



RI.
SE

We are Sweden's
Research Institute

Brief introduction to RISE



Concern overview of research areas



AI och Data
Science



Blå tillväxt



Byggd miljö



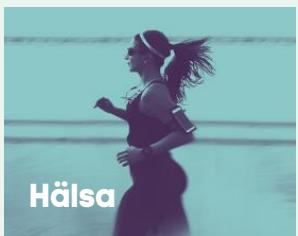
Cirkulär
omställning



Digital
säkerhet



Energi



Hälsa



Innovations-
system



Komponent-
tillverkning



Livsmedel



Material



Process-
tillverkning



Risk, säkerhet
och resiliens



Tjänste-
forskning och
digitalisering
av processer



Transporter
och mobilitet



Transport-
system

Test and Demonstration Facilities

Testbeds for hardware and pilot production



ProNano & Electrum
Laboratory



RISE Fiberlab



Printed Electronics
Arena 4.0

IT testbeds



DigiCore



ICE - Infrastructure and
Cloud Environment

Dynamic testbeds



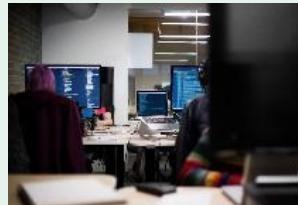
Autonomous shared
transport



The Pink



UX Lab



Cyberrange



UAV

RISE

Bio and Organic
Electronics

Printed
Electronics



Welcome to RISE in Norrköping



Bio and Organic Electronics Unit

Yusuf Mulla



Peter Andersson Ersman



Xin Wang



Dagmawi
Belaineh Yilma



Robert Brooke



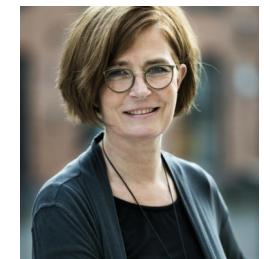
Astrid Armgarth



Mats Sandberg



Ursula Hass
Unit manager



Ulrika Linderhed



Valerio Beni



Jesper Edberg



Anatolii Makhinia



Naveed il Hassan Alvi



Ioannis Petsagkourakis

Printed Electronics Unit

Jessica Åhlin



Peter Dyreklev



Marie Nilsson



Patrik Eriksson



Kathrin Hübscher



Subimal Majee



Sandra Pantzare



Duncan Platt
Unit manager



Anurak Sawatdee – "Ek"



Jan Strandberg



Olle Hagel



Darius Jakonis



Pär Westrin



Lukas Hostacny



Our ecosystem



ECOSYSTEM OF ORGANIC AND PRINTED ELECTRONICS IN NORRKÖPING/LINKÖPING, EAST SWEDEN

LOE

Laboratory of
Organic Electronics



**RI.
SE**

Research Institute

PEA
Printed Electronics Arena

Printed Electronics
Arena

lead

Business Incubator

HOPE

Business
Accelerator

**Digital
Cellulose
Center**

Research Centre



TREESEARCH
Research
Collaboration

IMI | Innovative Materials Arena

Innovative
materials arena

LiU

Innovation
Innovation Office



Norrköping
Science Park

**LINKÖPING
SCIENCE
PARK**

Linköping Science
Park

Welcome to the Printed Electronics Arena in Norrköping



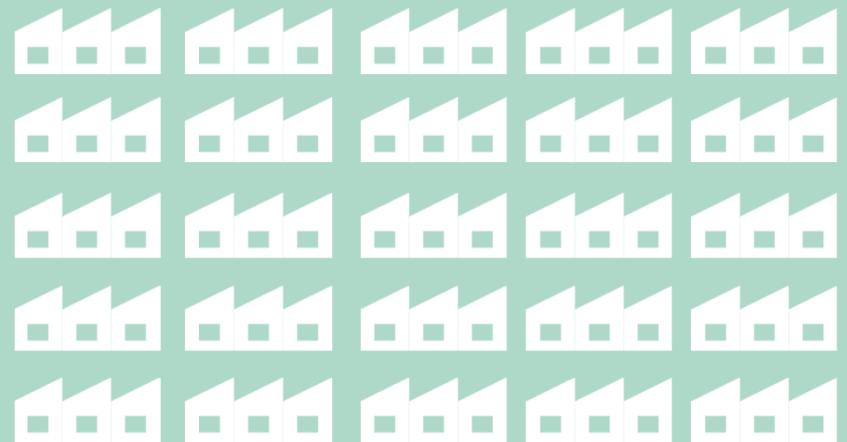
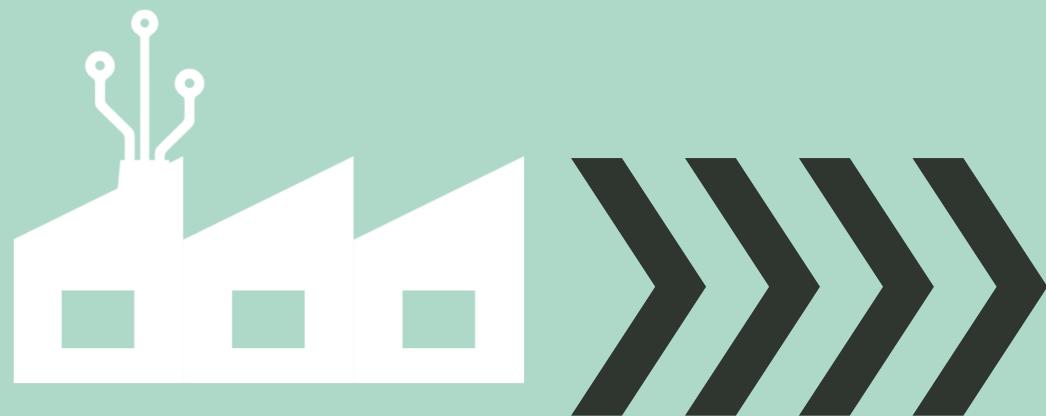
Innovation Cluster for
Printed Electronics
at an industrial level

