ioTech

Laser assisted deposition for advanced packaging

IO Tech founders

Hervé Javice
CEO

MBA Harvard University

- Board member & investment committee member at Atlas Capital
- Founder of the European corporate equity derivative business at Credit Suisse

Dr. Michael Zenou
CTO

PhD Physics, Hebrew University

- Expert in laser assisted deposition;
- Designed first-in-kind copper printer for PCB repair at Orbotech, KLA Group
- Optical engineering, electronics physics and nanotechnology.

Despite the great potential in multiple industries, additive manufacturing has not been widely adopted beyond prototyping

Manufacturing

$846B

Additive Manufacturing

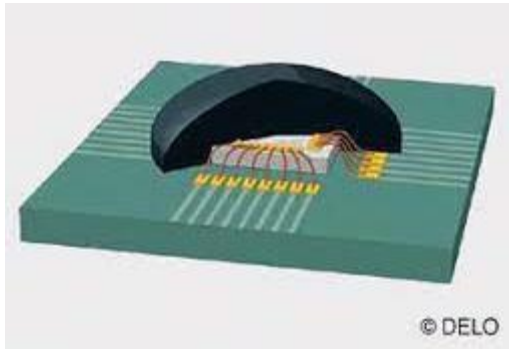
$21B

Breakthrough Technologies For Additive Mass-Manufacturing

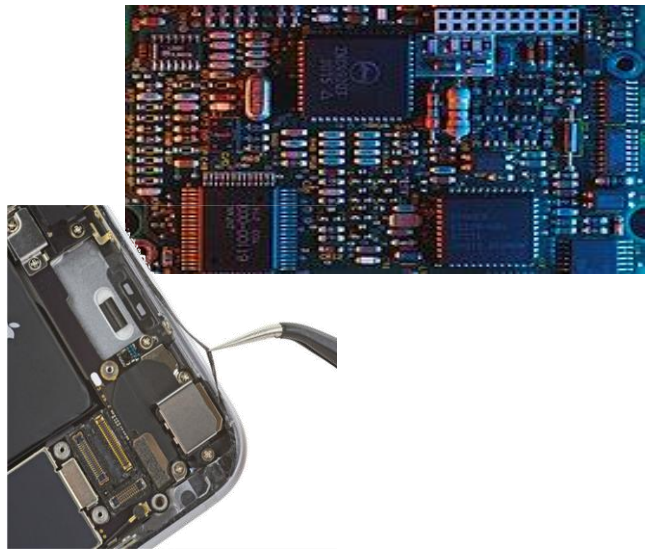
THE MATERIAL CHALLENGE

Certified industrial-grade materials tend to be too viscous for existing printers, and so approximations are used.

These approximations look like the real thing, but they lack in mechanical properties and functionalities



Coating materials



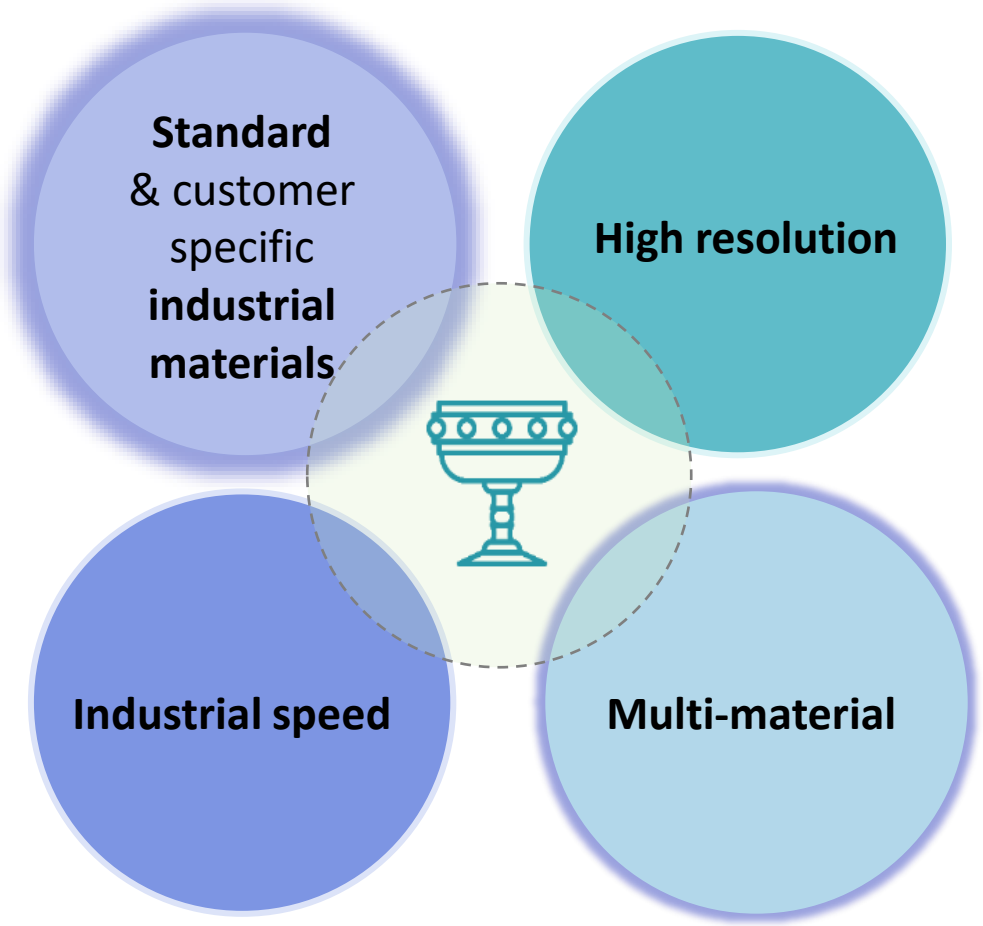
Epoxy

Conductive bonding materials

THE “HOLY GRAIL” OF ADDITIVE MANUFACTURING

Genuine industrial materials characterized by

- Thermoset
- High-viscosity
- High-loading
- Long-chain polymers
- Integrated fillers
- Particles size
- Conductivity
- Di-electric constant
- …



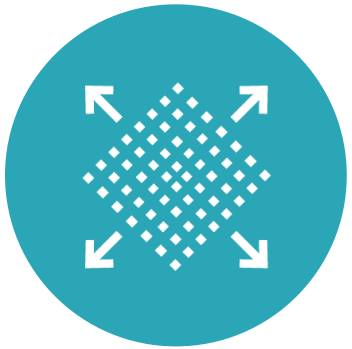
Breakthrough Technologies For Additive Mass-Manufacturing

MEET ioTech… NO MORE COMPROMISE

The world's only additive manufacturing solution for genuine industrial materials

