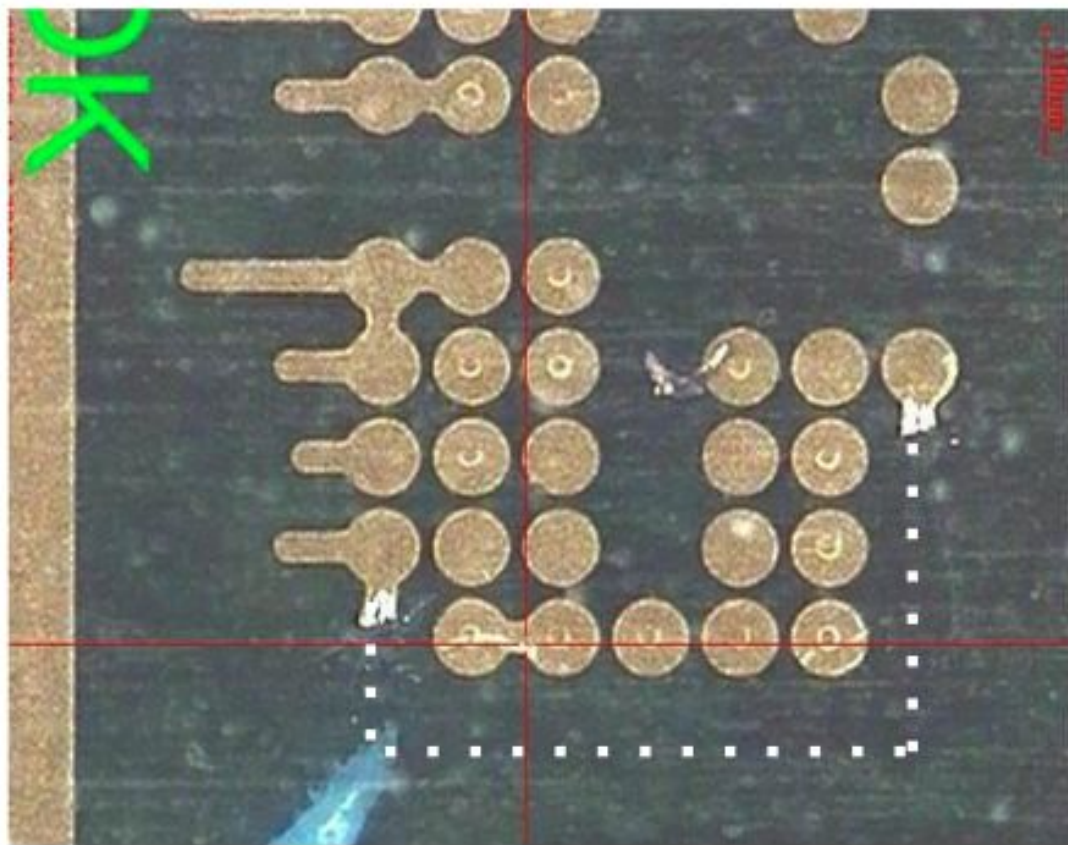
THE PERFECT COMPLEMENT TO INKJET

HUMMINK TECHNOLOGY INPUT: NANO-OBJECTS (VIRUSES, NANOCATALYST) SORTING DEVICES

