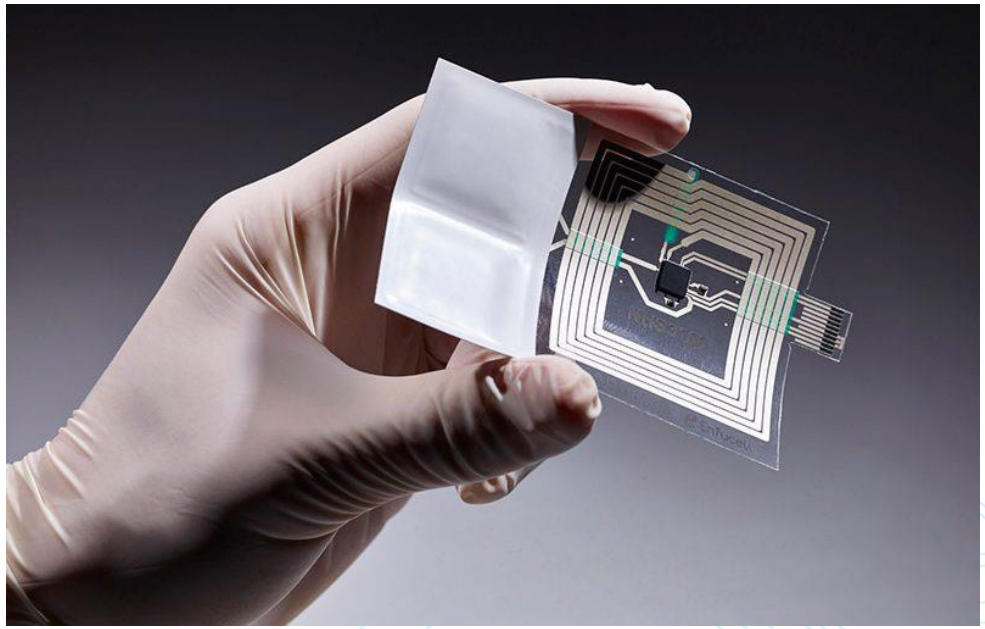
LEE-BED

Bring your ideas and concepts to market using lightweight, flexible, printed electronics

Pilot line Infrastructure

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814485

What is lightweight embedded electronics?



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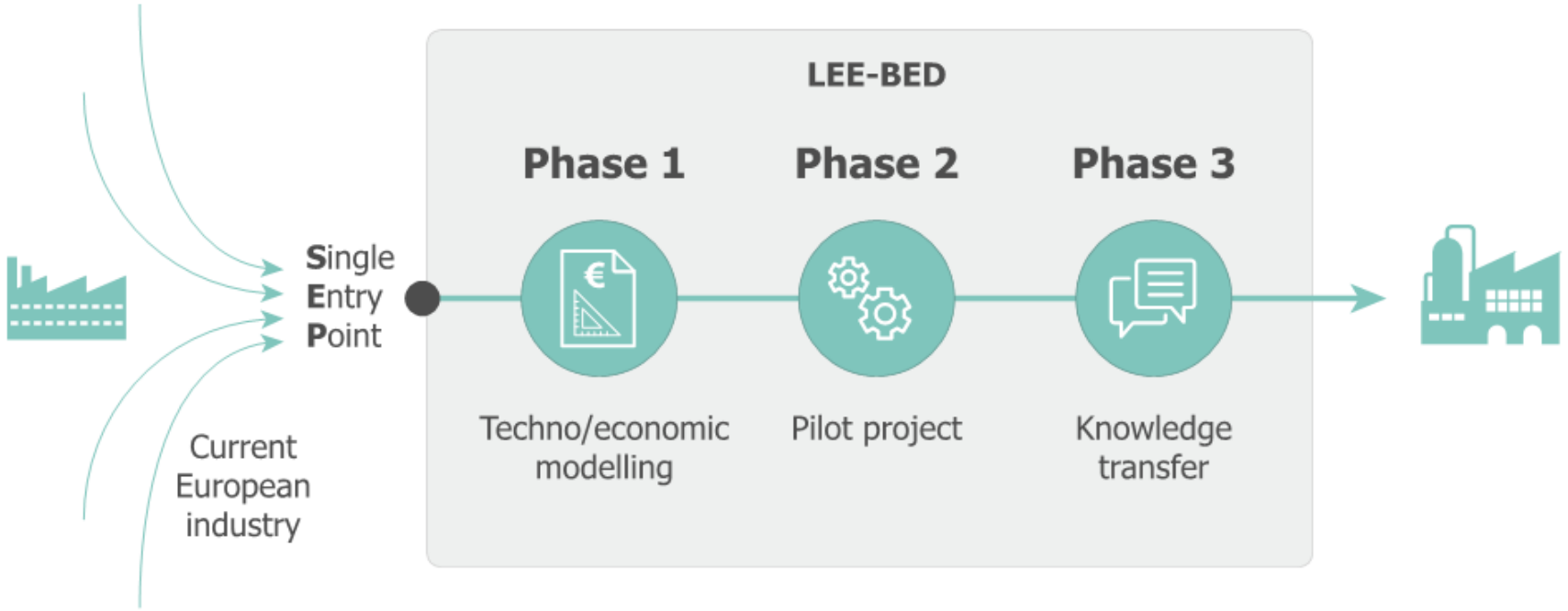
LEE·BED

Innovation Test Bed for development and production of nanomaterials for lightweight embedded electronics

www.lee-bed.eu



The single entry point (SEP) is the main contact point for customers wanted access to LEE-BED services and pilot lines

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DANISH TECHNOLOGICAL INSTITUTE

LEE-BED partners

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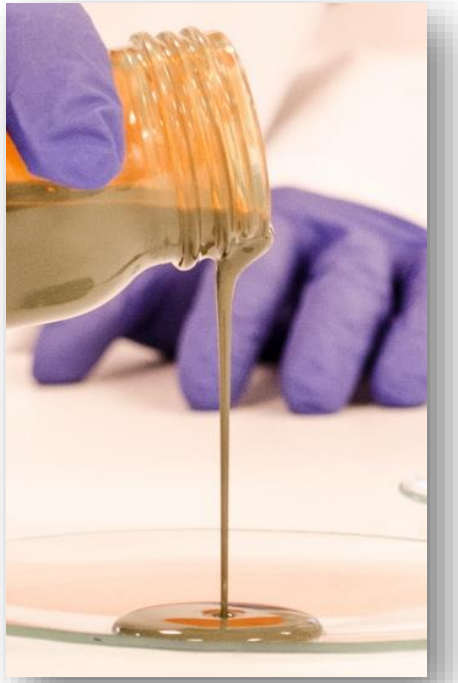
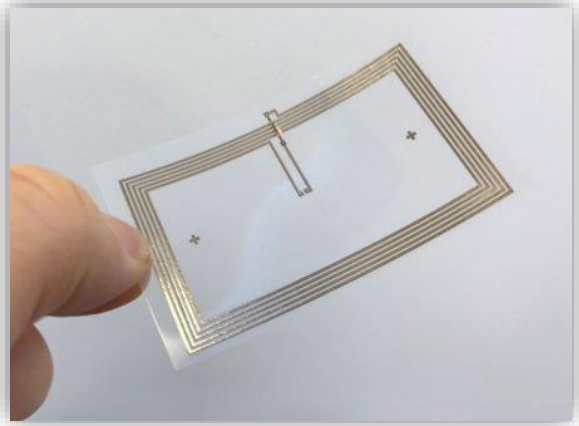
Pilot Projects: Access to Pilot lines