Printing unprintable industrial materials

Polymer Silicone Ceramics Metal Solder Adhesives



High resolution

Dynamic from 20µm to 500µm

Combining polymers, metals & ceramics

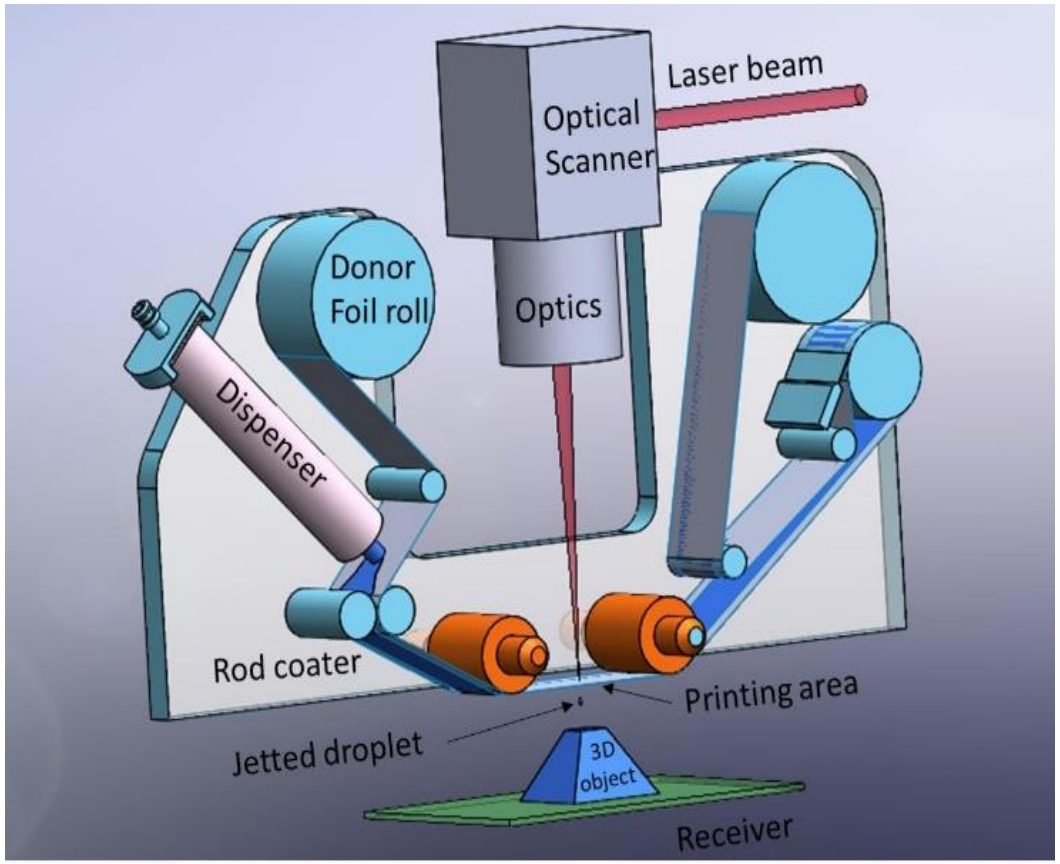
Up to 6 materials

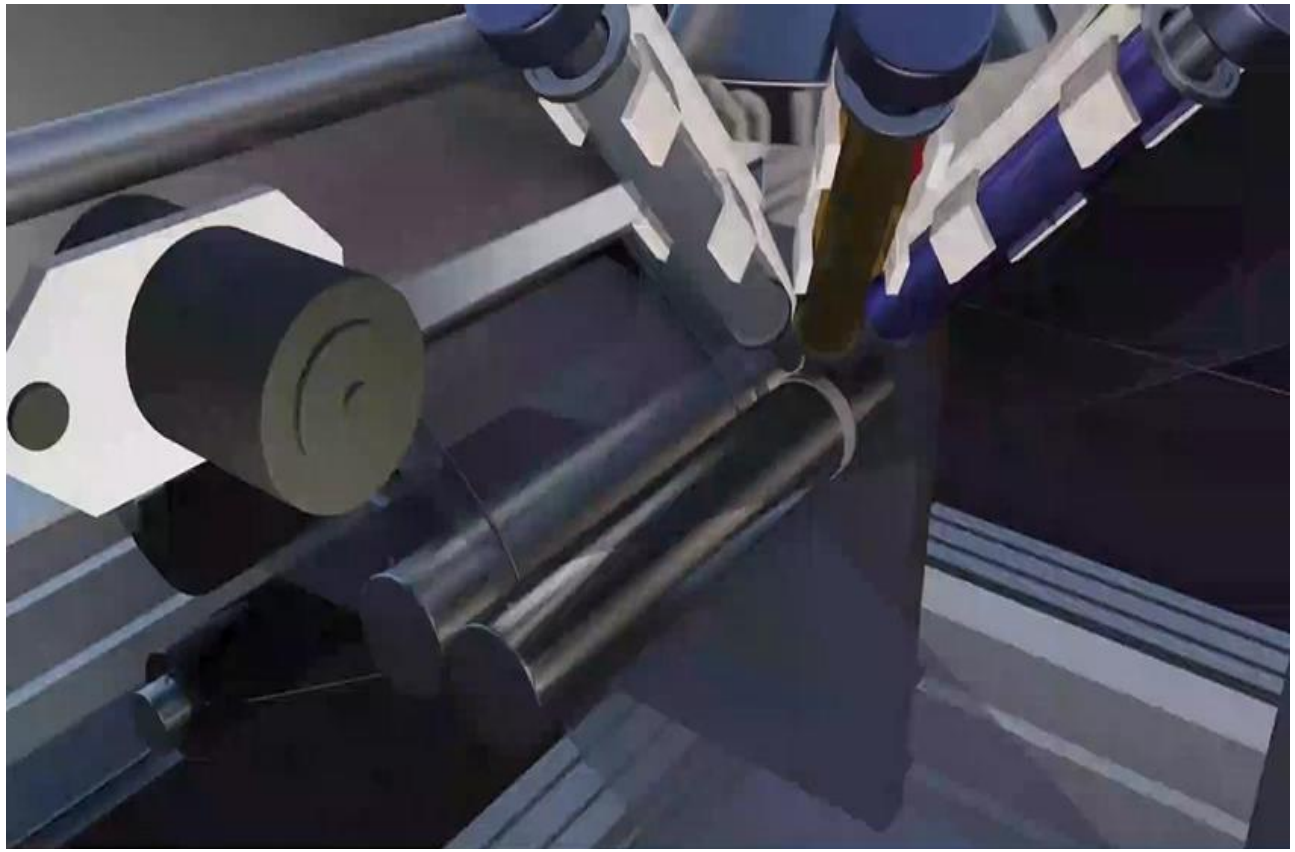
Fast & efficient

Up to 300cm^3 / hour

Breakthrough Technologies For Additive Mass-Manufacturing

Innovative Dispensing Principle





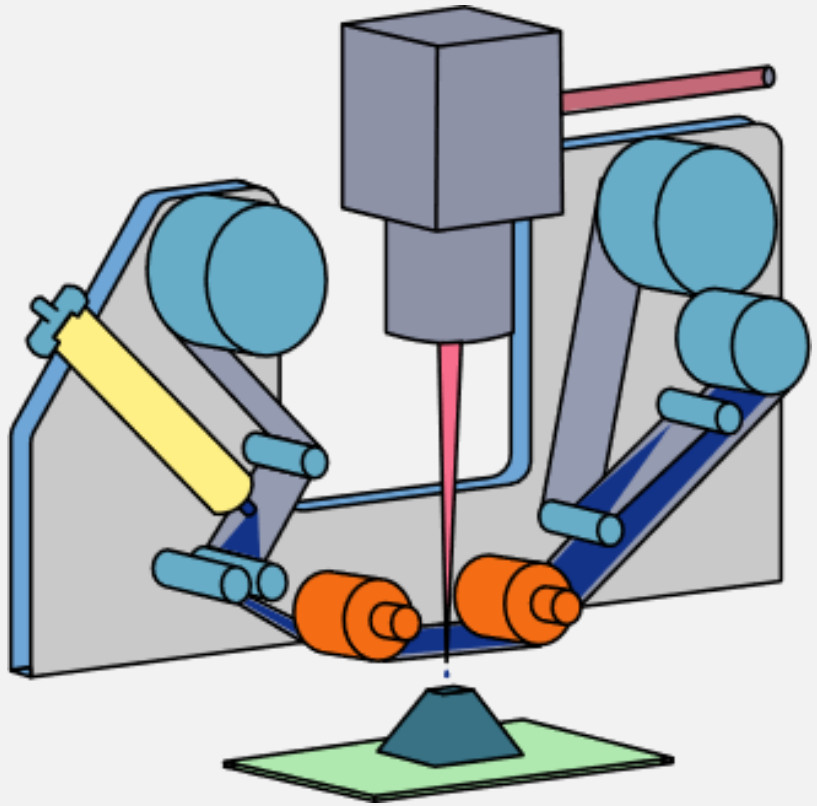
HOW WE PRINT THE UNPRINTABLE

deep innovation with 24 patent families

Nozzle-free laser jetting technology

Material of any viscosity can be used

BUILD PROCESS	IN-LINE POST- PROCESS	
Nozzle-free technology	Multi curing	Finishing
Layered molding process	UV / Therma	Laser sintering
		Laser ablation



Patent #10144034, 3D laser printing

Patent #10603684, coating system, application 16/694,616 granted

HOW WE PRINT THE UNPRINTABLE

deep innovation with 24 patent families

In-line post-processing

Complete in-line workflow

BUILD PROCESS	IN-LINE POST- PROCESS	
Nozzle-free technology	Multi curing	Finishing
Layered molding process	UV / Therma	Laser sintering
		Laser ablation

Multi Curing

UV curing

Thermal curing

Finishing

Laser sintering

Laser ablation

3 Patents
new 3D printing methods

7 Patents
Coating, Leveling and curing systems

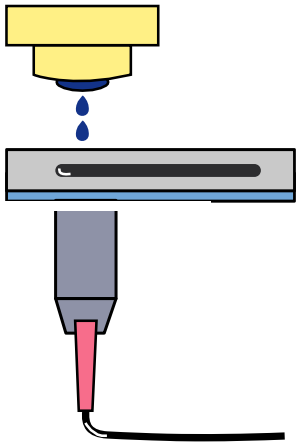
6 Patents
conductive materials printing

Breakthrough Technologies For Additive Mass-Manufacturing

From mechanical technologies to laser jetting

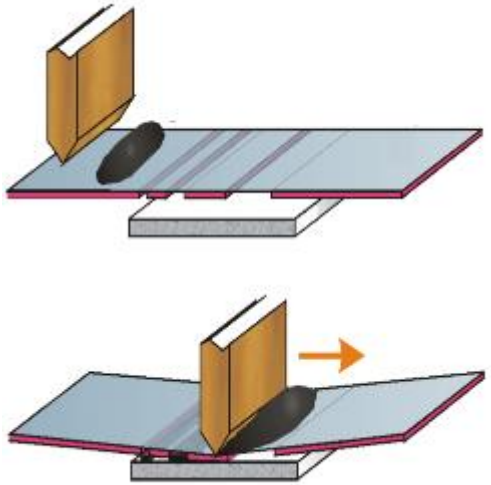
TRADITIONAL DIGITAL

Nozzle size defines
Viscosity, speed
and resolution



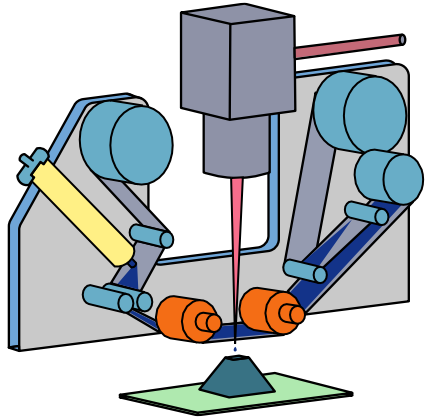
TRADITIONAL NON-DIGITAL

Mesh size defines
Layer thickness
and resolution



LASER JET

No nozzle, no mesh
Full flexibility



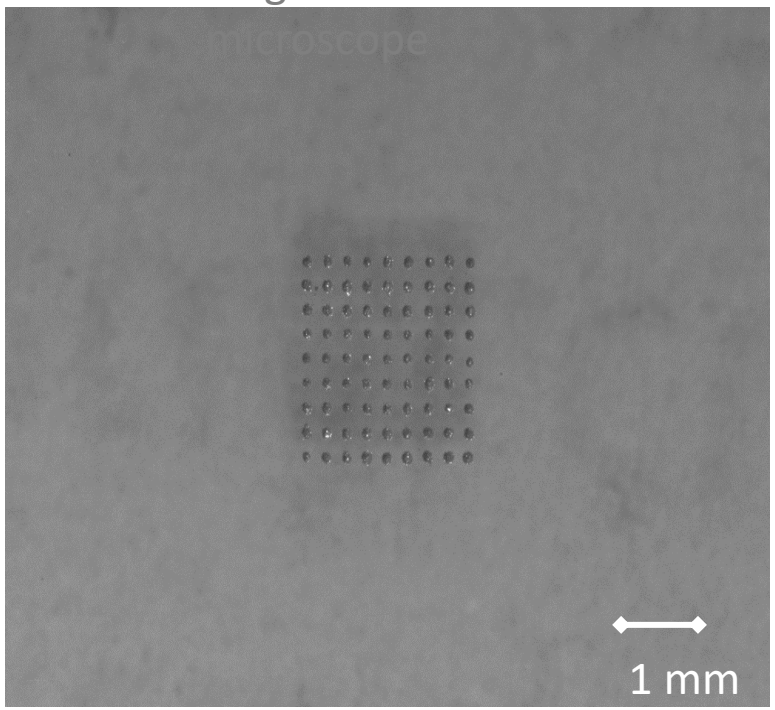
Technology comparison for high viscosity materials

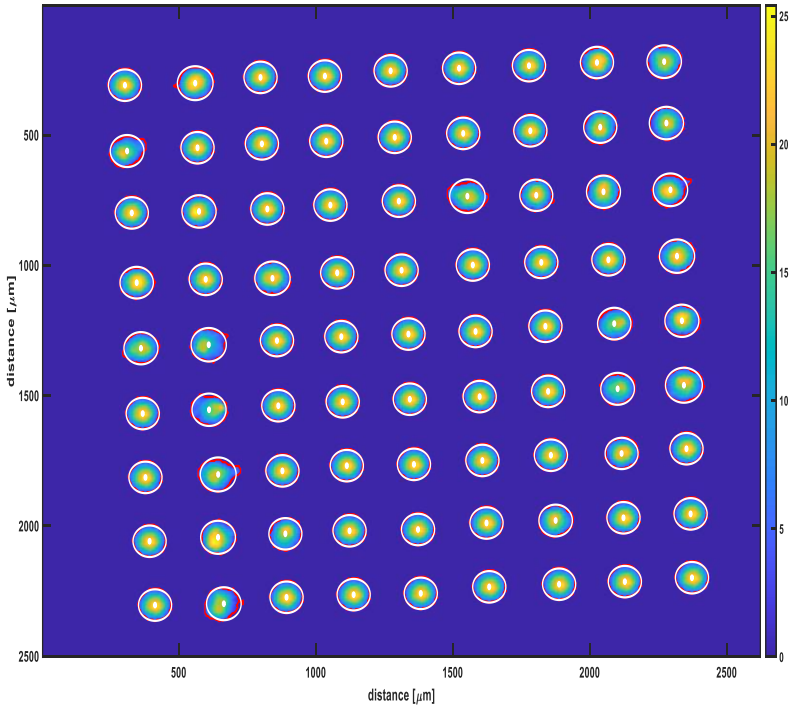
Technology	Dispensing	Screen Printing	IO Tech
Digital	✓	X	✓
Multiple materials	✓	X	✓
Direct post-process	X	X	✓
Dynamic resolution	X *	X	✓
Multiple layers	✓	X *	✓
Resolution	+	++	+++
Speed	+	+++	++
Maintenance	$$	$$	$

Die attached conductive epoxy glue QMI529HT

Droplet 120 µm

Large field microscope



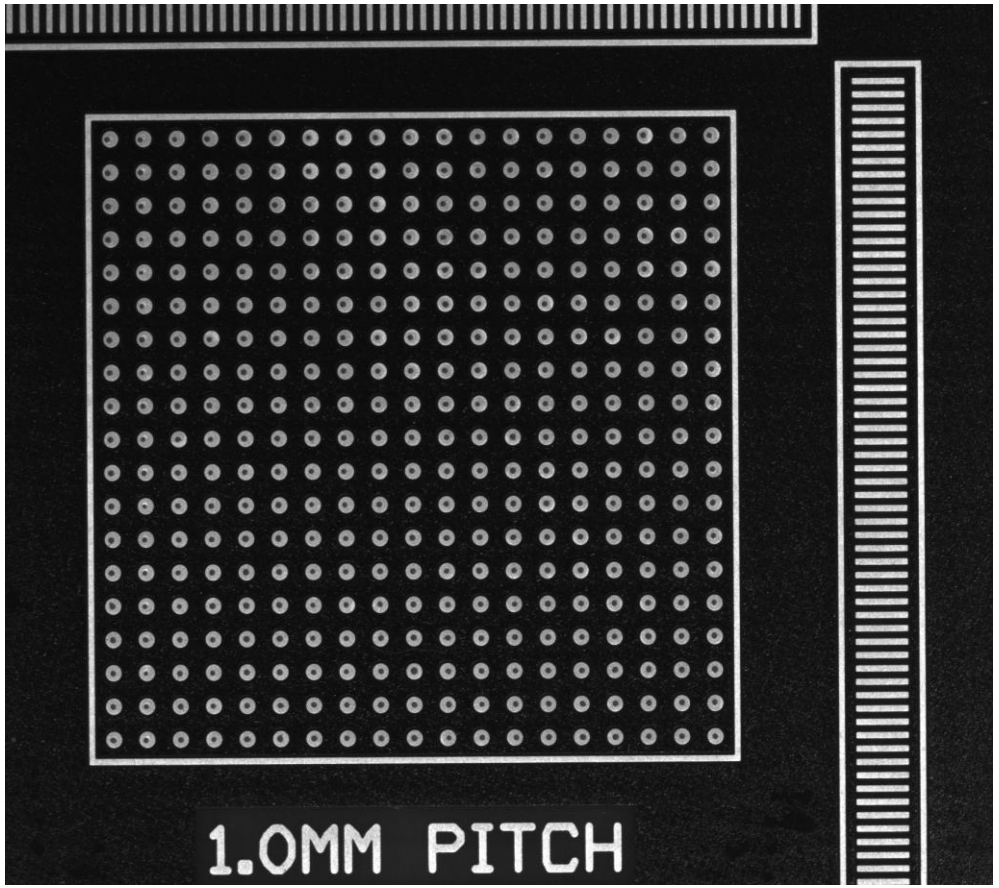


	Average	STD	Pk to Pk
Radius[µm]	61.2	1.45	60-68
Maximum Height [µm]	23.6	1.6	19.32-25.41
Volume [pL]	127	7.6	105-150
Average Height [µm]	10.92	0.61	8.37-12