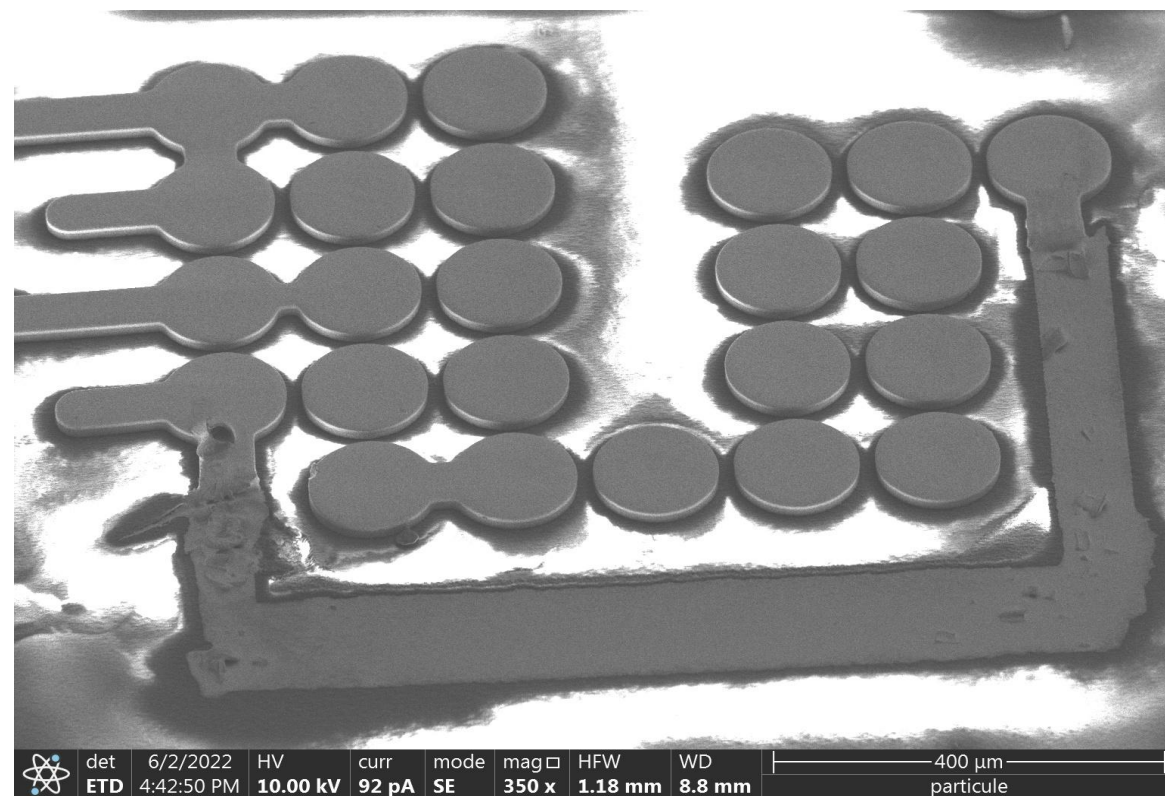


PCB REPAIR

Scratched PCB

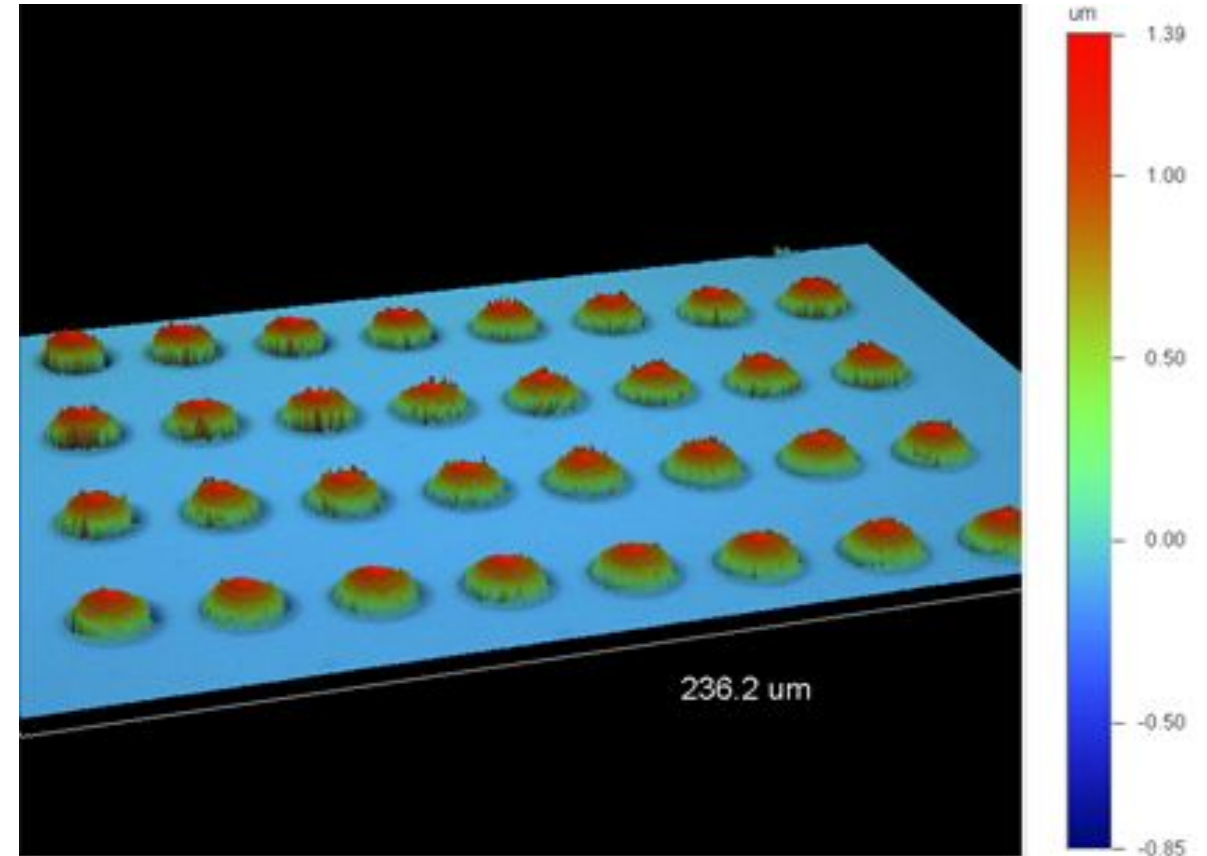
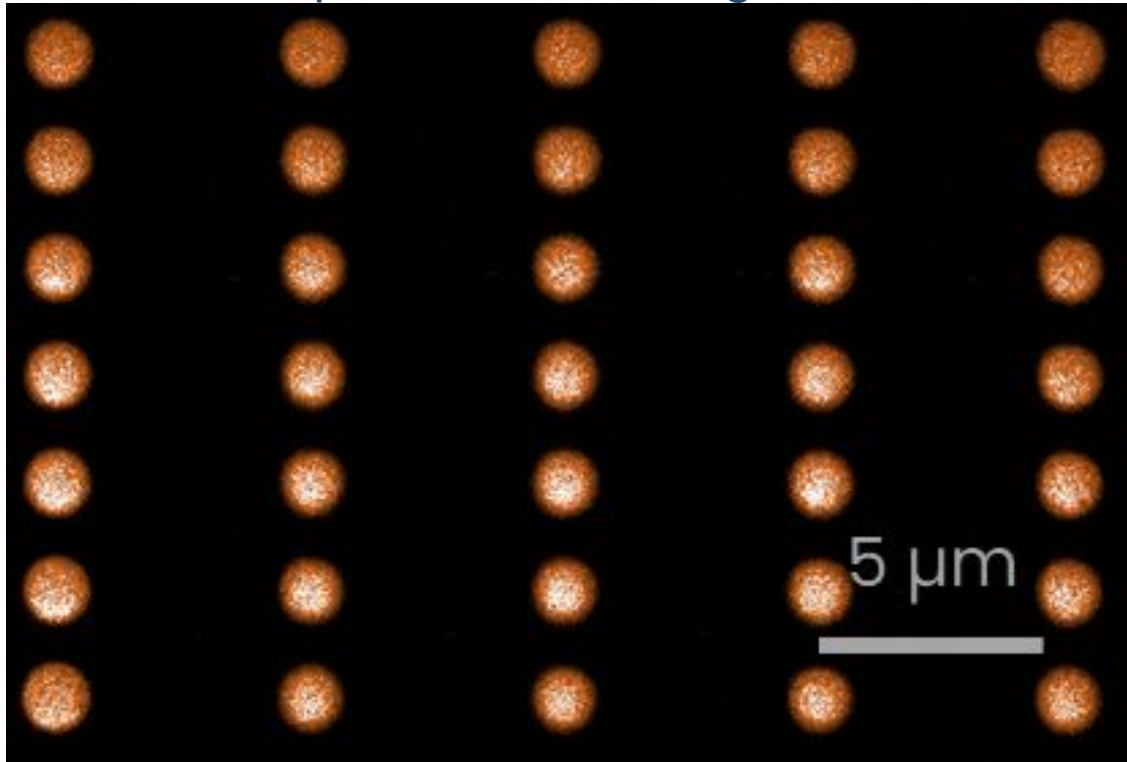