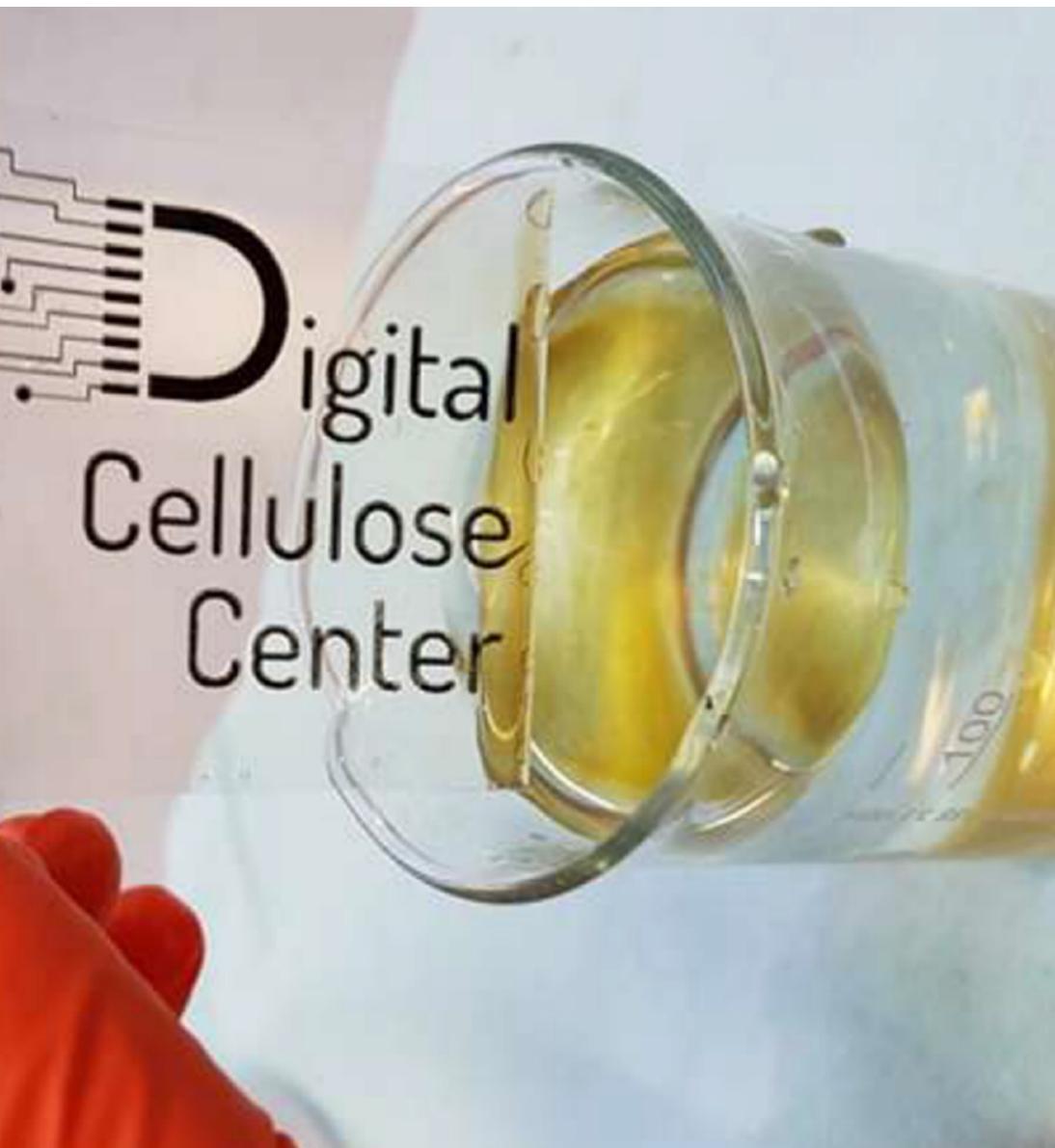


HOPE

ACCELERATOR FOR ORGANIC AND PRINTED ELECTRONICS

Goal 2025: 25 start-up and growth companies





Vision: Make cellulose-based products an integral part of a sustainable, digital society

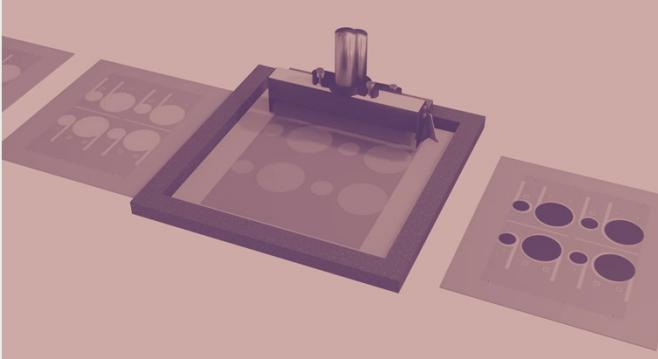
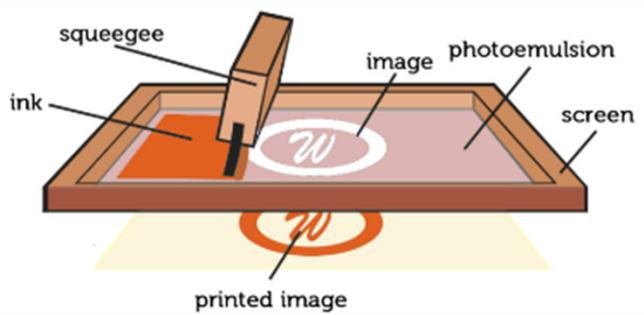
- DCC constitutes of RISE, LiU and KTH and 13 industrial partners in the supply chain
- Total budget on 5 years, 111 MSEK
- Impact and knowledge on:
 - Cyclability of DCC materials and case study on carbonized wood
 - Energy storage
 - Interaction between materials
 - Transport of ions, gas, vapor
 - Sensors and actuators integrated in cellulose