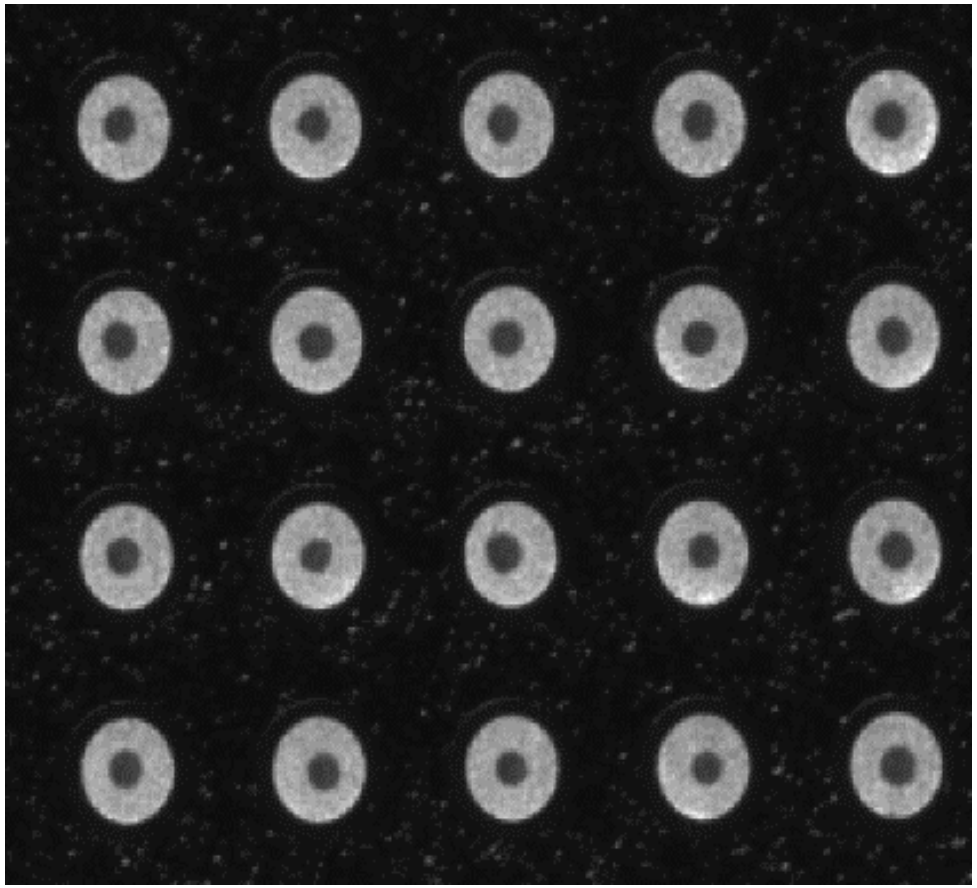
Breakthrough Technologies For Additive Mass-Manufacturing

Solder paste type-6

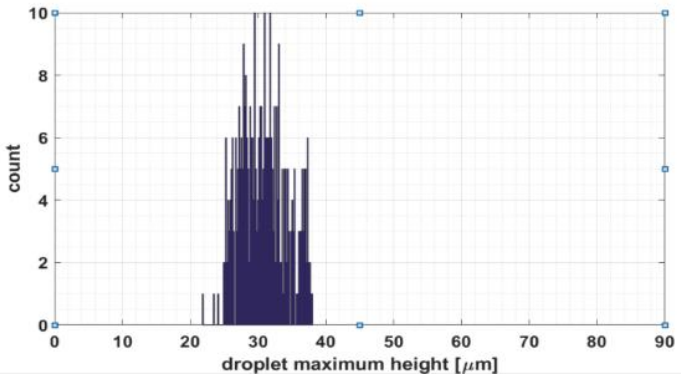
Large field telecentric objective

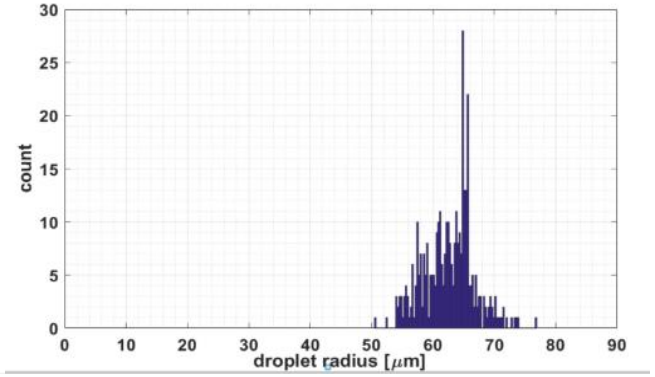


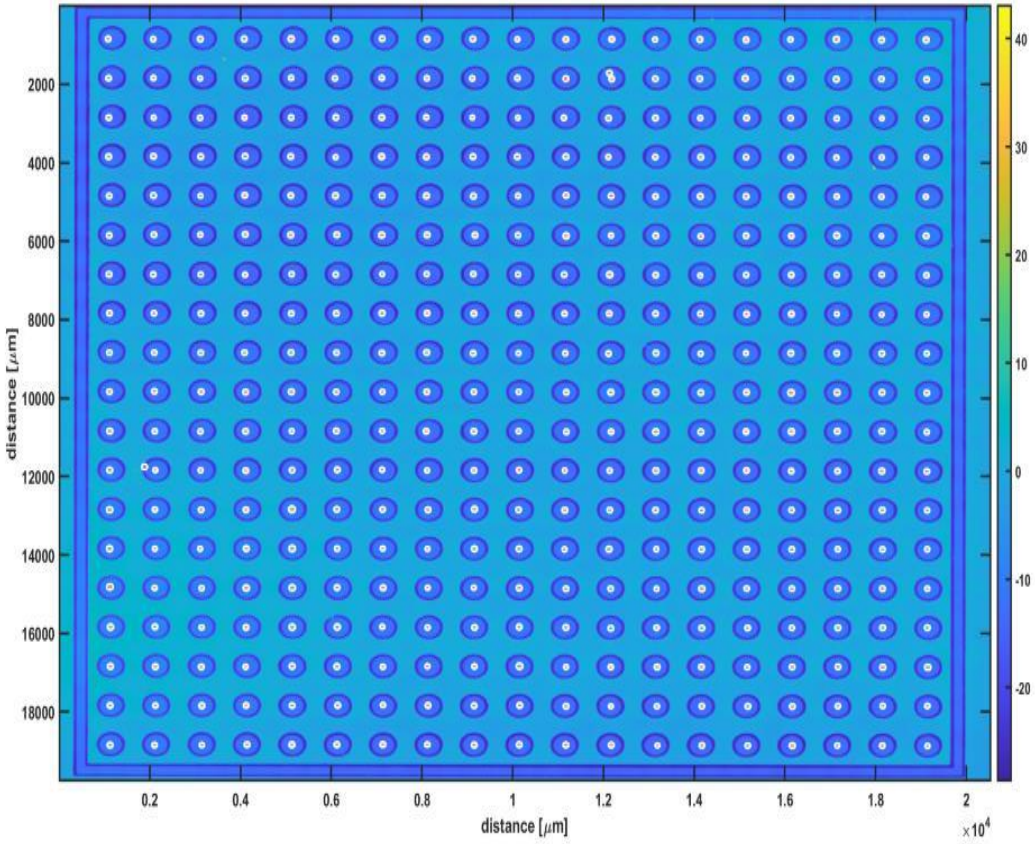
Digital zoom



Solder paste type-6



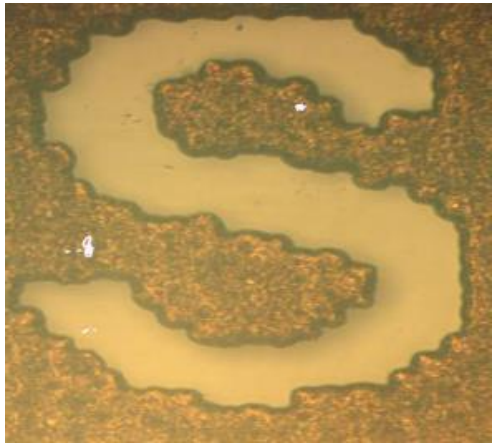


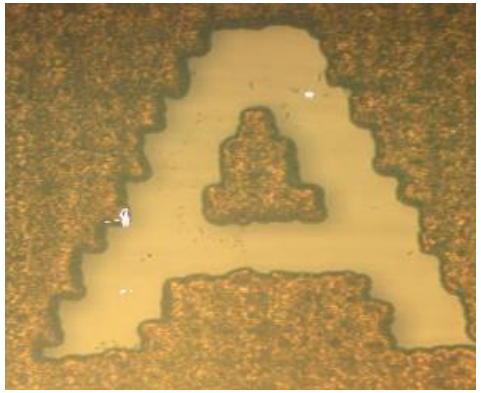


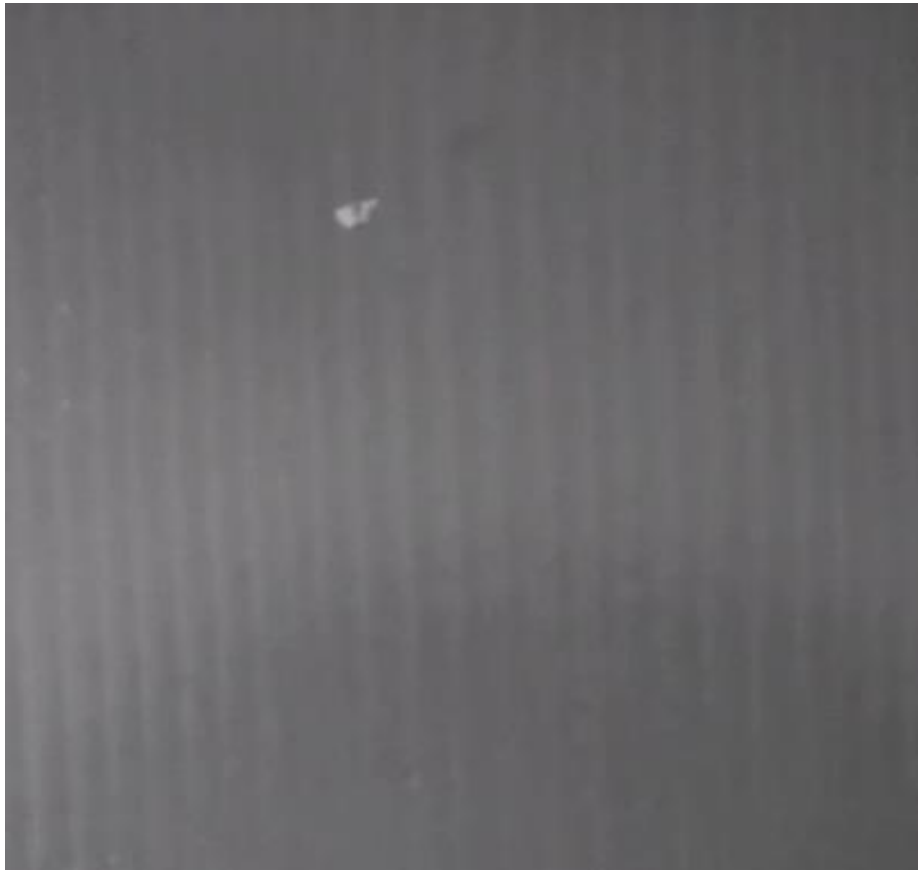
	Average	Std	Min	Max
Radius [um]	62.7	4.1	50.5	76.9
Height Max [um]	30.8	3.4	21.8	38