LEE-BED can perform Proof of concept, prototyping and pilot production projects

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DANISH TECHNOLOGICAL INSTITUTE

DTI's supercritical flow pilot reactors

Manual reactor

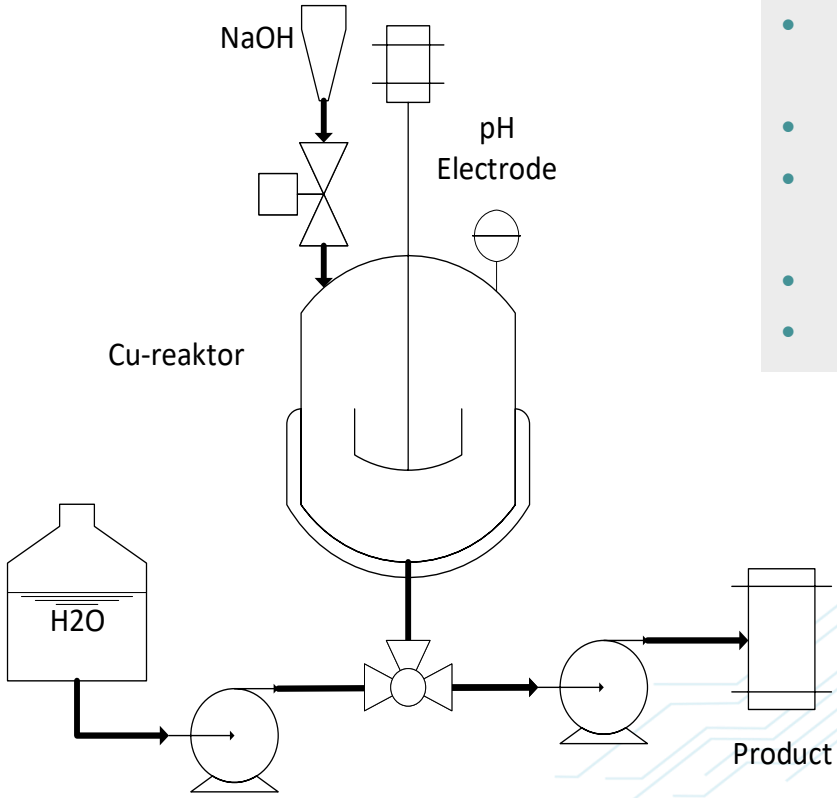
Semi-automated reactor

Production-ready automated reactor

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814485

DANISH TECHNOLOGICAL INSTITUTE

Solvothermal batch pilot line



- 3L, 40L & 80 L jacked reactors
- Rapid screening
- Up to 10kg nanomaterials per day
- PLC automated systems
- In-line process monitoring

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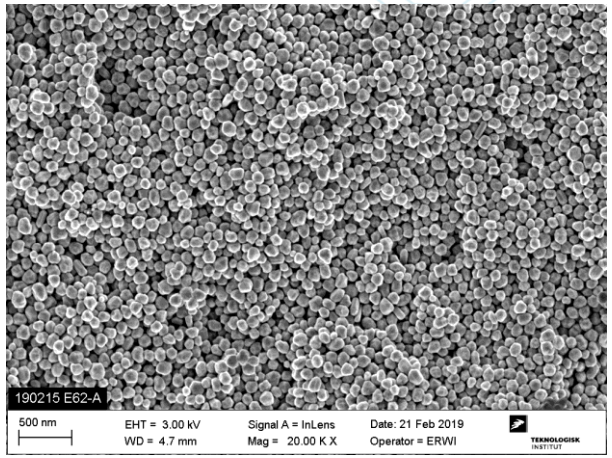
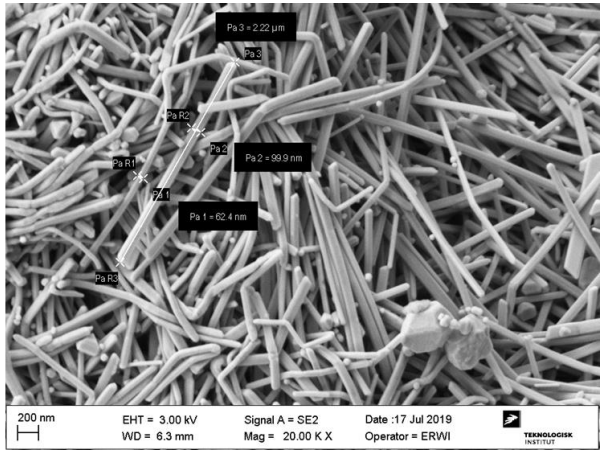
DANISH TECHNOLOGICAL INSTITUTE

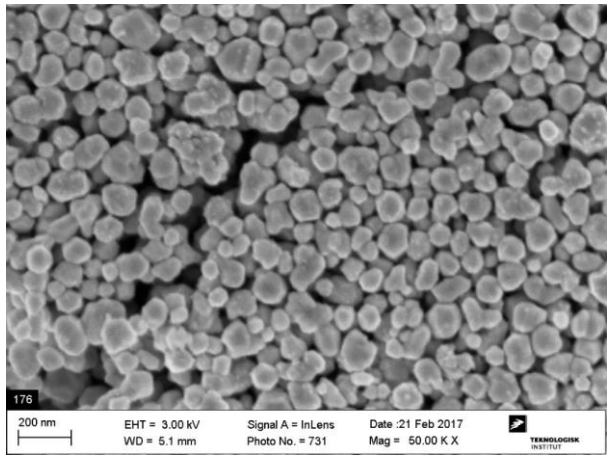
LEE-BED developed nanomaterials



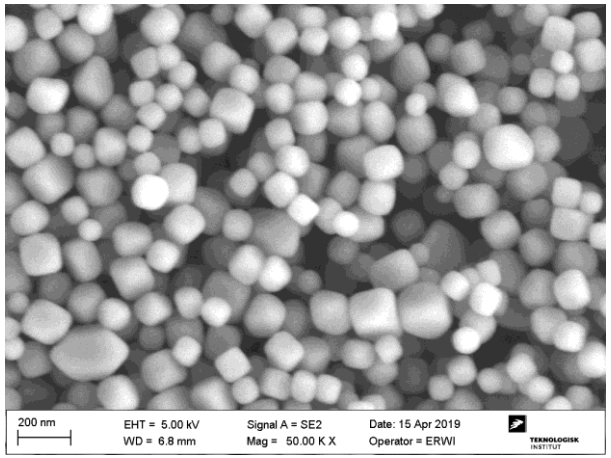
AgNPs for ink-jet, valve-jet and lift printing