What is Printed and Organic Electronics?



Screen Printing

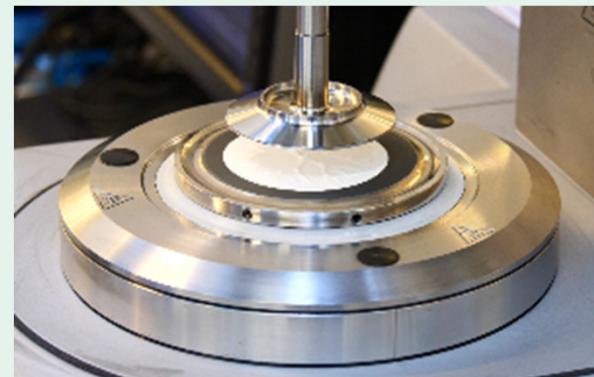


Manufacturing using printing technology

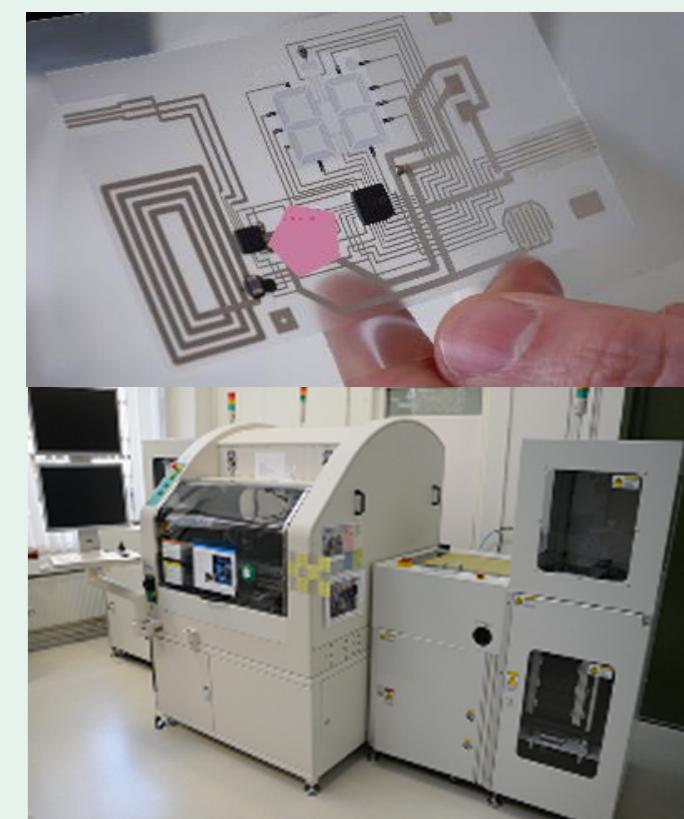
**RI.
ISE**

Material development and ink formulation

- Conductors (C & metals)
- Semiconductors (organic)
- Insulators
- Electrolytes
- Sensor materials
- Display materials
- Encapsulation

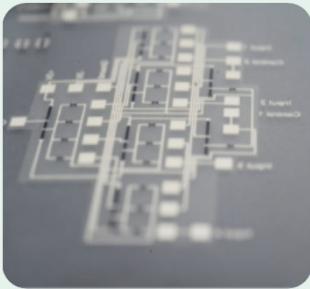


Hybrid systems - Combination of printed circuits and conventional electronic components



Examples of printable components

Transistors



PROPERTIES:
Electrochemically and
electrolyte gated OFET
0.5 - 1.5 V
Switch time: 10^{-6} to 10^{-2} s

Sensors



PROPERTIES:
Electrolyte sensor capacitors
or transistors.
Piezo and Pyroelectrical
Analyte parameters:
humidity, temperature,
heat, pressure,
vibrations etc

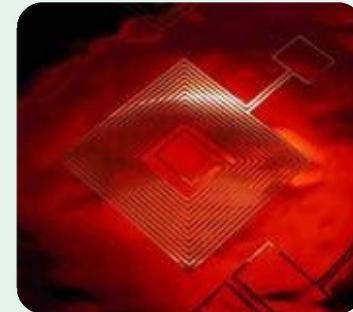
Display



PROPERTIES:

- Monochrome
- Emissive or reflective
- Paper or plastic
- 1-3 V (reflective)
- 110 V (emissive)

Antennas



PROPERTIES:
Metal Al, Cu
1 kHz - 10 GHz
Resolution: 100 μ m
Material thickness: 1-10 μ m