Breakthrough Technologies For Additive Mass-Manufacturing

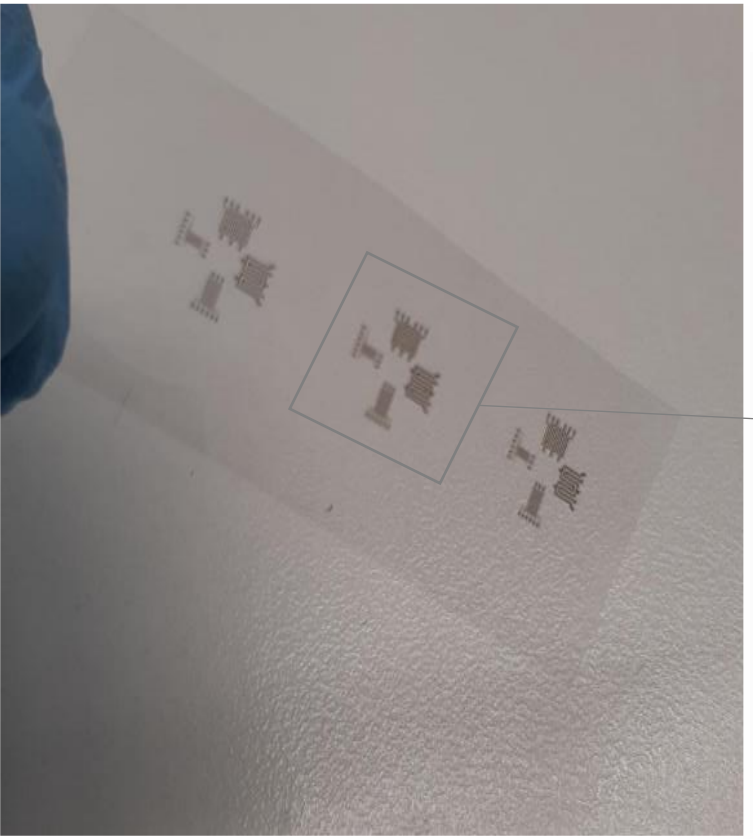
Printing of metal pattern

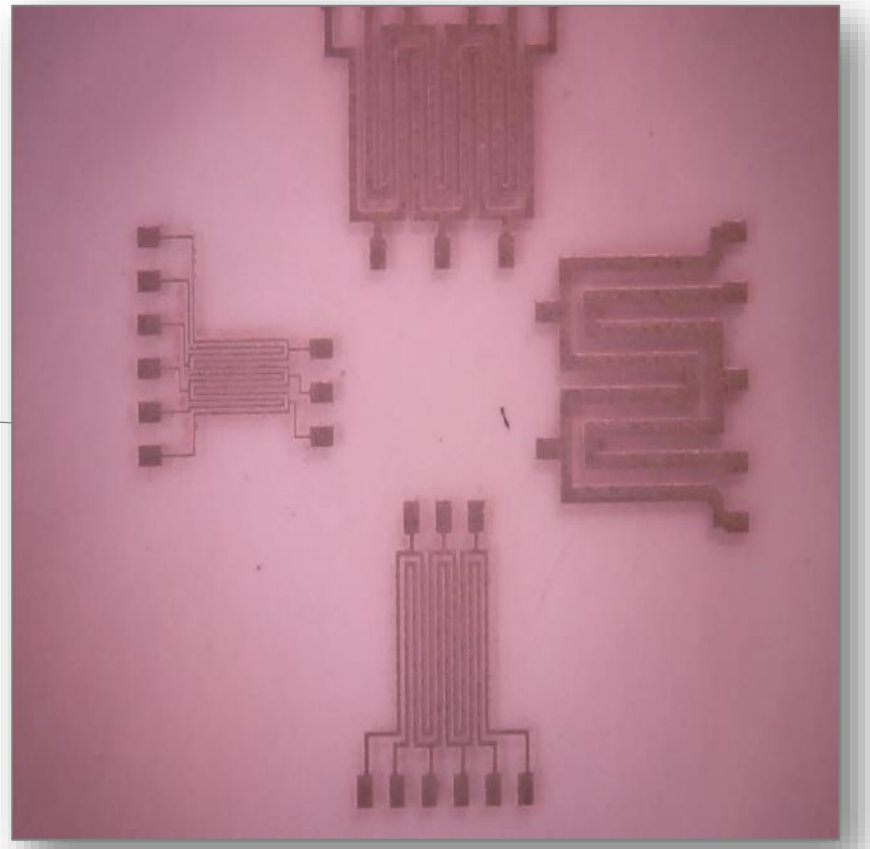


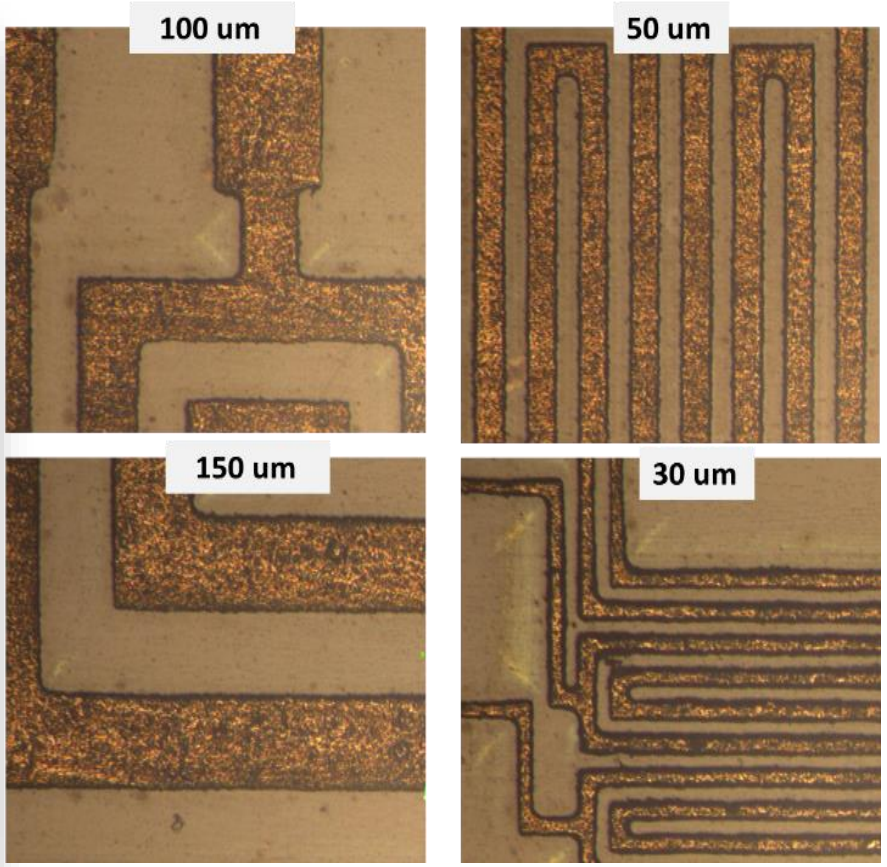




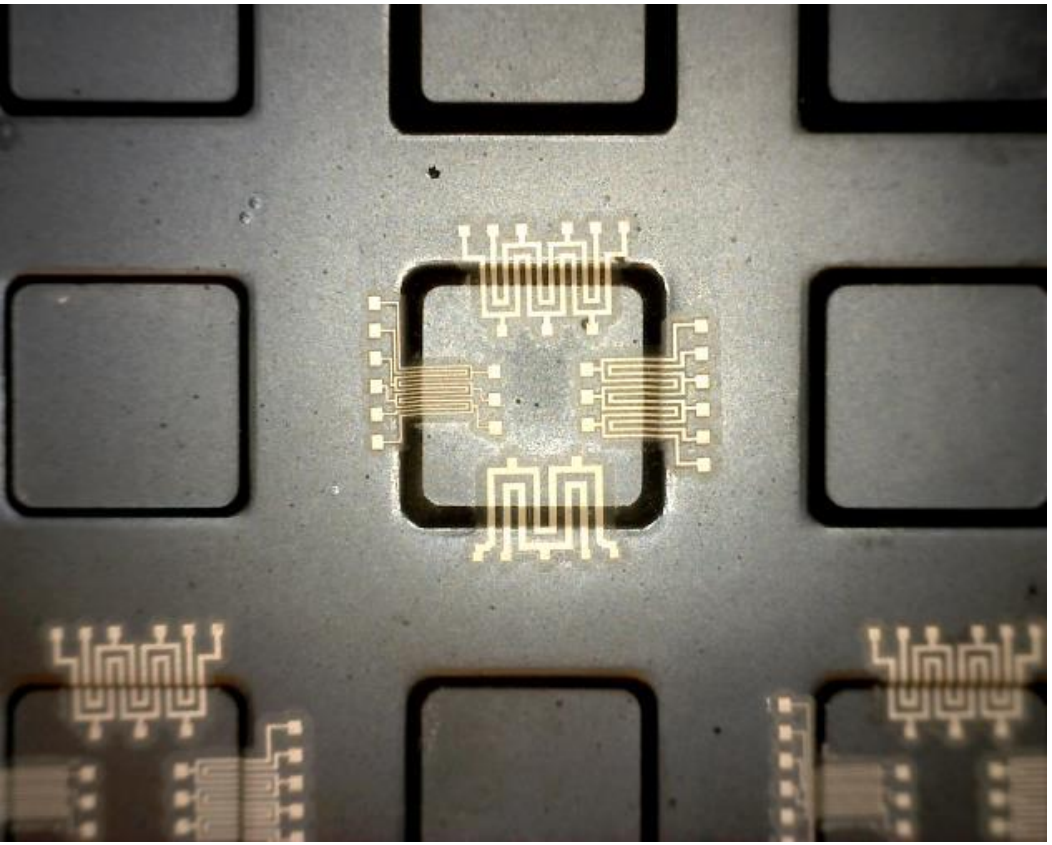
Printing of conductive track on flexible substrate