AgNWs for transparent and low loading conductive screen print inks



Copper micro and nanoparticles for cost effective ink-jet, screenprint, flexo inks and resin infusion



BaTiO3 for resin infusion and ink-jet high dielectric inks

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DANISH TECHNOLOGICAL INSTITUTE

Gas phase pilot line

vsparticle

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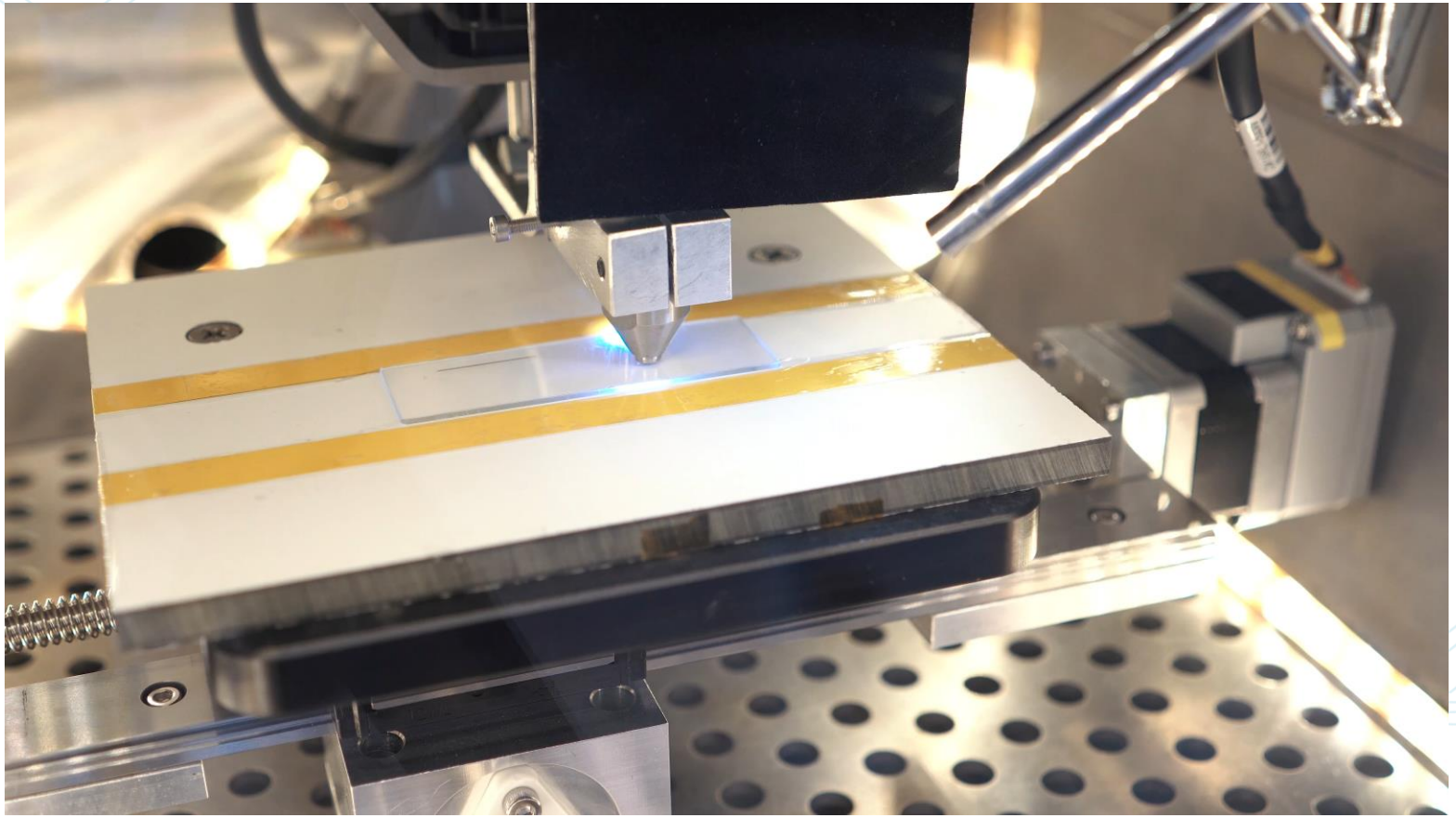
Direct writing of nanomaterials



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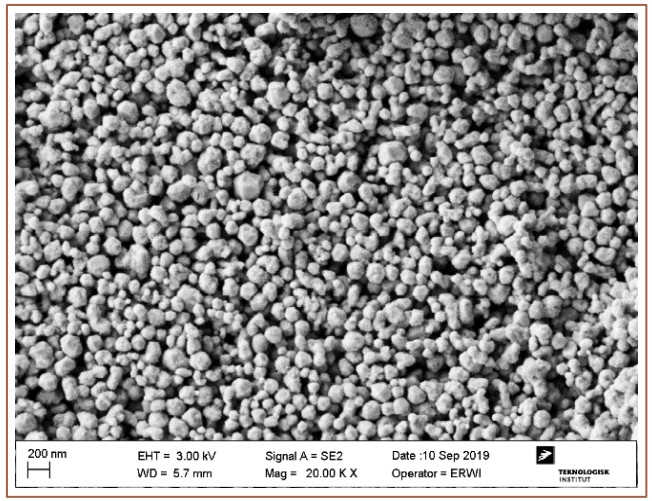
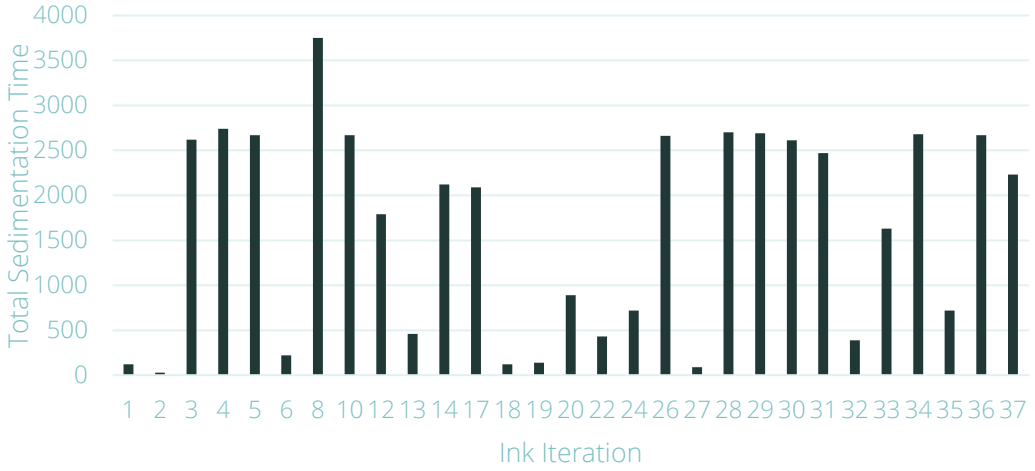
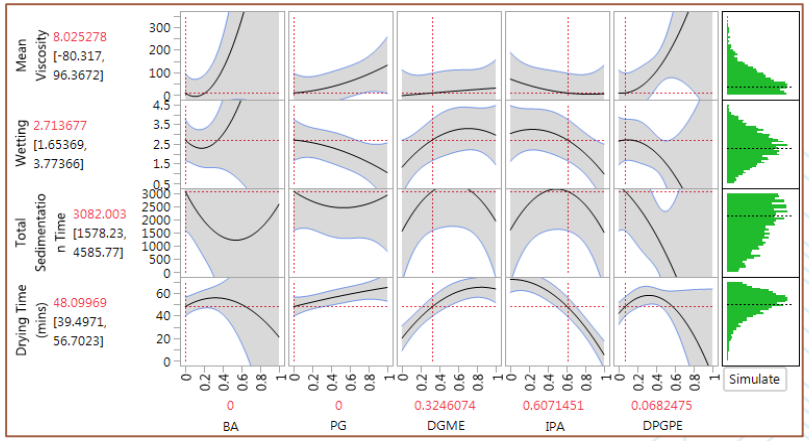
Rapid screening using AI & robotics