Repaired



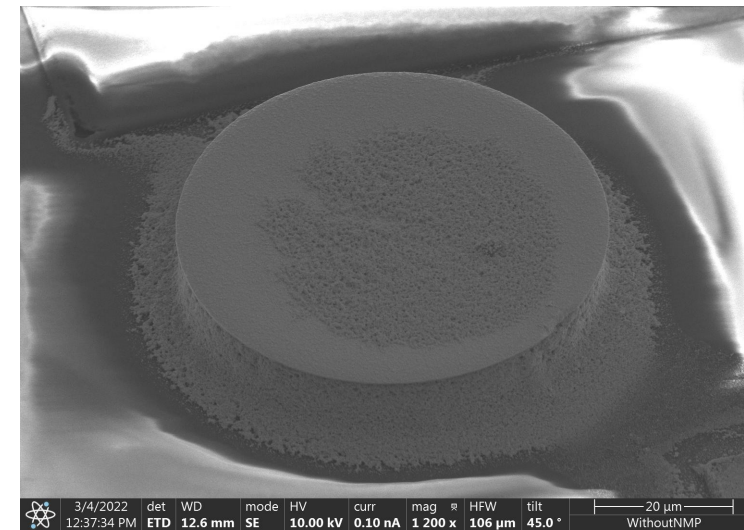
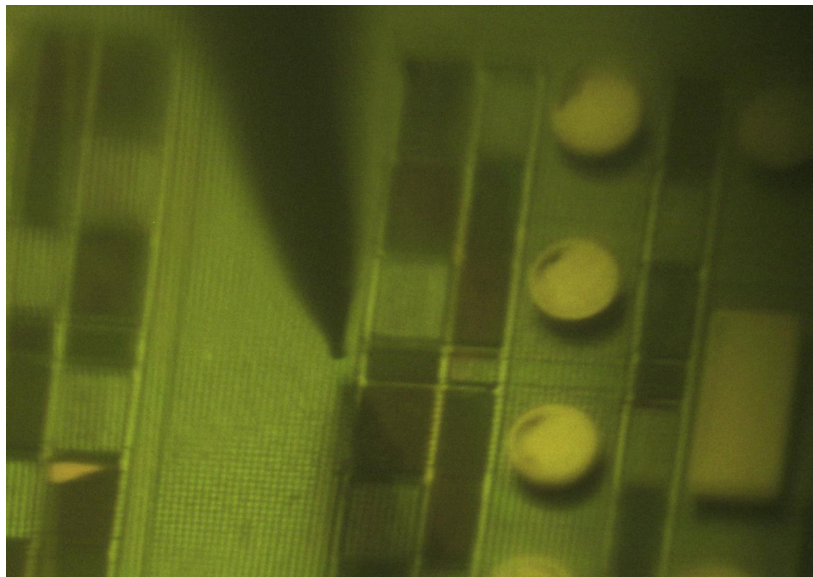
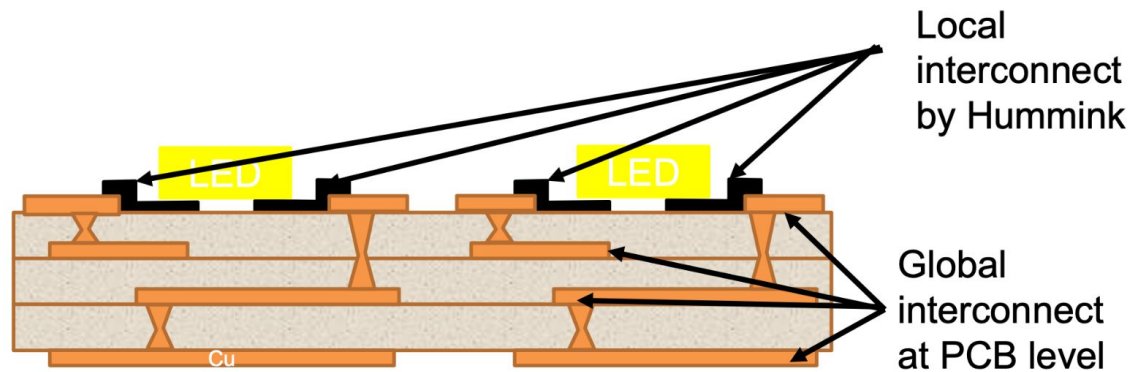
Display – QD Deposition