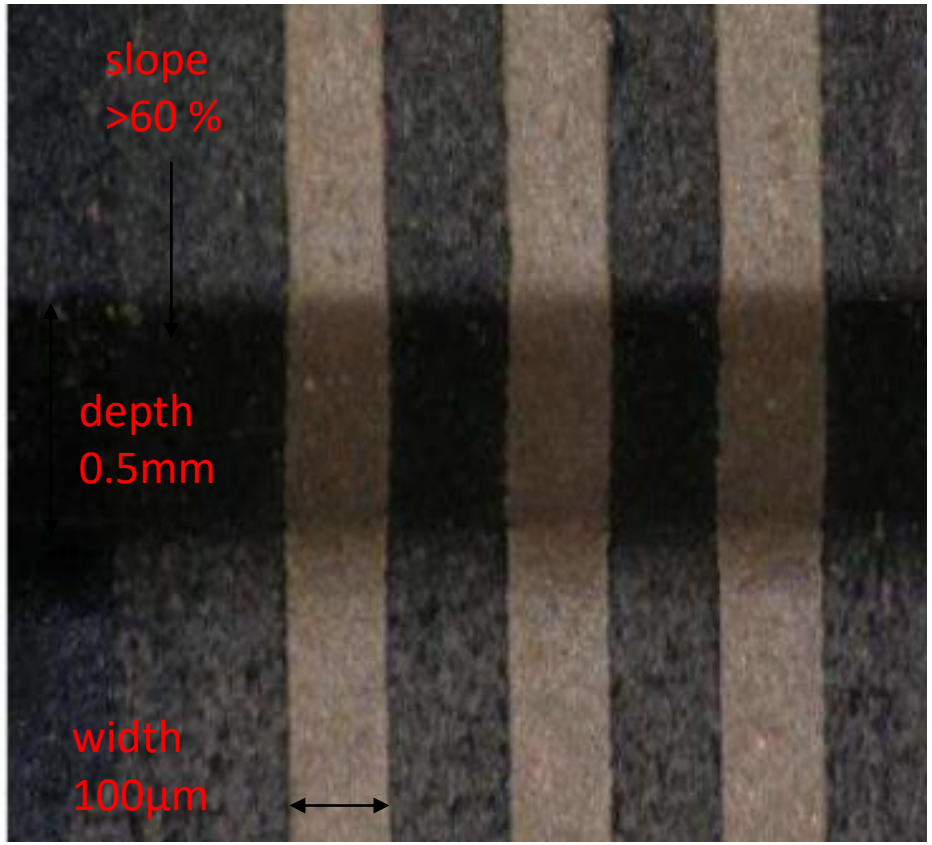




Printing of conductive track on non-conformal substrate

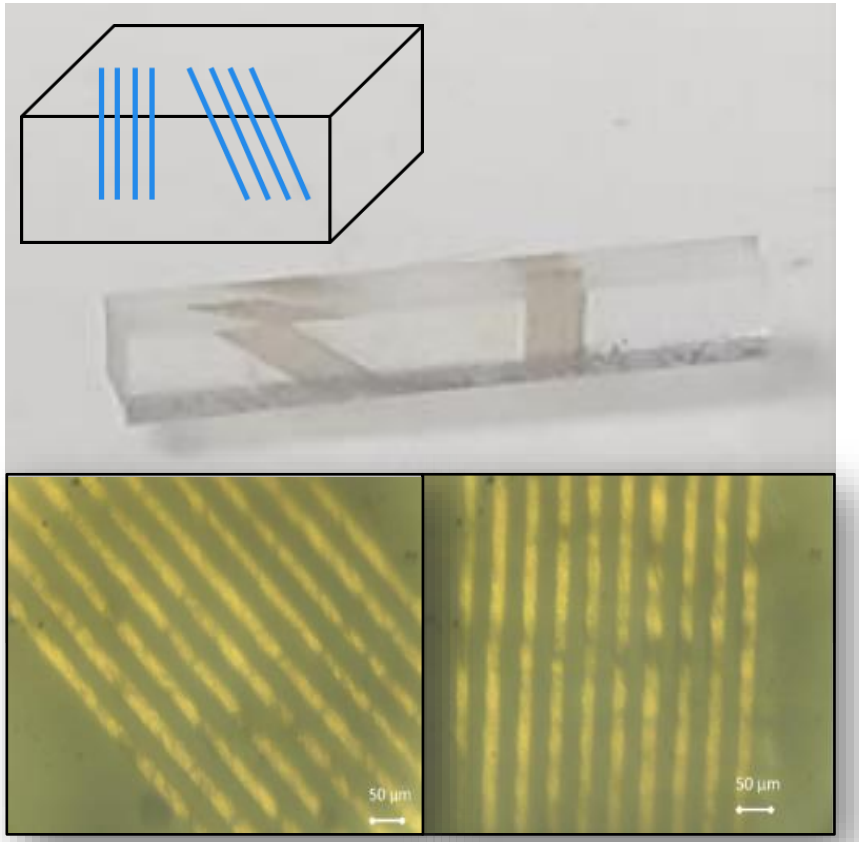


metal line on a slope



PRINTING MULTIPLE MATERIALS (ORGANIC/METAL)

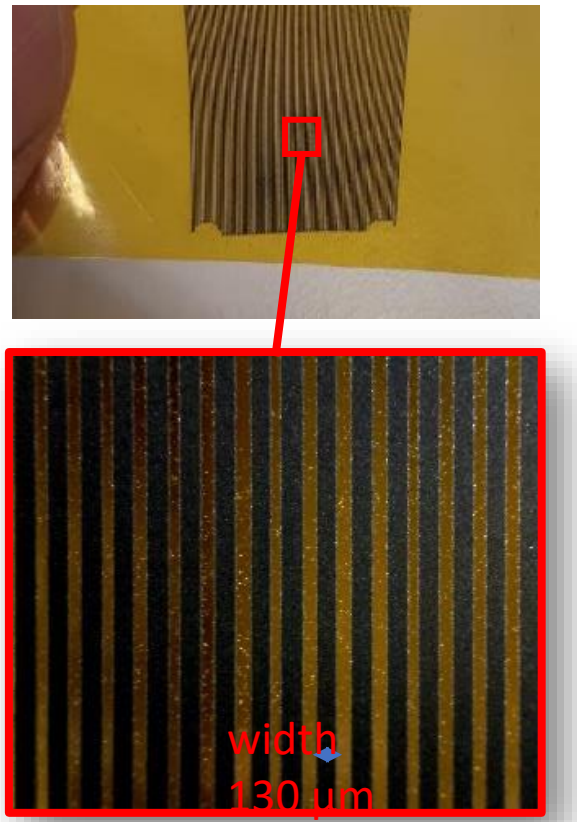
fine metal line in elastomer



conductor & dielectric on metal

PRINTING MULTIPLE LAYERS/MATERIALS (ORGANIC/METAL)

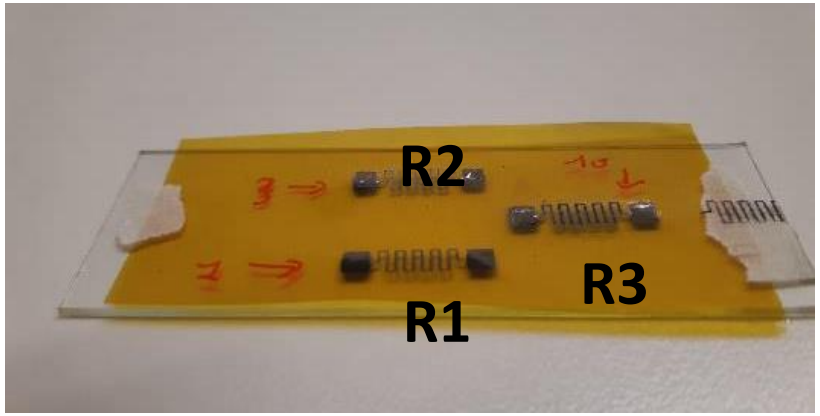
fine carbon line on flexible substrate



carbon and silver together

PRINTING MULTIPLE LAYERS/MATERIALS (ORGANIC/METAL)

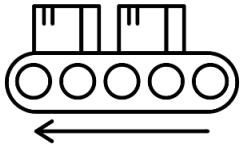
carbon and silver printed at different aspect ratios



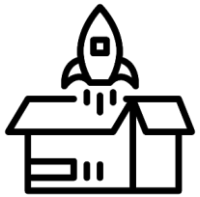
Resistor	# of print	Thickness [µm]	Resistance Pre-sintering [Ω]	Resistance Post-sintering [Ω]
1	1	14	39k	12.50 k
2	3	42	13k	4.16 k
3	10	140	4k	0.81 k

Breakthrough Technologies For Additive Mass-Manufacturing

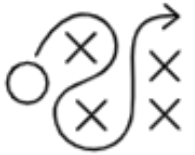
DELIVERING MULTIPLE BENEFITS ACROSS INDUSTRIES



Commercial-ready functional objects
Not prototyping



Enhanced functional properties
Wide range of currently unprintable industrial materials



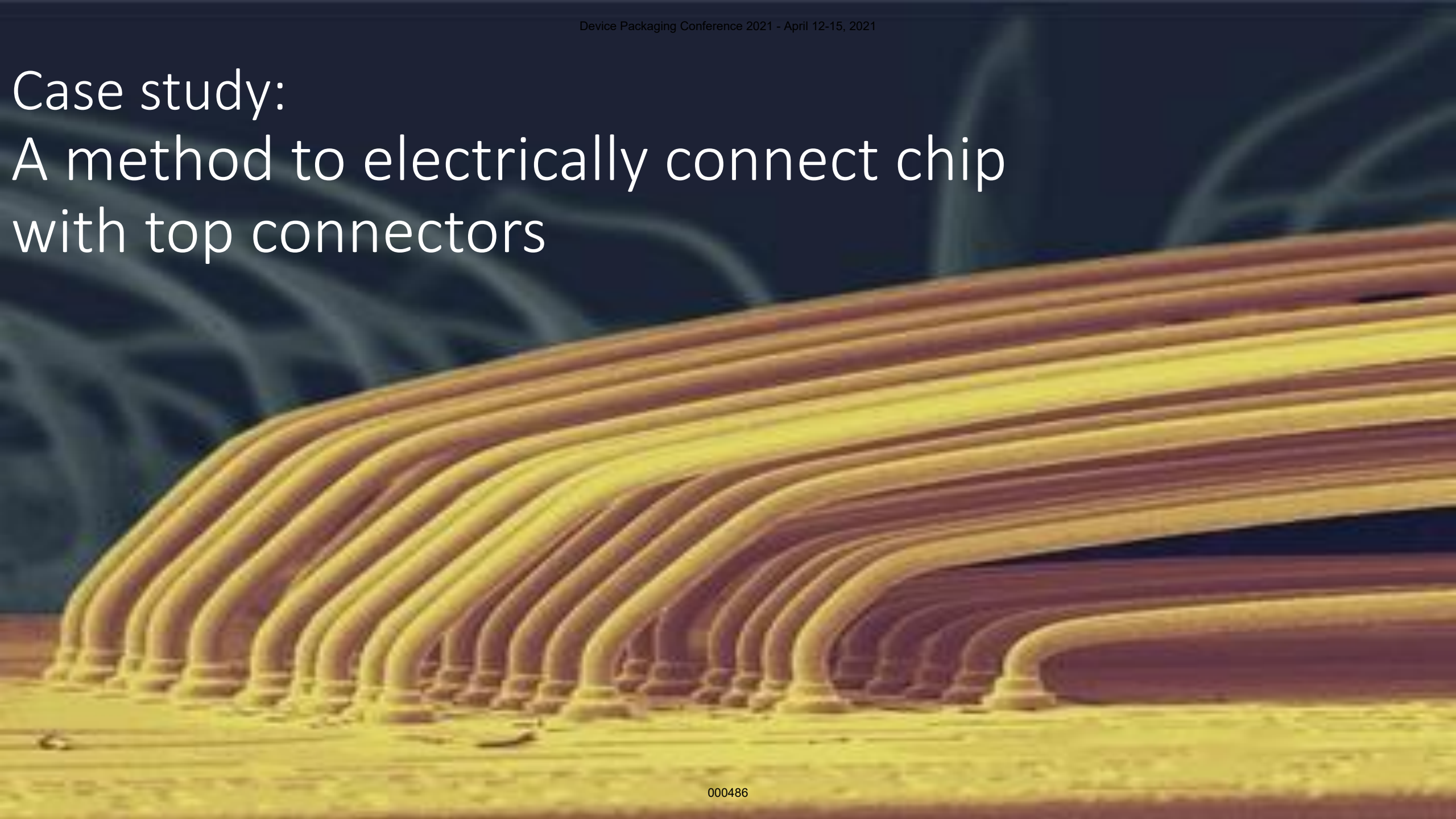
Manufacturing flexibility
Volume, design, customization, material properties