- Automated DoE inkjet screening trial of solvent mixes for copper particle dispersion
- 37 iterations of the ink produced automatically
- Results confirmed Principal Component Analysis

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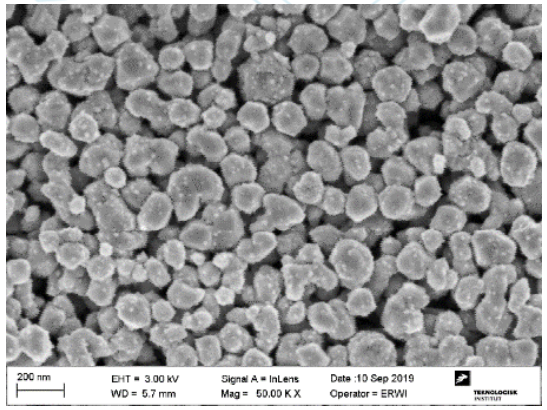
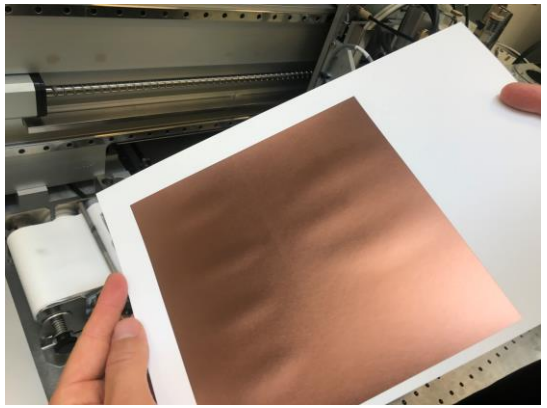
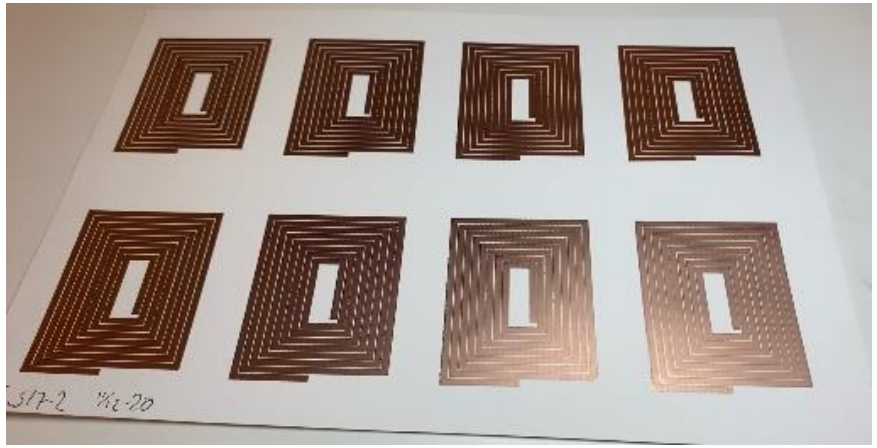
Copper based ink jet formulation

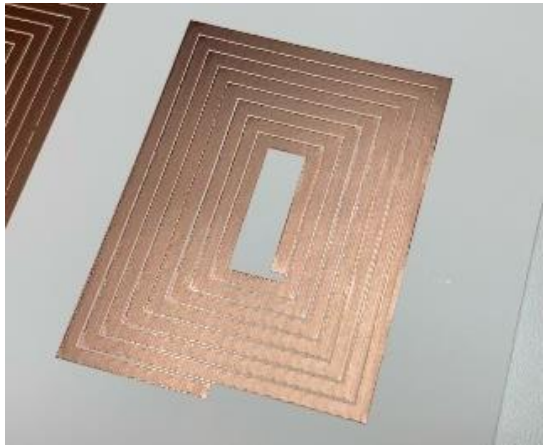


Ink jet formulation

Nano copper pigment 100-200nm size
20-30 wt% metal loading
DGME based solvent
Photonic sintering: 1 layer 60 mOhm sq.







Ink jet printed NFC antenna

Ink jet printed strain sensor

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814485

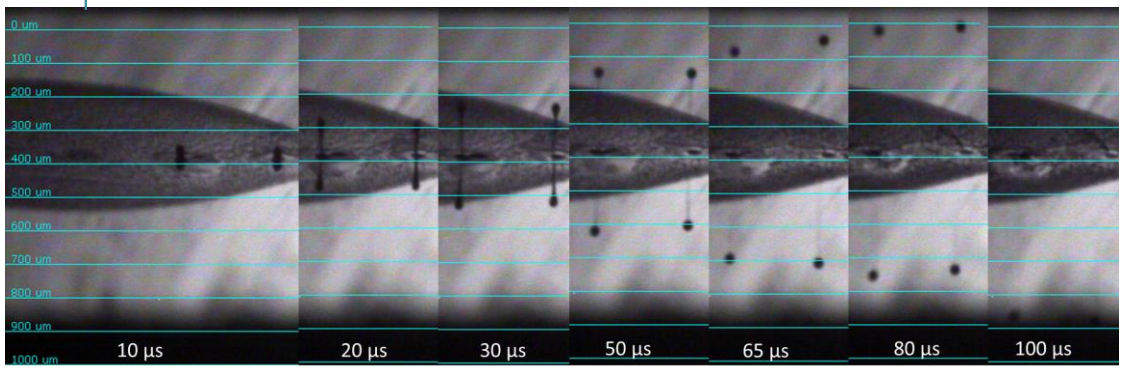
cpi

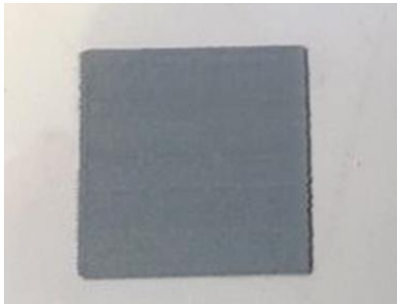
DANISH TECHNOLOGICAL INSTITUTE

Zn based ink jet formulation

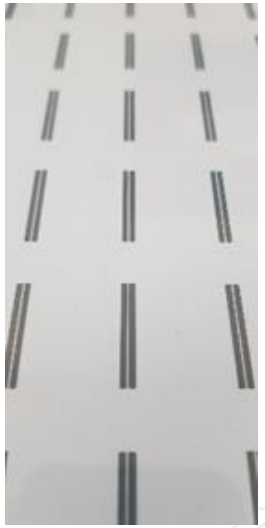
- Good drop formation
- Chemical curing results in a conductivity of $7x10^3$ S/m.
- Functionality showed by mounting of a LED