Fluorescence image of quantum dots on glass



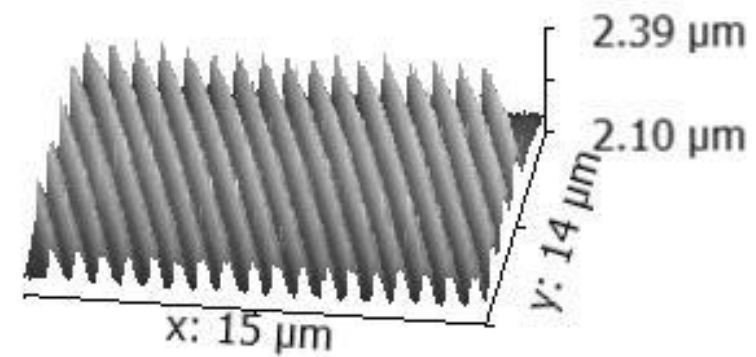
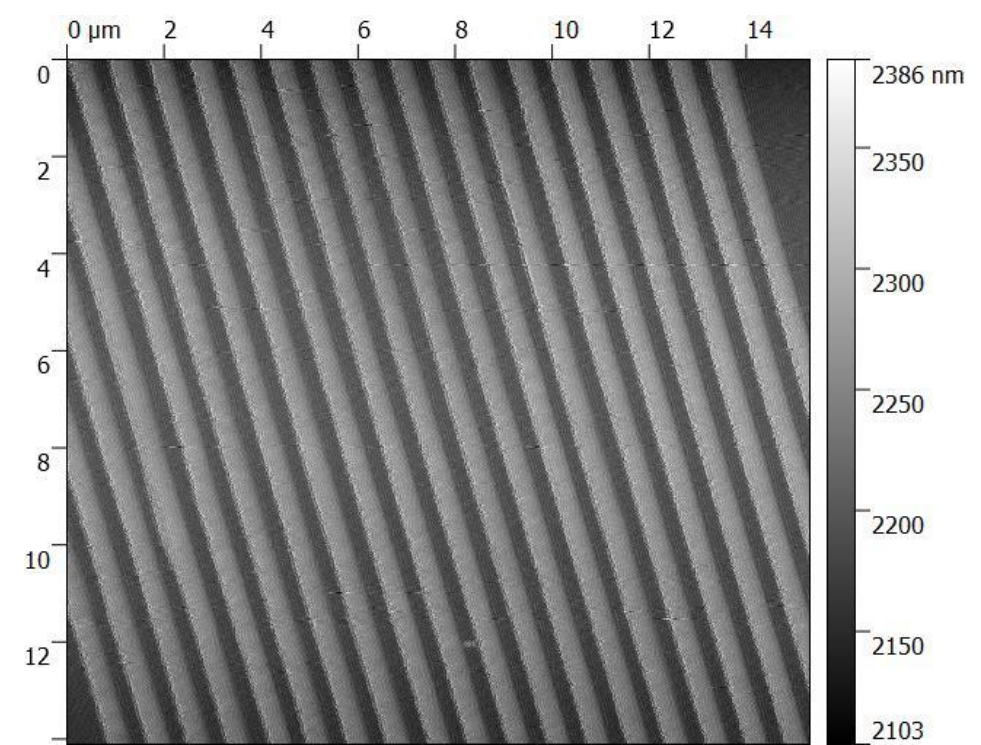
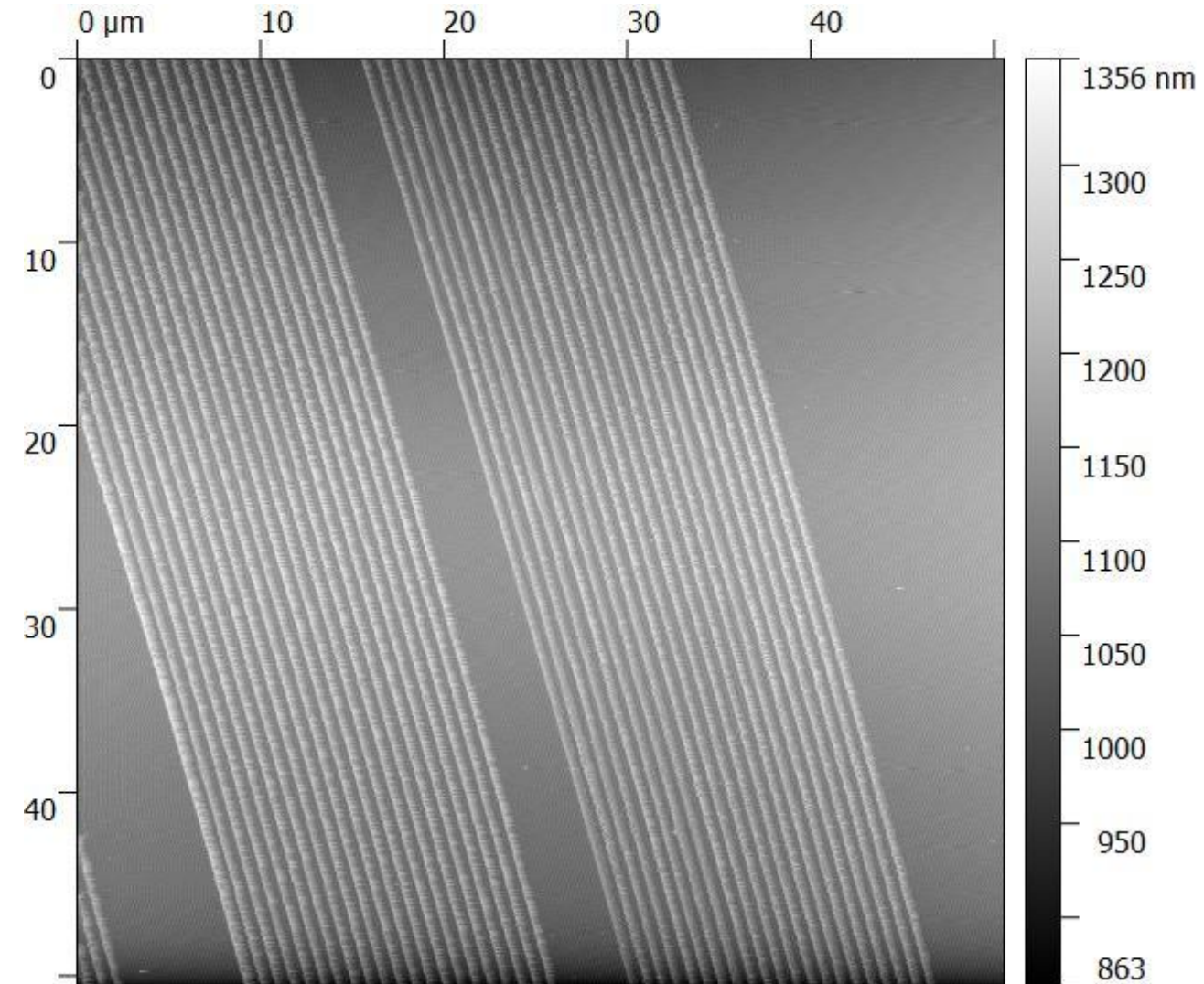
**Quantum Dots patterning on glass by Hummink
Unprecedented 20 nm positioning precision**