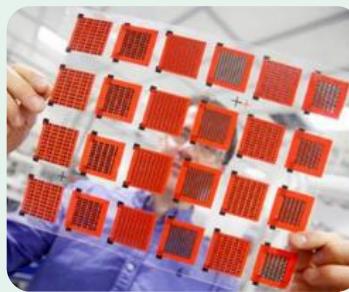
Energy storage, harvesting and conversion

Batteries/ Supercapacitors



PROPERTIES:
1-10 mAh, 1.5 V
Energy Dense
Rechargeable
Lifetime comparable to Li-Ion
Thin, flexible
(Imprint Energy, Enfucell,
Blue Spark)

Thermoelectric generators



PROPERTIES:
All polymer
Screen printable
ZT 0.25

PV celler



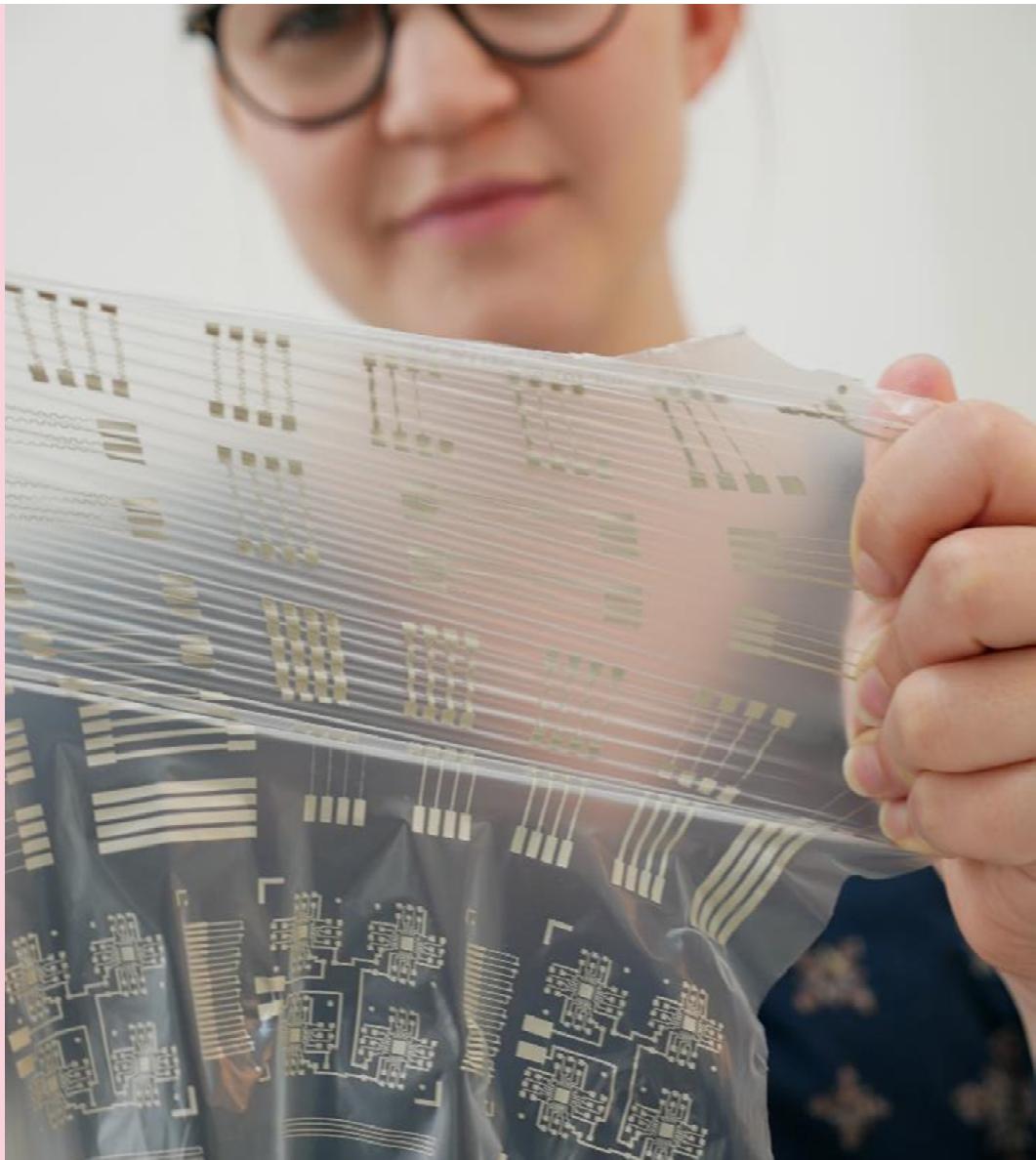
PROPERTIES:
All printed
Plastic substrate
Efficiency < 10%