Drop formation



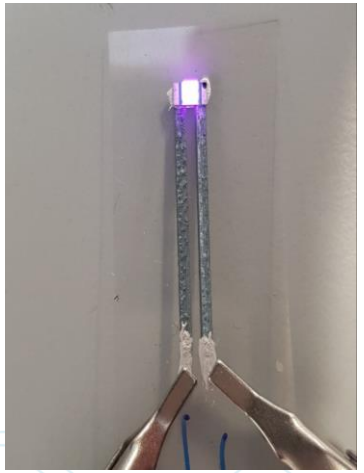


1x1 cm^2



Line width1mm

Mounted LED



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Component pilot lines

Prototyping

3D multi material

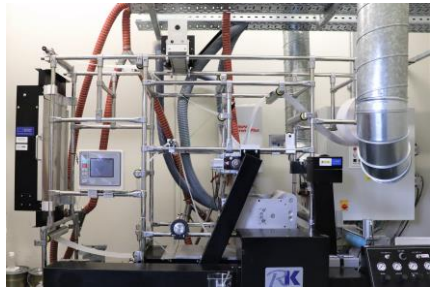
S2S inkjet

TNO TU/e DANISH TECHNOLOGICAL INSTITUTE RI.SE

- Sheet to sheet
- Multimaterial 3D printing

Production

Packaging



RESEARCH CENTER ITENE BUSINESS, SCIENCE & INNOVATION

IoT

cpi

Large format Inkjet

RI.SE

- Roll to Roll

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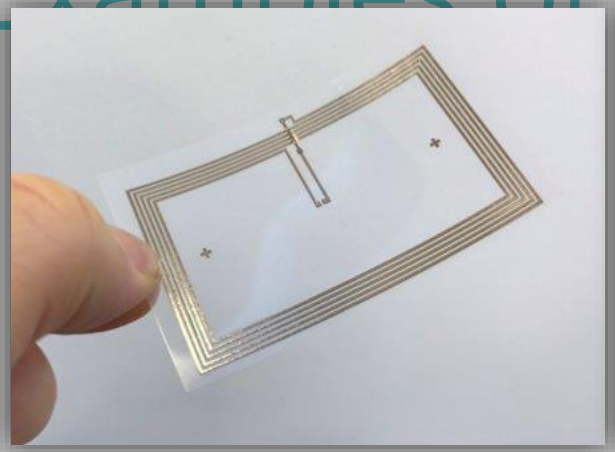
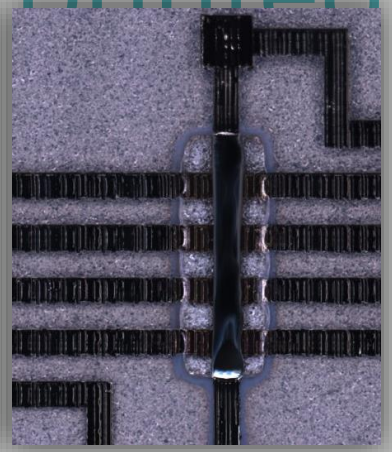
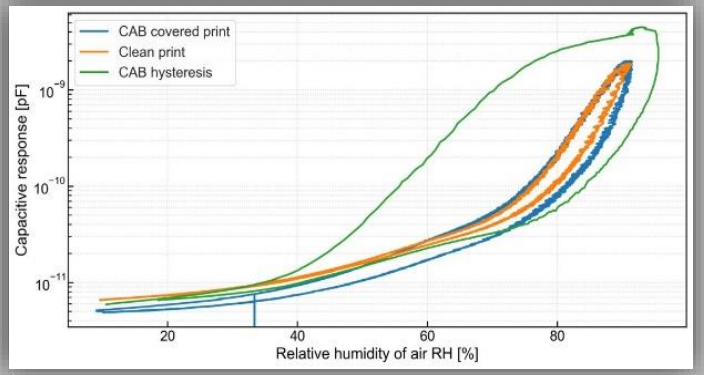
Examples of printed components

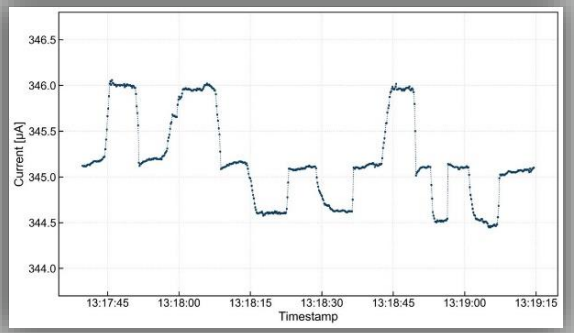




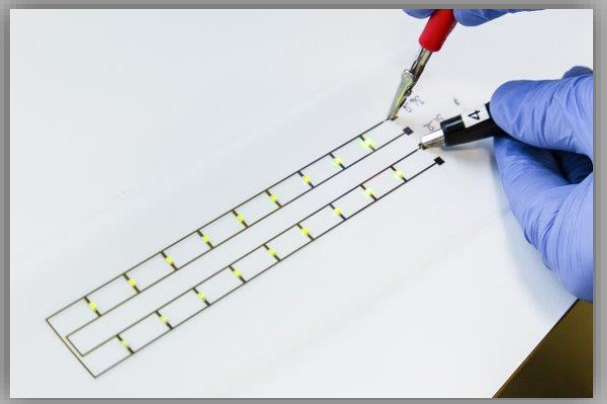
IoT components



Capacitive gas sensors & touch sensors



Mechanical strain sensor



LED lighting

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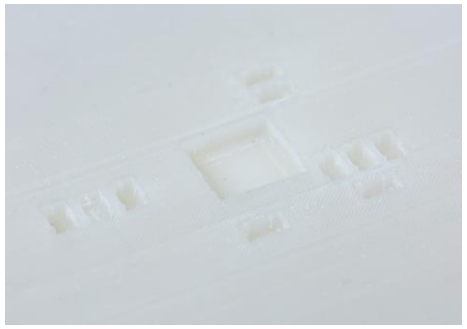
research and innovation programme under grant agreement No 814485