PCB INTERCONNECT

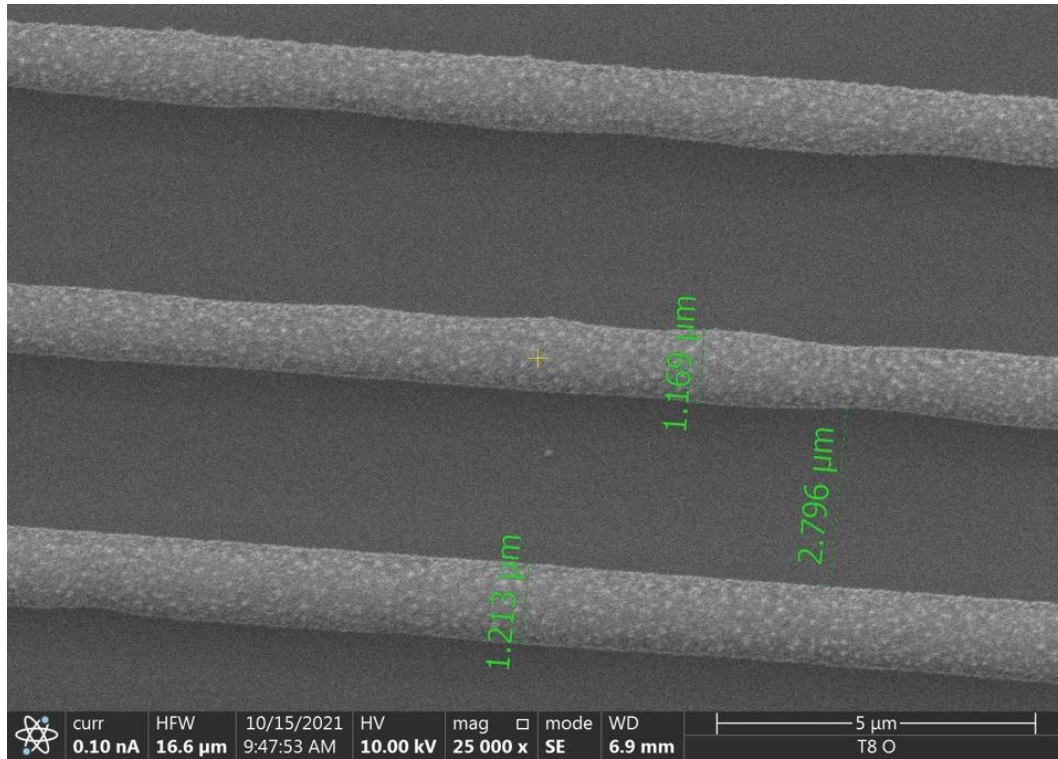


Silver Ink
20 nm positioning precision

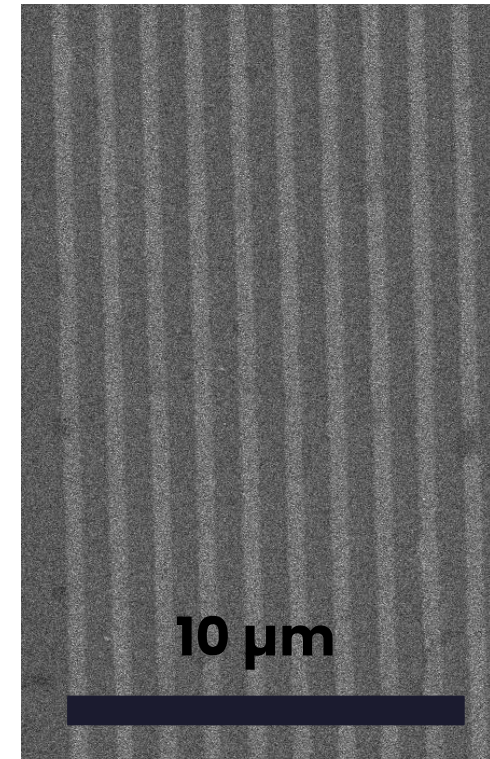
WAVEGUIDES



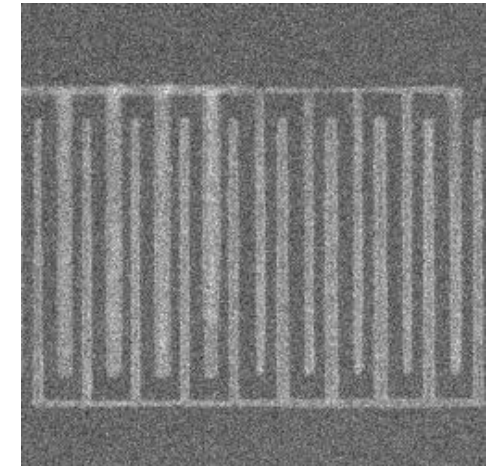
EGOFETs, OFET, Transistor building



Silver ink
1.2 μm line width
2.8 μm spacing
Si Wafer