Inspiring innovation
Unlimited designs with multi-material combinations

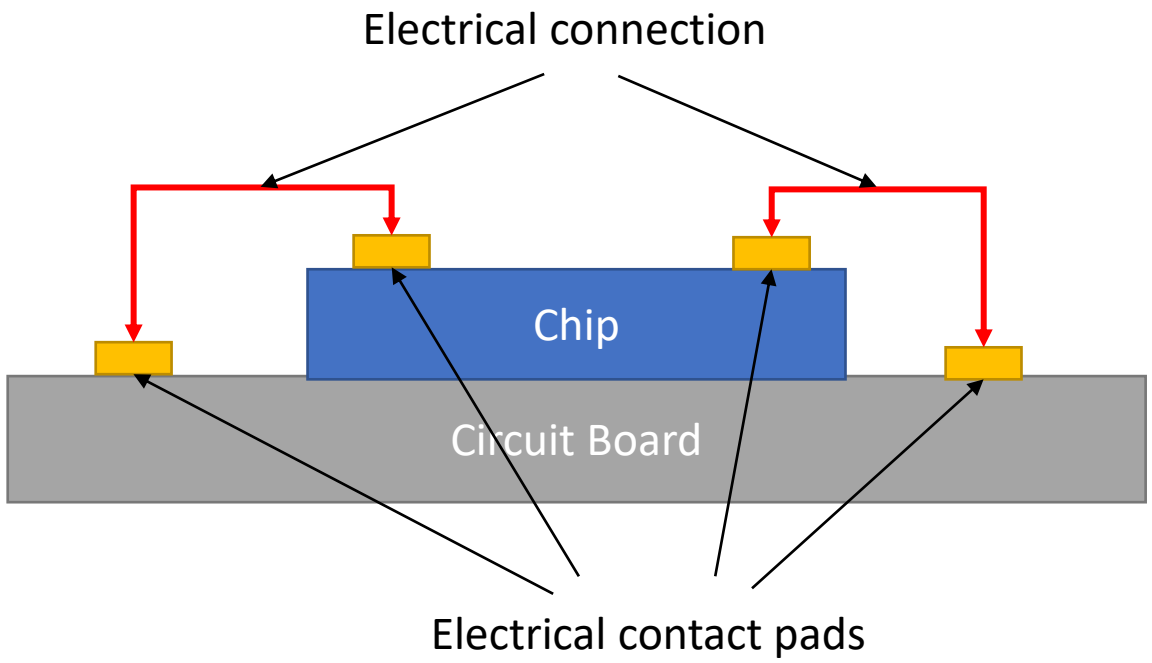
Lower cost of ownership
Simple maintenance and no expensive consumables

Faster & simpler production process
integrating multiple production steps

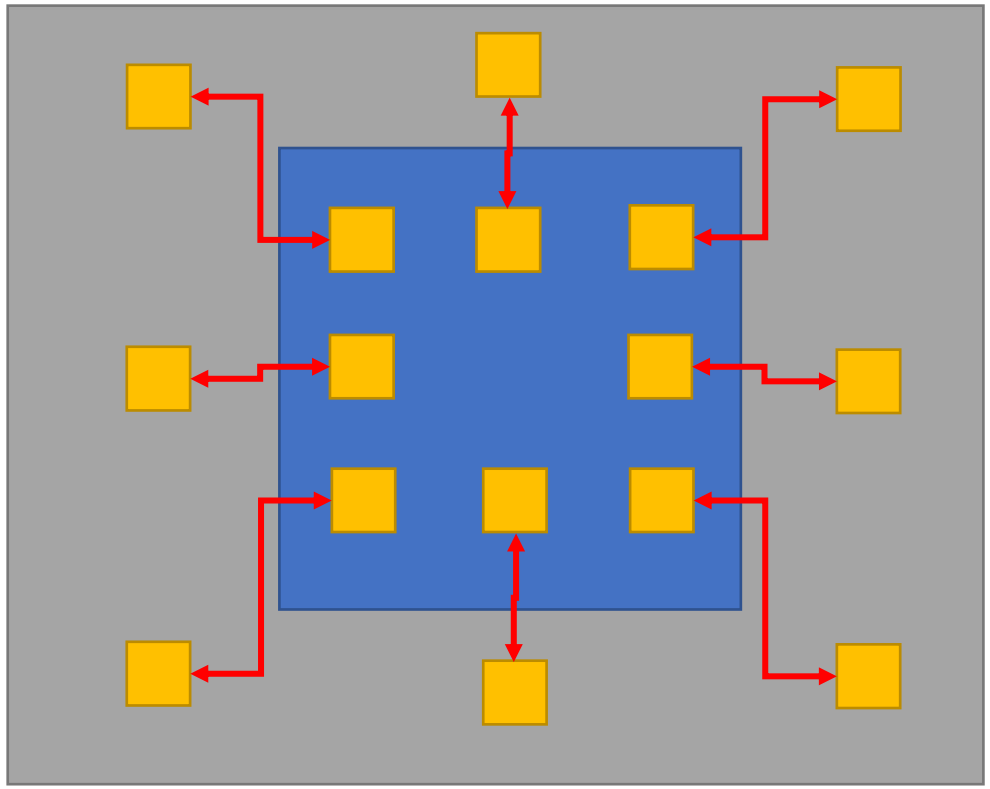
Case study:
A method to electrically connect chip with top connectors