3D printed NFC passive temp logger

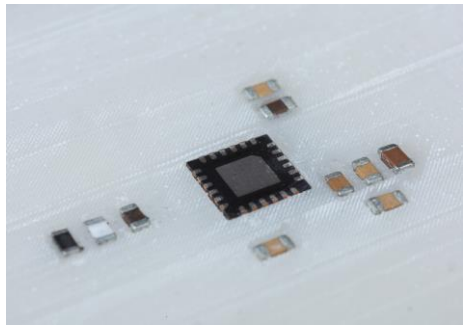
Processing steps to integrate electronics

1. Print cavities for components
2. Clean and place components in cavities
3. Print grooves for circuitry
4. Fill grooves with conductive ink and cure
5. Repeat step 1 - 4 and finish product

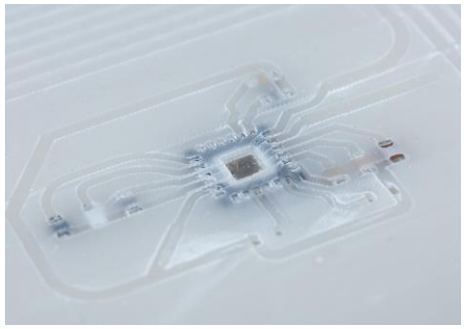
Self-harvesting NFC tag with temperature sensor



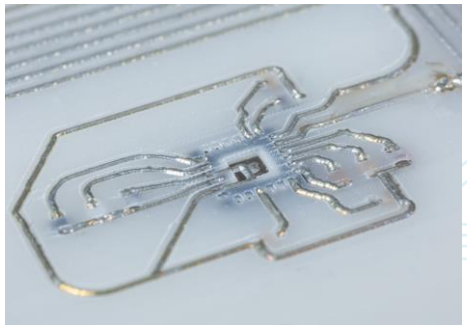
Print cavities



Place components



Print groove circuit



Fill groove circuit

Repeat steps & Finish

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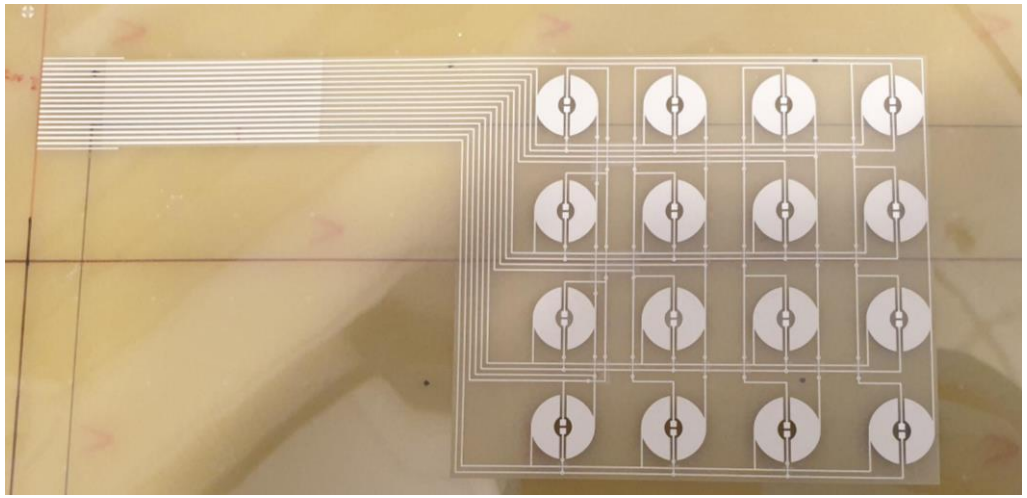
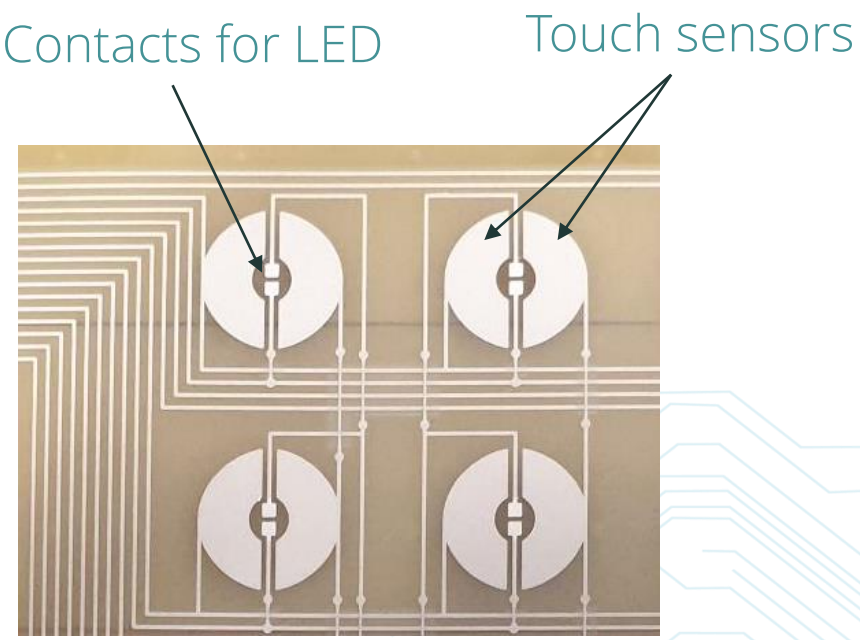
Prototyping of interactive touch & LED lighting

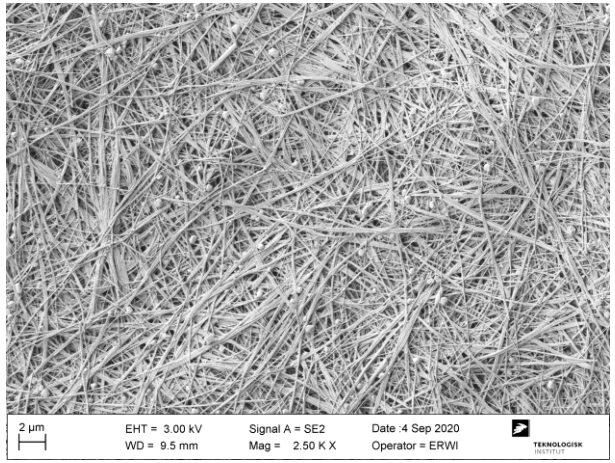




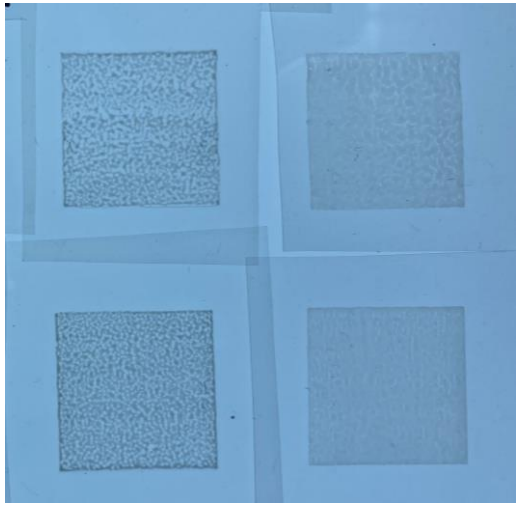
4 layer printed on same side of substrate
Ag / Dielectric / Ag / Dielectric
Produced using S2S flatbed screenprinting pilot line

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814485

Development accross the entire value chain



LEE-BED developed Silver nanowires diameter 50-100nm, length 10-100µm.