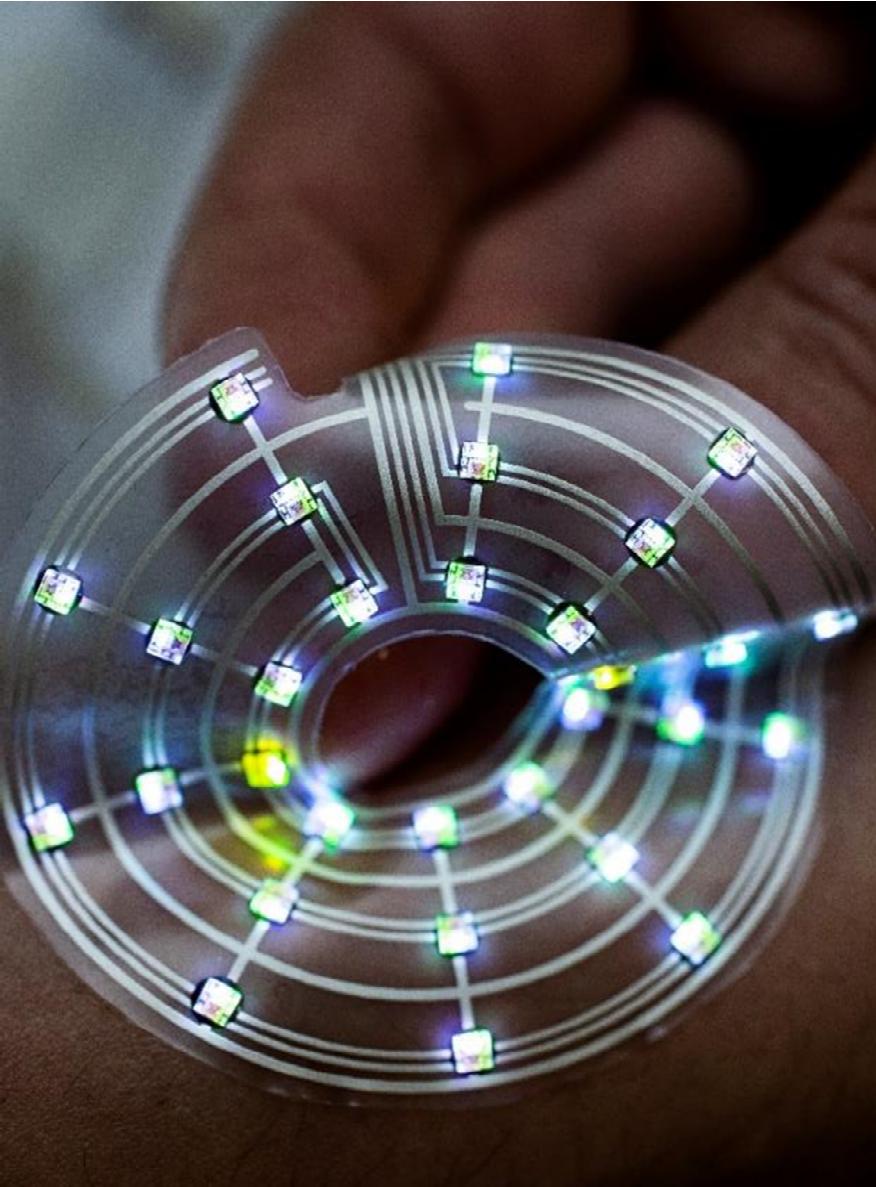
RF energy harvesting



PROPERTIES:
All-printed diodes + antennas
2 GHz
1V

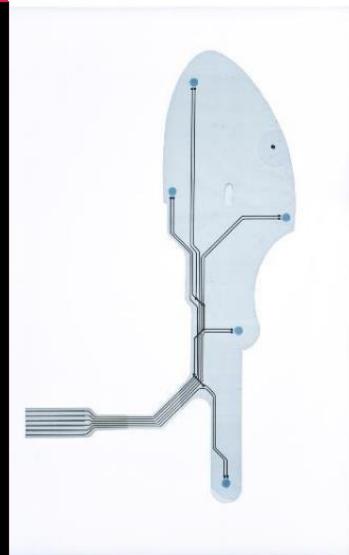
**Light, thin, flexible,
soft, stretchable,
sustainable**