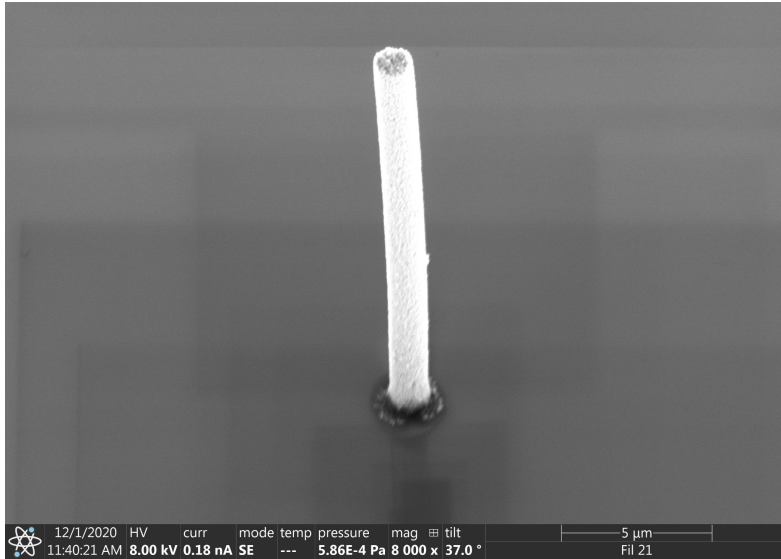


Silver ink
460 nm line width
600 nm spacing
Si Wafer

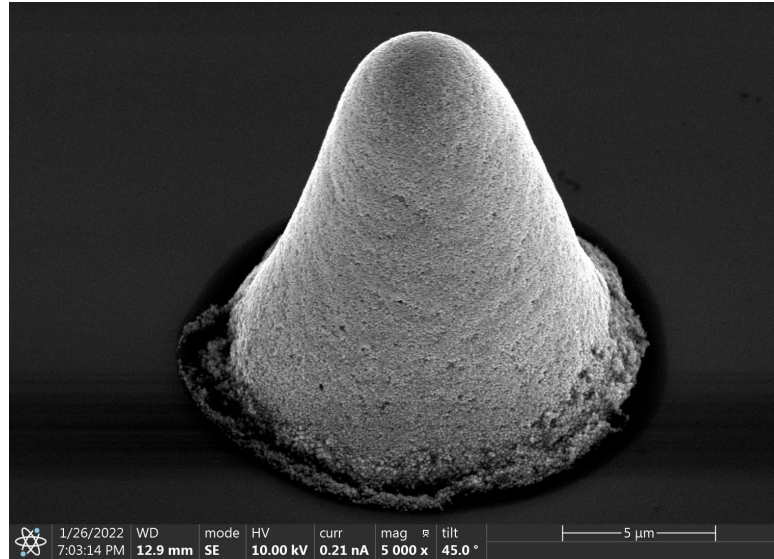


ADVANCED PACKAGING / 3D STRUCTURES

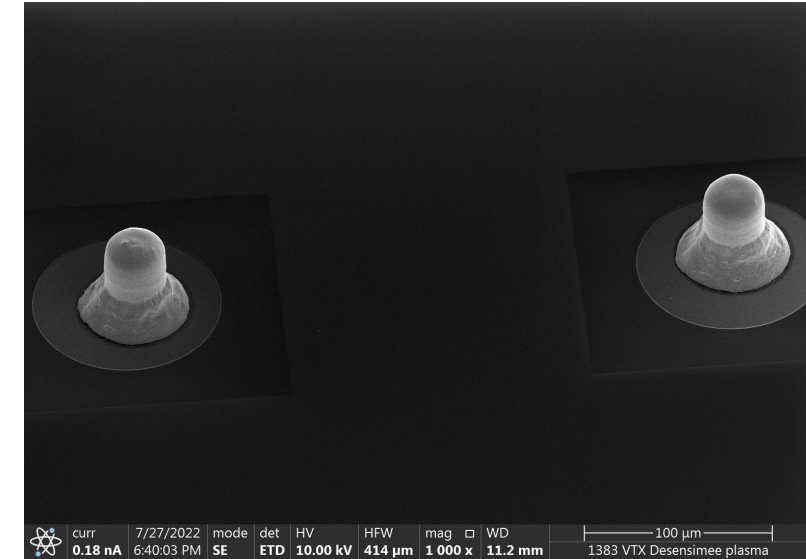
Silver Bumps - Various size and shapes
(~10 $\mu\text{Ohm.cm}$ after 30 min @ 150°C)