LEE-BED developed transparent inks using LEE-BED nanowires, optimizing screen printability, optical transmission and electrical performance

Using silver nanowires, based inks, LEE-BED developed a coating and laser etching process in order to fabricated fully transparent circuitry on a PET foil. Here capactive touch sensing, LED lighting and thermocouple components have been integrated on the foil.

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Challenge

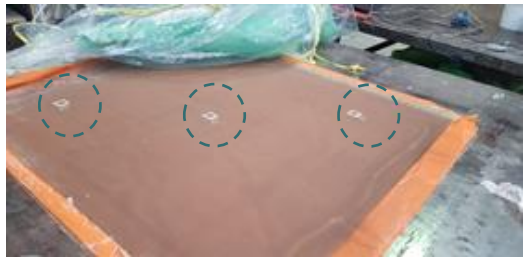
Structural health monitoring using externally bonded cable sensors

Cable sensor

LEE-BED solution

Embedded wireless sensors

LEE-BED sensor



wireless - communicatio n

Sensor embedded within the laminate

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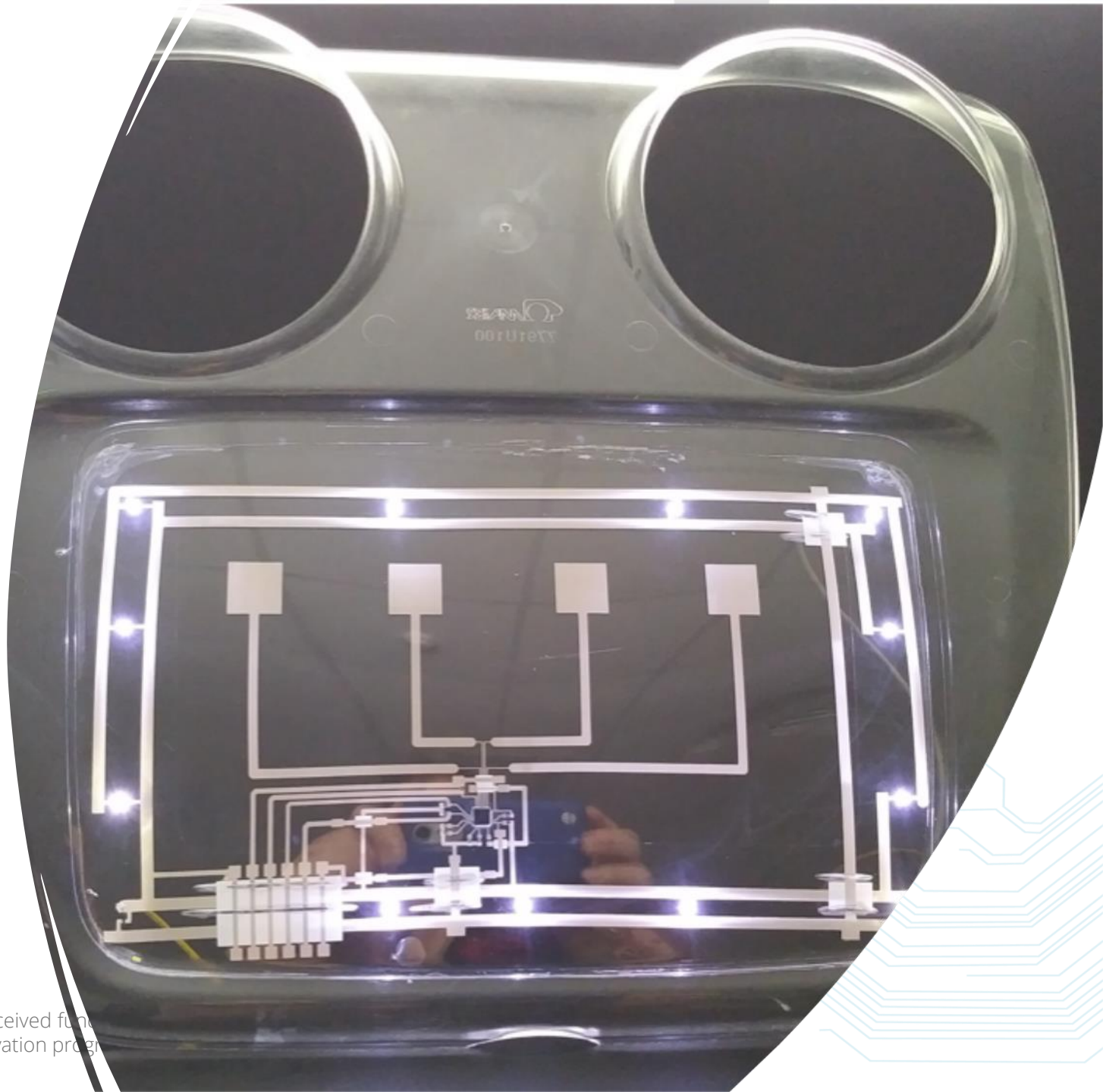
acciona

Printed foil embedded in injection moulded parts

- Touch sensing, LED lighting and microcontroller printing onto plast foil

- Printed foil is placed inside injection mould form and embeded inside plastic part