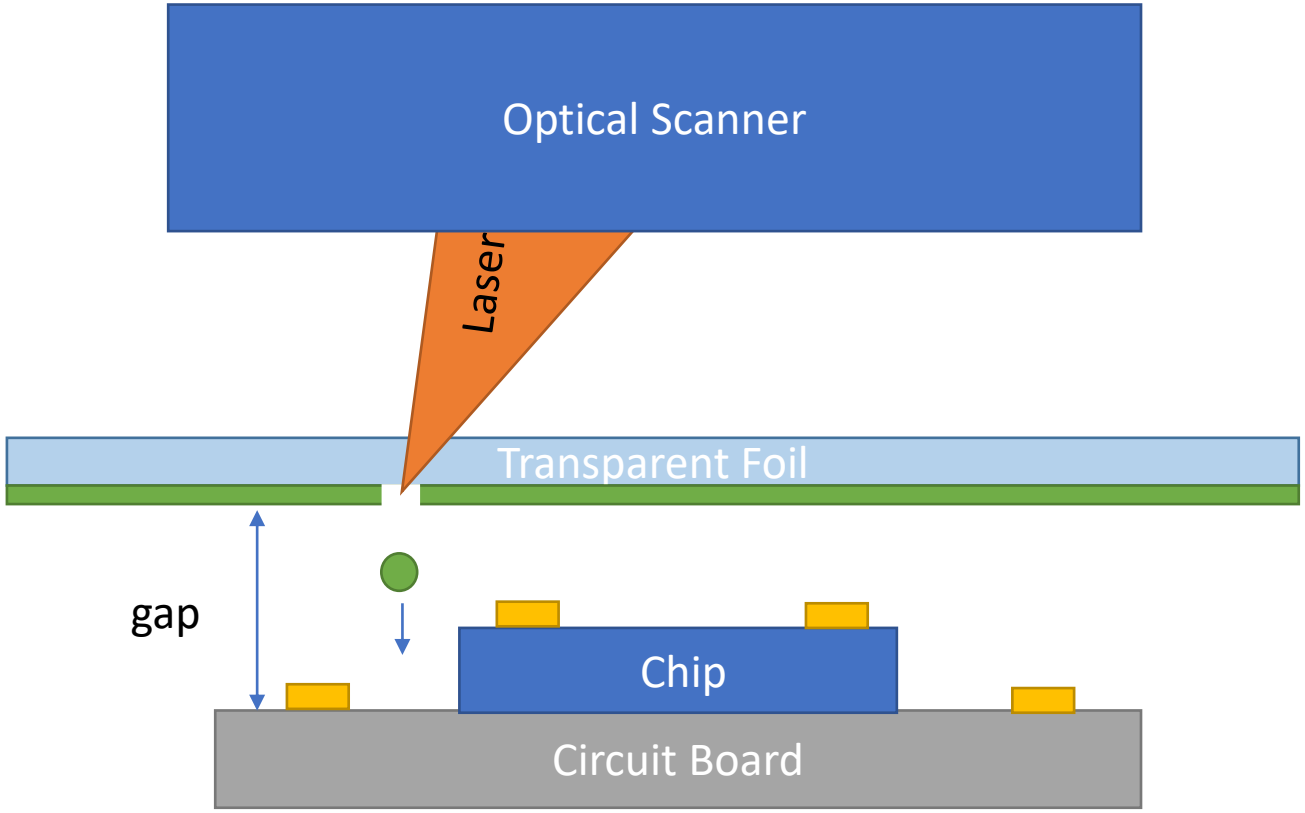


SIDE VIEW

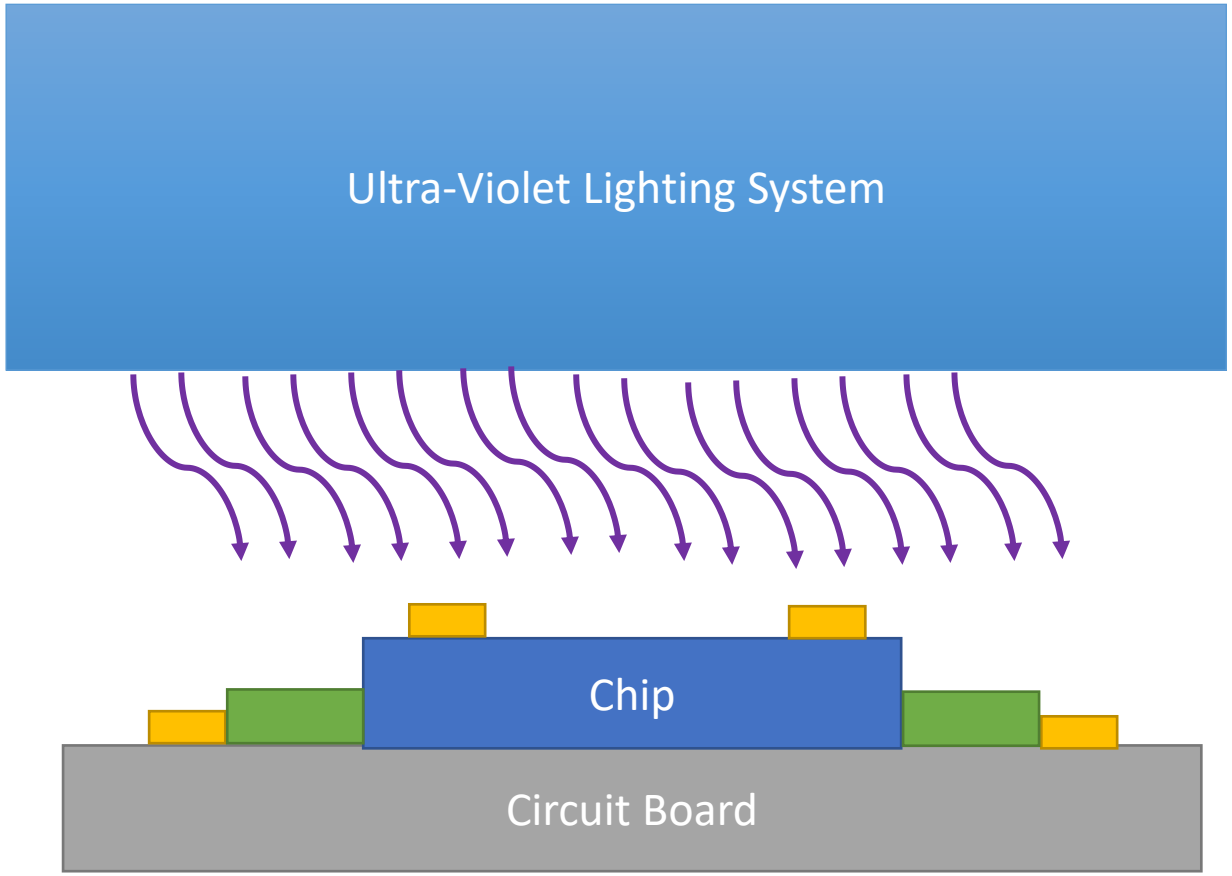


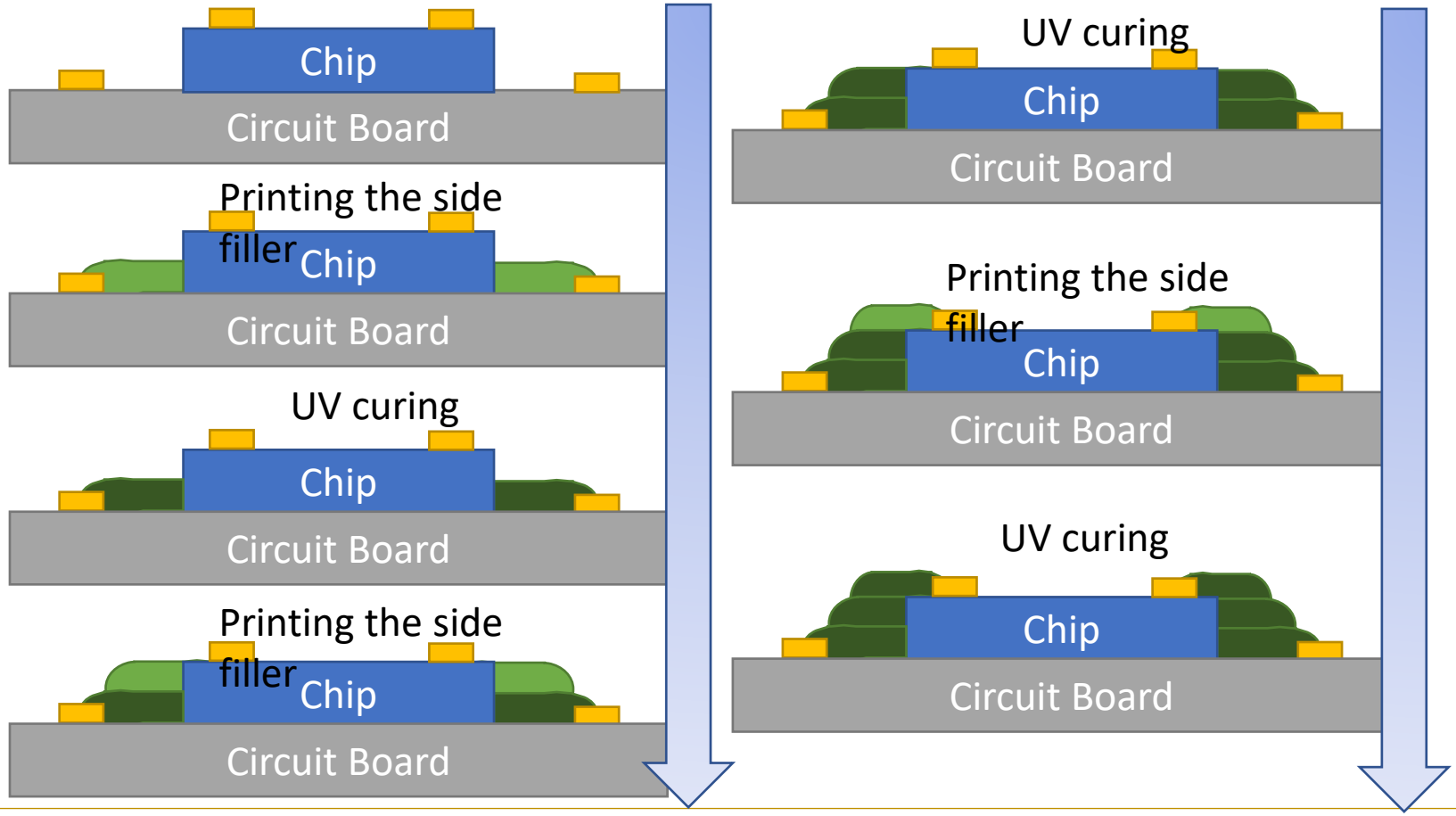
TOP VIEW

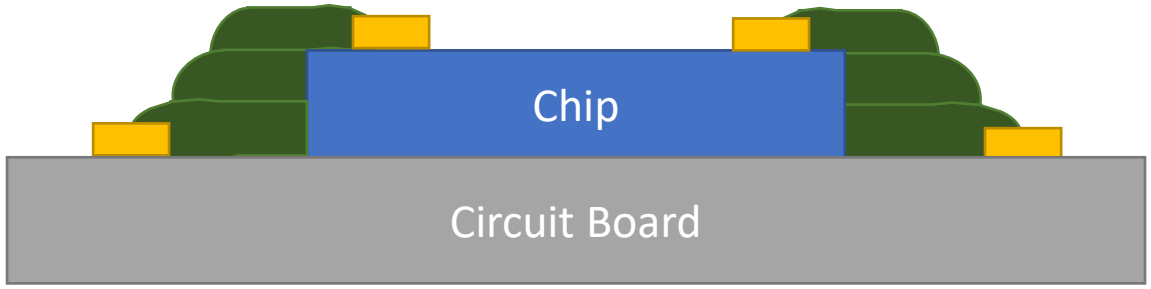


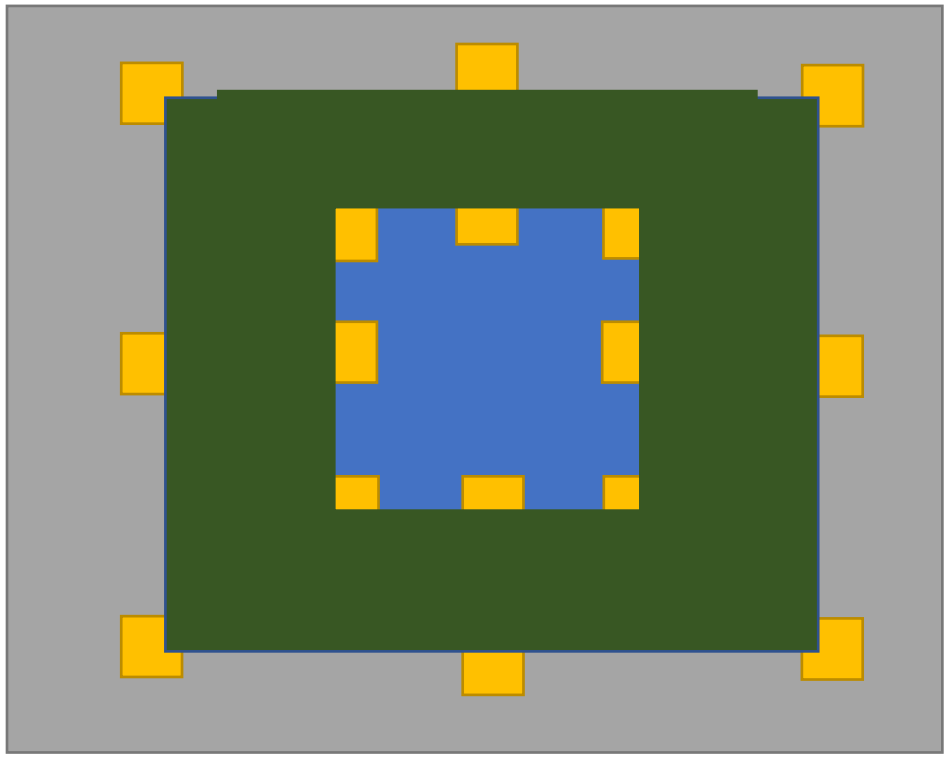


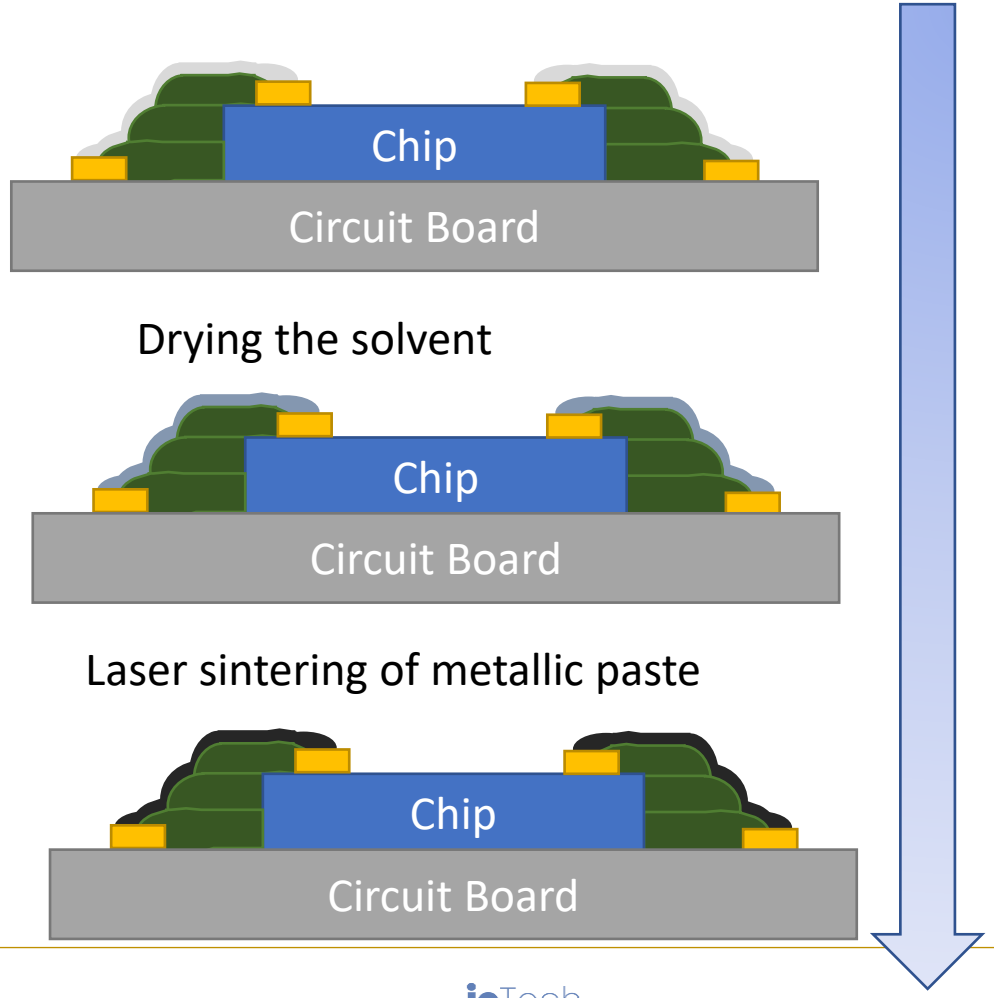
Micro-deposition by laser printing


Ultra-Violet Lighting System
Chip
Circuit Board

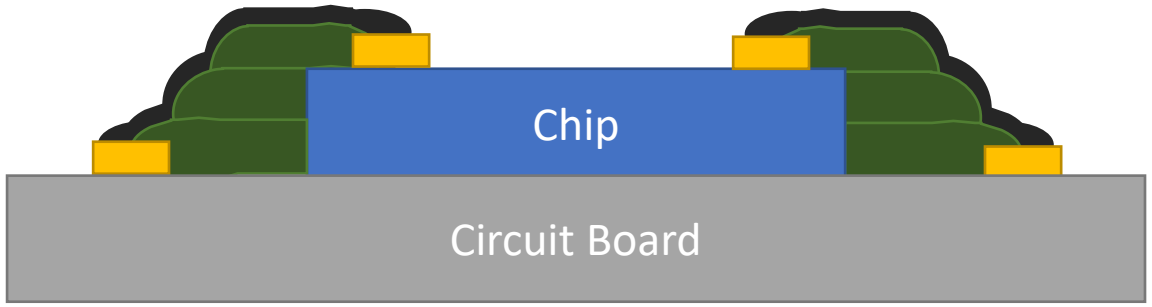

Chip
Circuit Board
Printing the side filler
Chip
Circuit Board
UV curing
Chip
Circuit Board
Printing the side filler
Chip
Circuit Board
UV curing
Chip
Circuit Board
UV curing
Chip
Circuit Board
Printing the side filler
Chip
Circuit Board
UV curing
Chip
Circuit Board