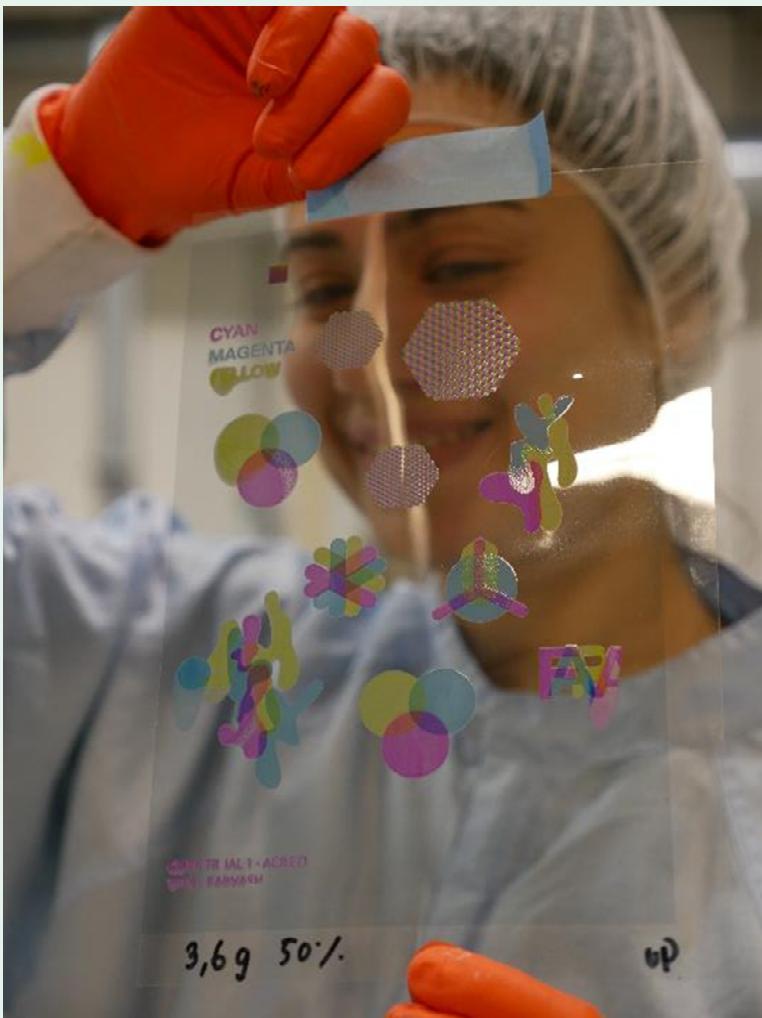




Smart sensors and indicators



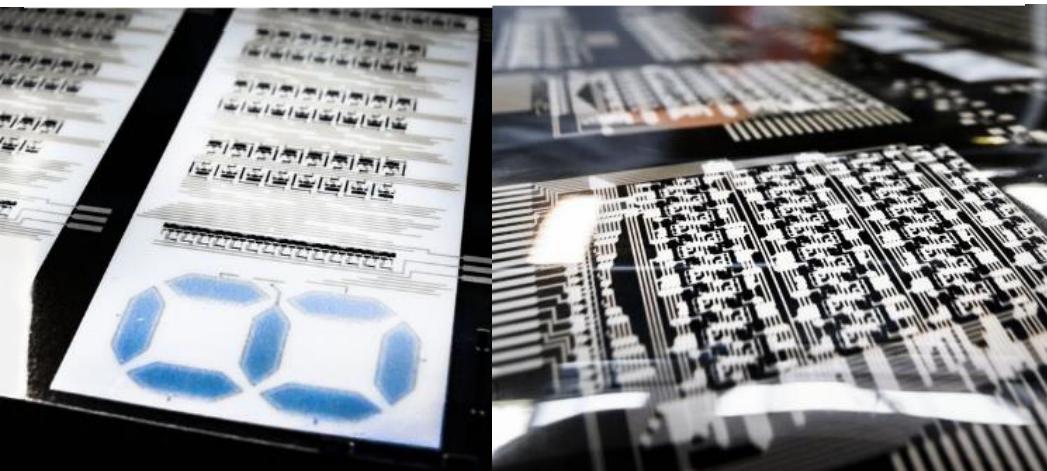
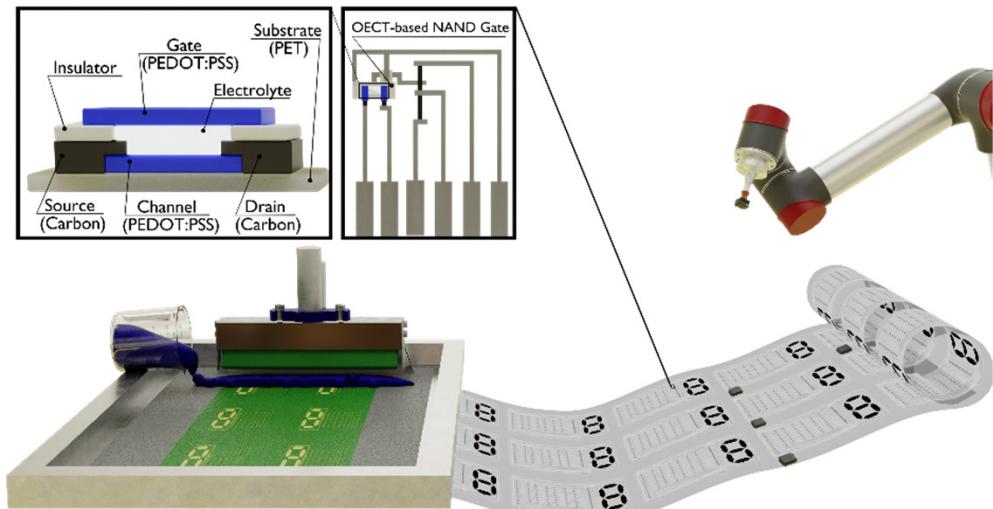
Electrochromic displays