This project has received fu
research and innovation prog

Characterization Services

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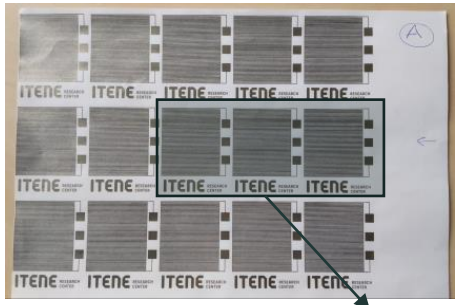
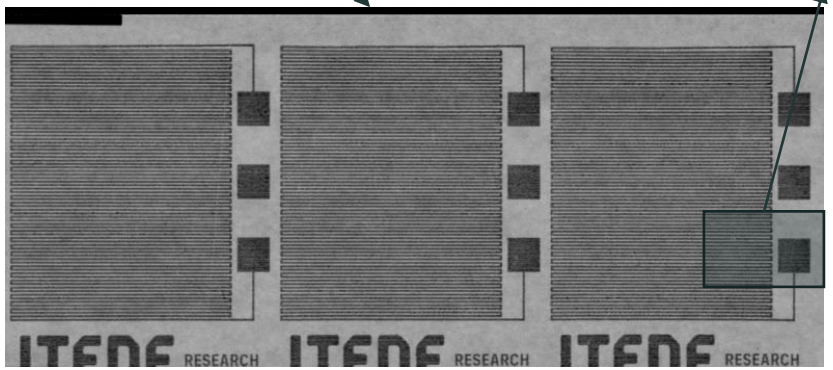
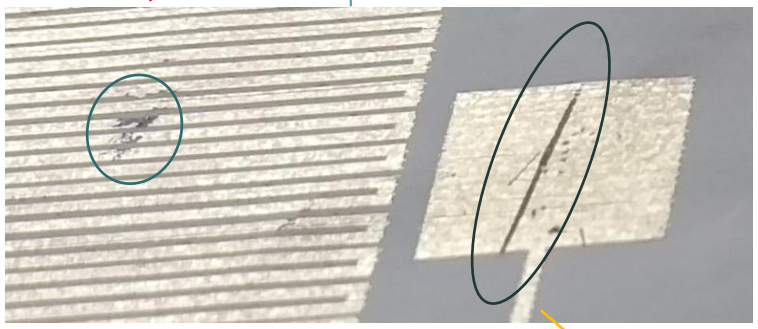
Radiographic QC

#1 Hamamatsu C12200

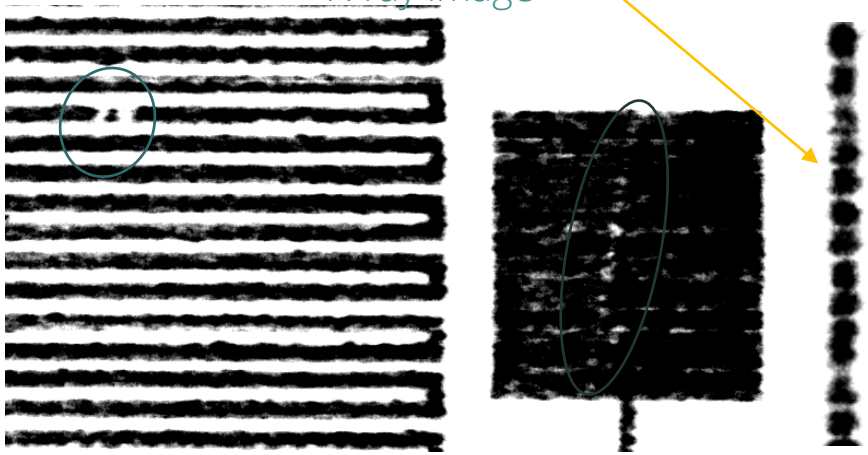




a) photo b)

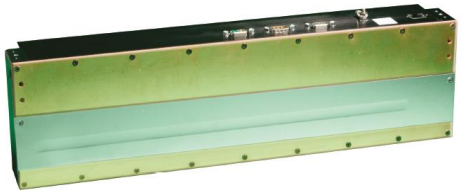


X-ray image c)



#2 Direct Conversion TDI

Effective px size ~48 µm, G=2.1X

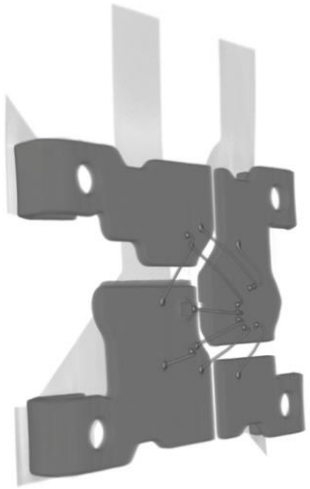


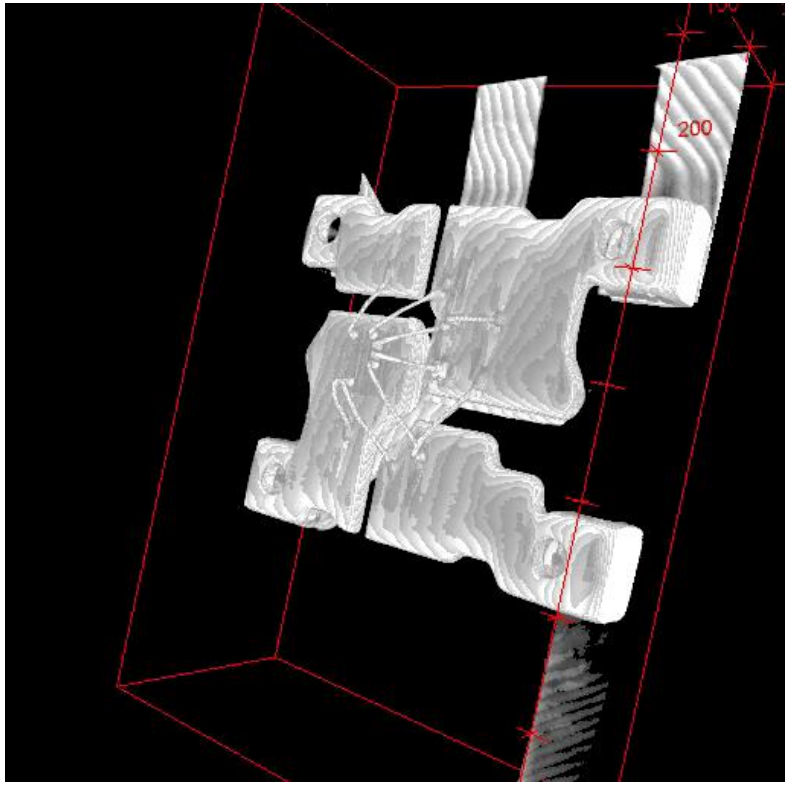
→ Better Contrast

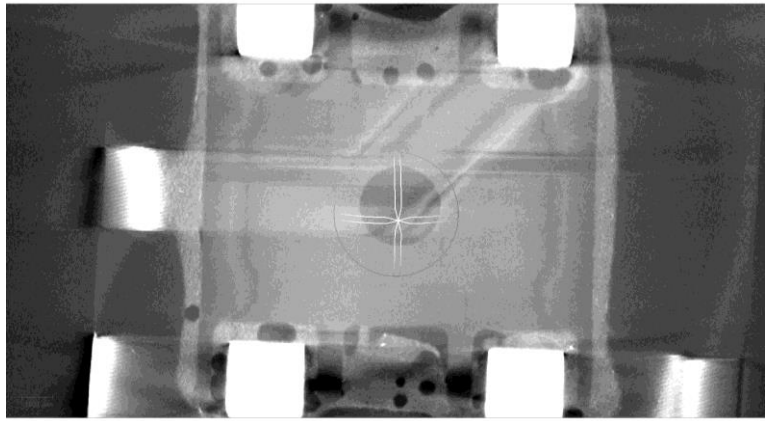
→Higher resolution possible

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814485

Micro and Nano CT QC







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