Pillar on Si Wafer
d: 1 μm
h: 20 μm

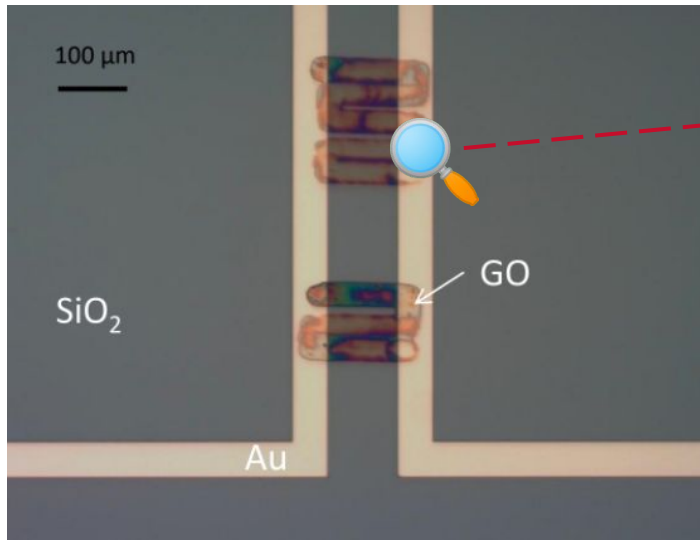


Bump on Si Wafer
d: 15 μm
h: 20 μm

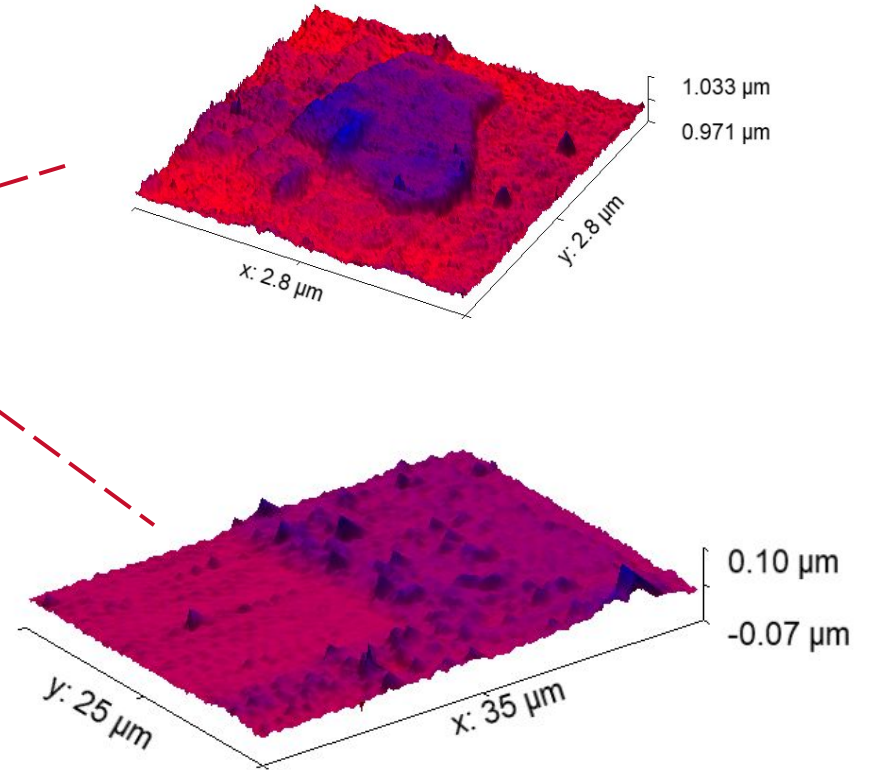
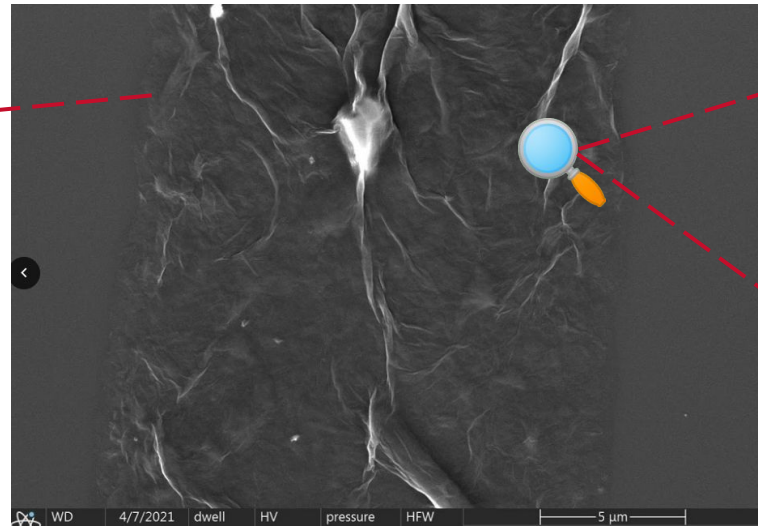


Bump on Al pads
d: 30 μm
h: 30 μm

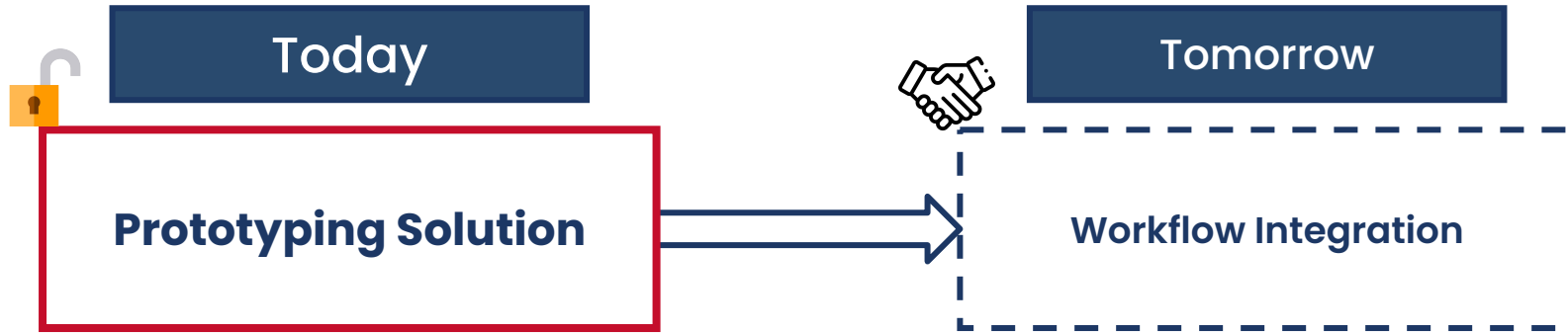
GRAPHENE-BASED TRANSISTOR



Graphene oxide ink connecting gold electrodes



DEPLOYING HUMMINK'S TECHNOLOGY

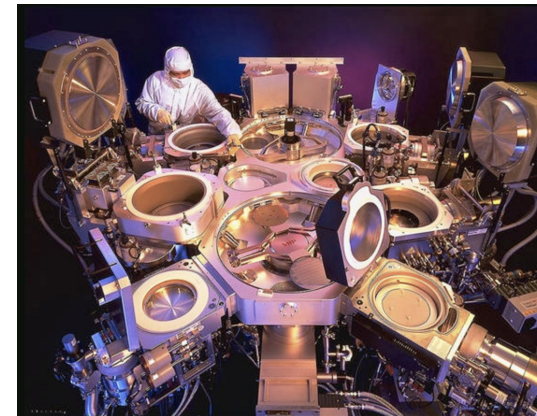


Democratizing Hummink's capacities
Affordable, Compact & Easy-to-use

**Automated
Multi-nozzle deposition**



NAZCA machine



Large scale production facilities
through licensing agreements

THANK YOU!

contact@hummlink.com



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