Display Technology



Component Integration

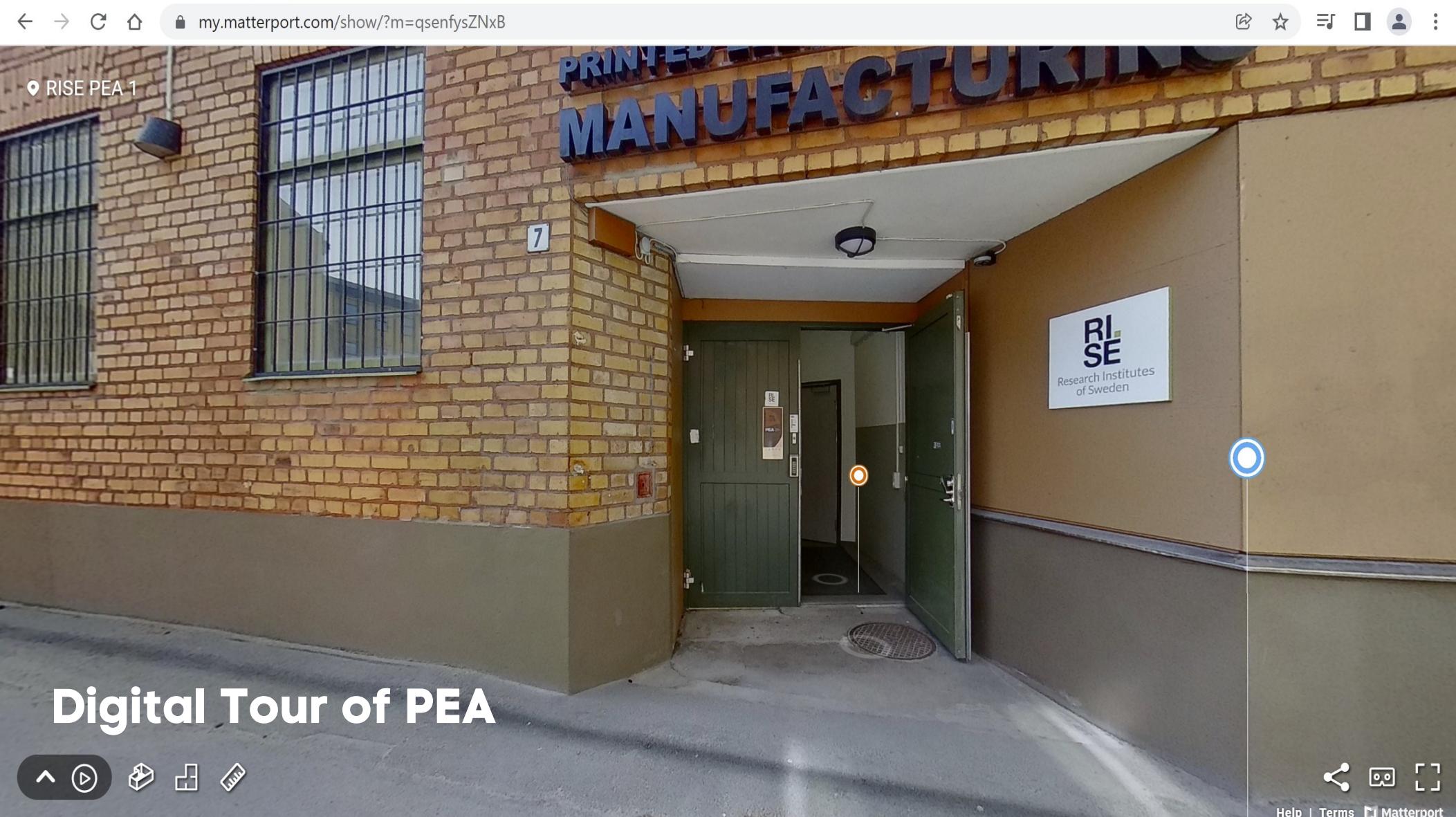


More information about PEA

[PRINTED ELECTRONICS](#) [ABOUT US](#) [CONTACT](#) [SVENSKA](#)

Printing excellence, prototyping, sensors and applied research in conducting polymers

[OUR FOCUS AREAS](#)



Help | Terms Matterport

Capabilities at PEA



Strategic Focus Areas for RISE Bio, Organic and Printed Electronics

- Green Electronics
- Energy
- Health and MedTech
- Sensors
- Packaging and Logistics
- Production methods and Infrastructure

Printed Electronics Arena – Norrköping, Sweden

Competences:

- Development of printing and patterning processes
- Device design for Printed Components
- Ink formulation for screen, inkjet, gravure, flexo, slot-die coater, aerosoljet
- Electronics design – circuits and systems including wireless connectivity, firmware etc.
- System Integration
- Generic hybrid platform development (Si + printed devices)
- Demonstrator design and manufacturing
- Rapid prototyping (3D printing and electronics assembly)
- Upscaling and Tech transfer of processes to industry
- Pilot production
 - Ink manufacturing
 - Screen printing
 - Synthesis
- Component and system characterization
 - Electrical characterisation
 - Physical/chemical analysis
 - Environmental testing
 - Semi-automated testing

Printing and drying/curing processes:

- Screen (semiautomated and automated sheet-based flatbed)
- Inkjet (flat bed and R2R, industrial printheads)
- Gravure (sheet based experimental)
- Slot-die coating (sheet based experimental)
- Flexo printing (sheet based experimental + proofing)
- Aerosol jet
- Thermal drying
- IR/NIR drying/curing
- UV-curing
- Xenon-flash photonic sintering (Novacentrix)
- 3D-printing

Materials classes:

- Conductors (Inorganic & Organic)
- Semiconductors (Inorganic & Organic)
- Insulators
- Sensor materials
- Display materials
- Encapsulation

Ink formulation capability

- Ink pilot production (up to 10 kg/batch)
- High shear mixing
- Speed mixing
- Probe sonicator
- Powder milling
- Rheology measurements