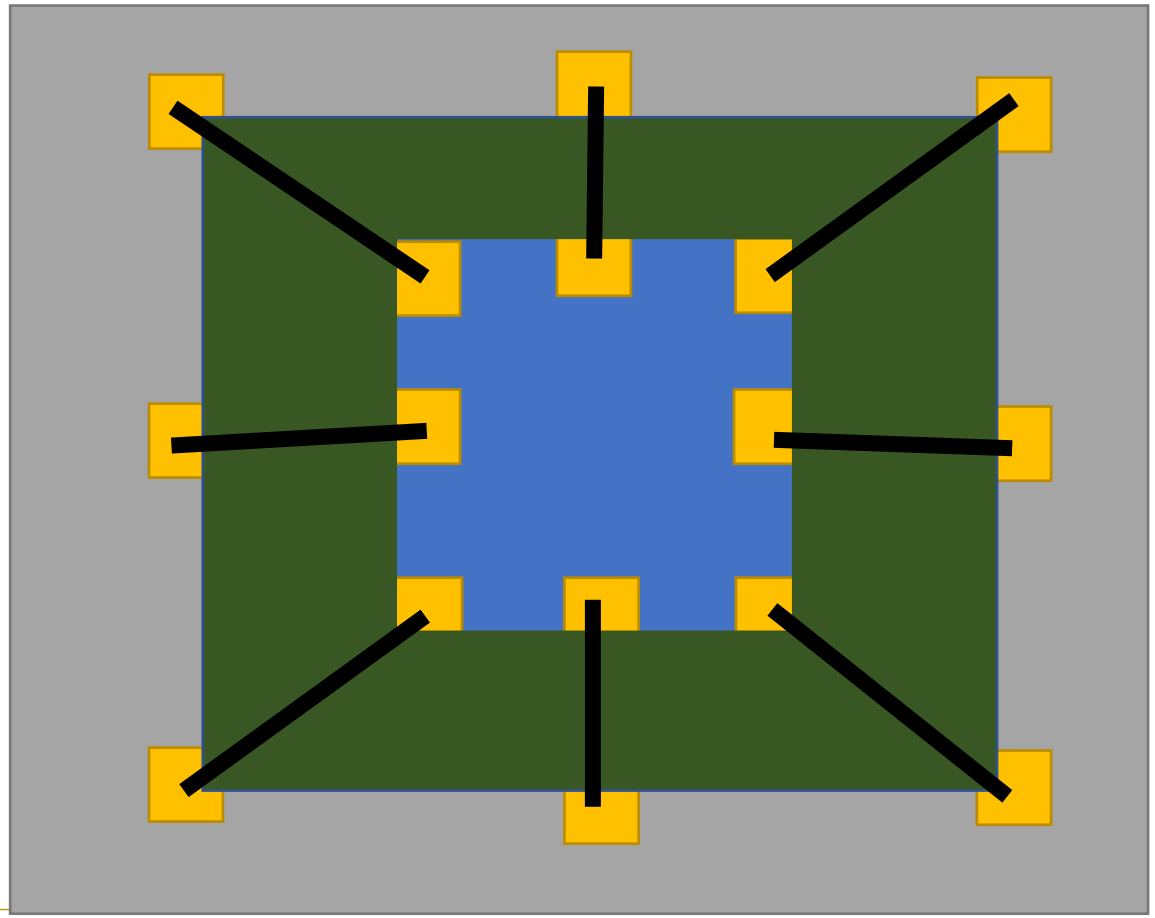

Chip
Circuit Board



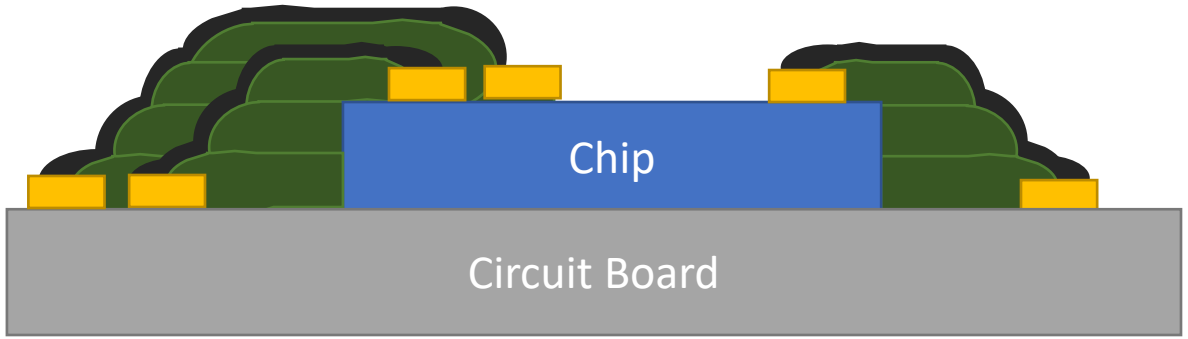

Chip
Circuit Board
Drying the solvent
Chip
Circuit Board
Laser sintering of metallic paste
Chip
Circuit Board

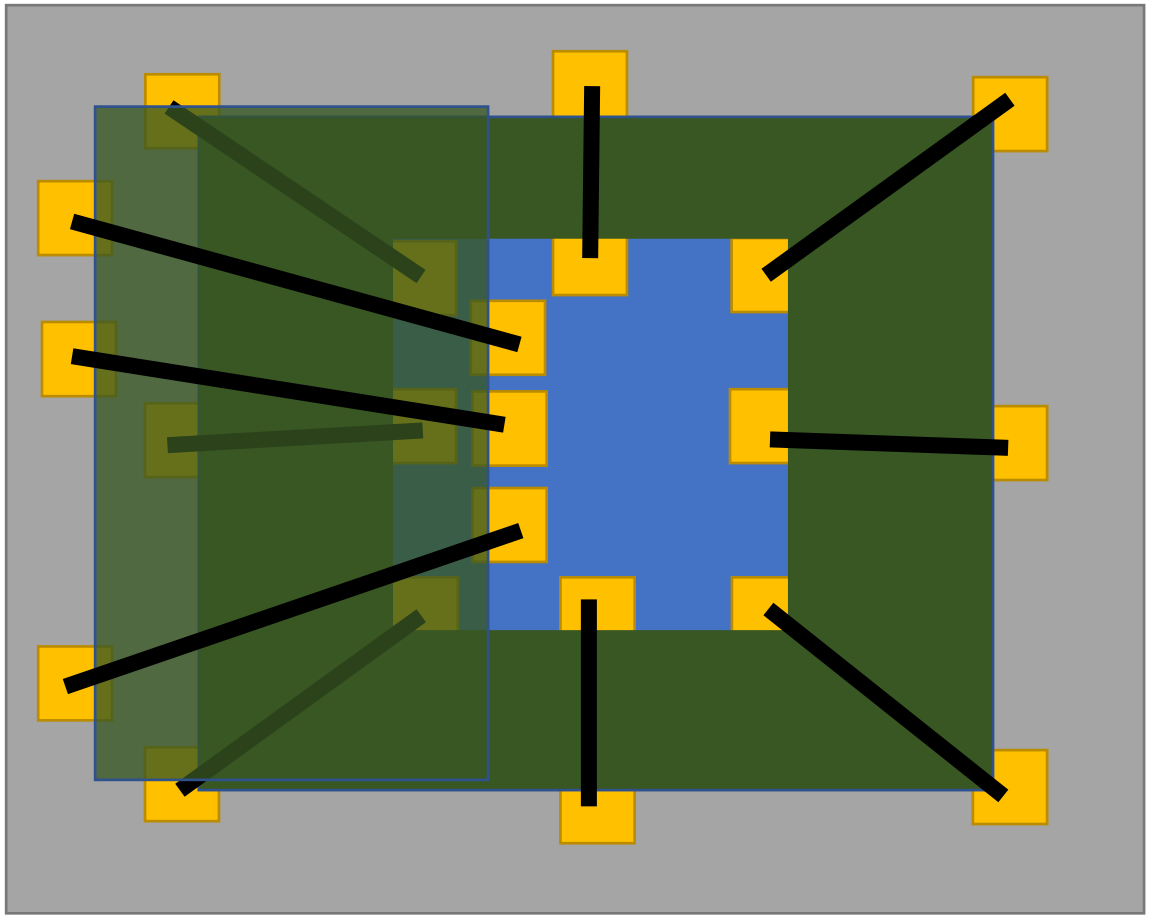
AFTER PRINTING OF THE CONDUCTORS PATTERN

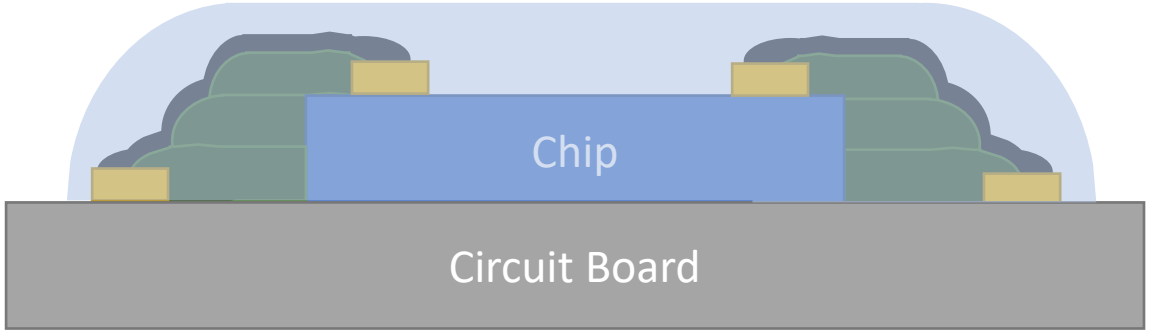


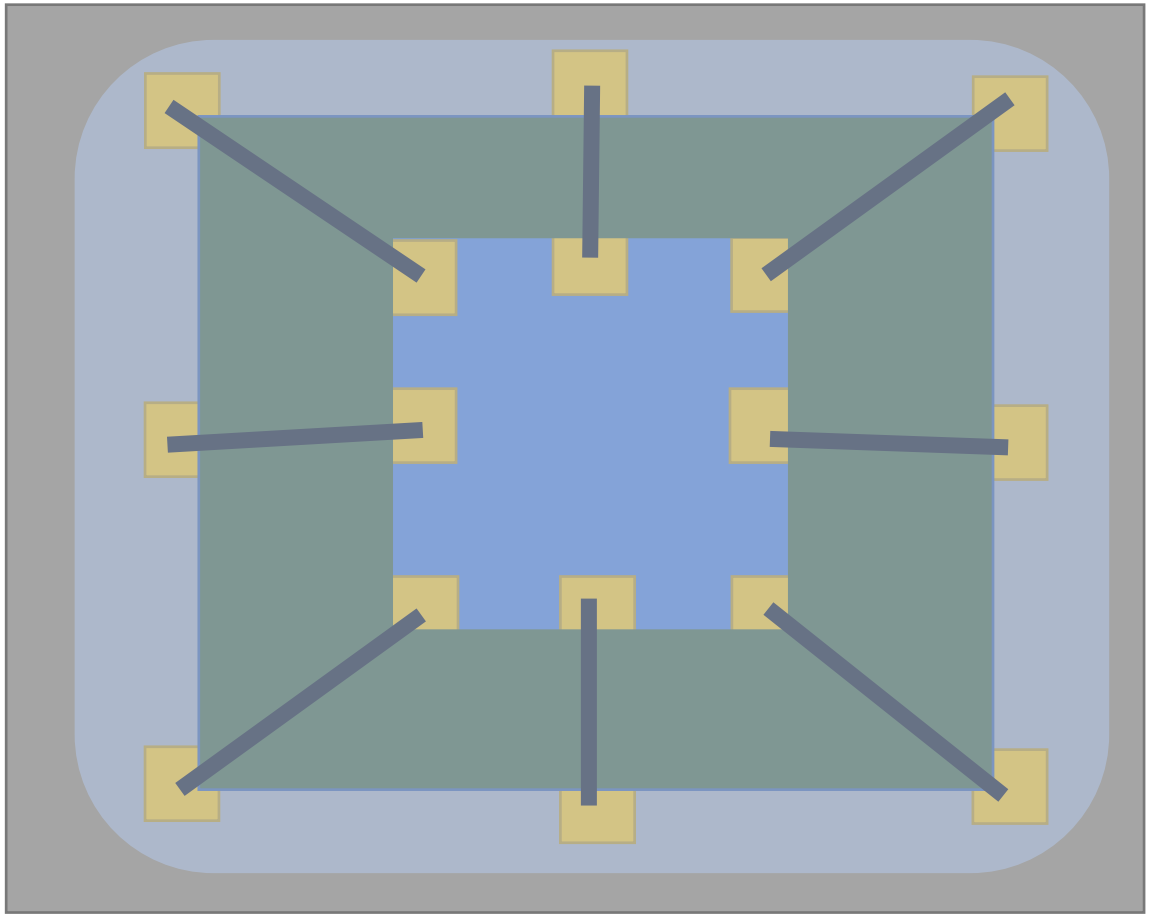


MULTI STEP






Chip
Circuit Board



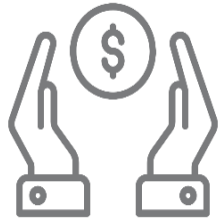
P.O.C APPLICATIONS

- Ball deposition via dispensing
- Digital screen printing
- Via filling
- Via to via conductive interconnect
- Conformal coating : waterproof , passivation layer, protective layer, …
- … and more …

COLLABORATION MODEL

OEM Products

ioTech print engine integrated in partner solution



Branded Products

Complete solution for manufacturers

ioTech

THANK YOU!

Hervé Javice hjavice@i-o-tech.com +972 54 309 4985