Screen printing

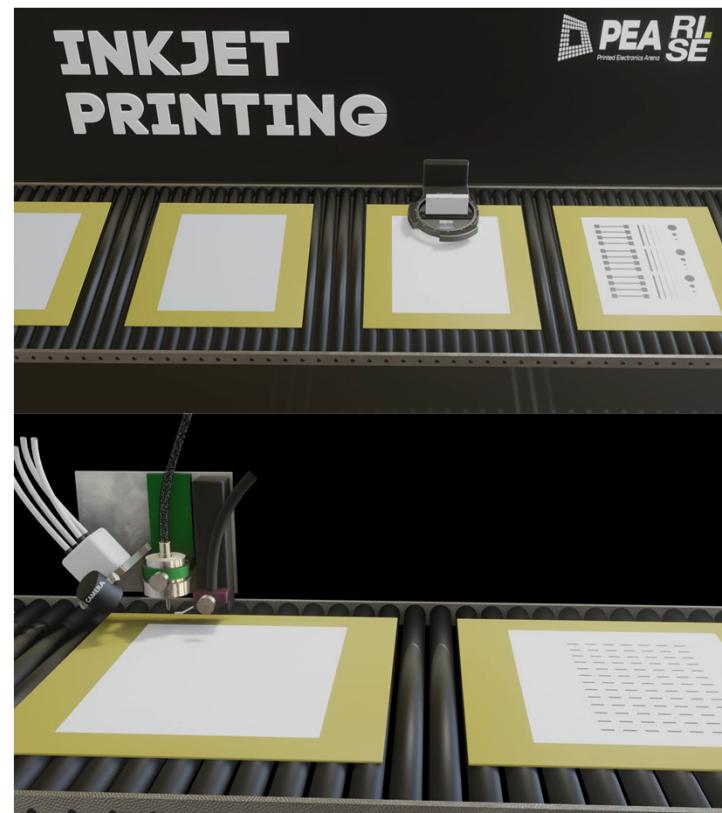
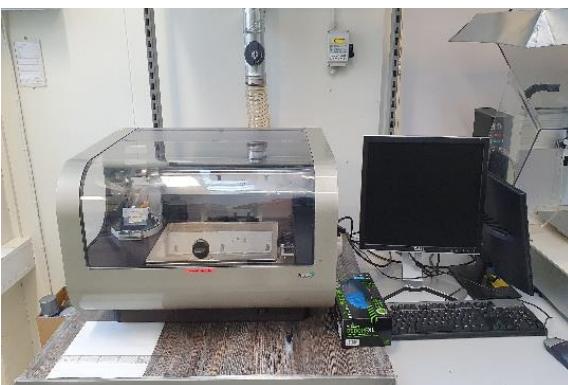
- Sheet based planar screen printing
- 2 DEK systems
Horizon 03iX
- semi automated
- ATMA MF66/F
– fully automated incl. dryer
- EKRA E2 screen and stencil printed
- Natgraph Air Force Combi dryer (UV/IR/hot air)

Testacolor Gravure & Flexo

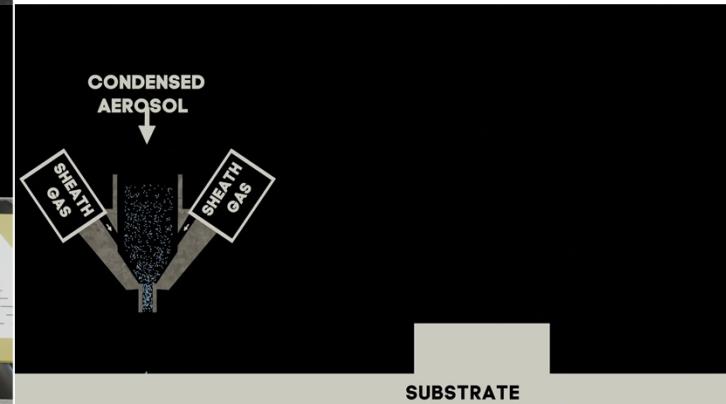
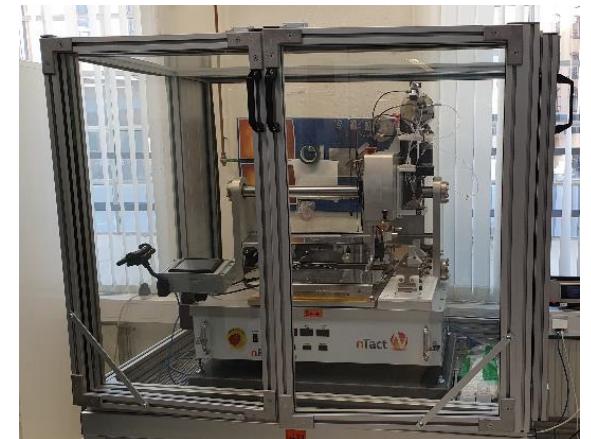


Inkjet

- Ceradrop F Series MF150006-Nindustrial inkjet
- Optomec Aerosol jet
- Novacentrix PulseForge 1300 photonic sintering
- Dimatix DMP280 cartridge type printer
- R2R industrial inkjet large format printer



Slot-die coater nTact



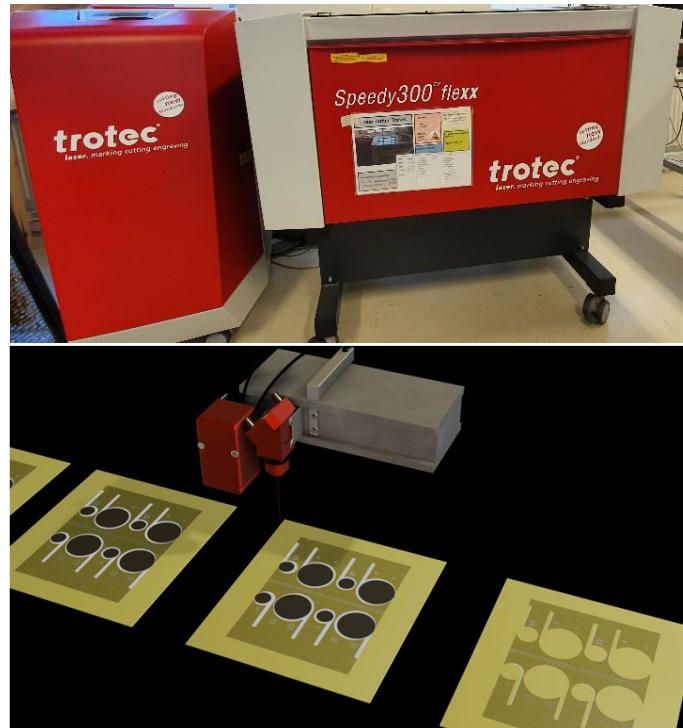
Pick and place assembly

Besi 2200 Evo Pick Datacon for SMD, batteries, printed components etc.

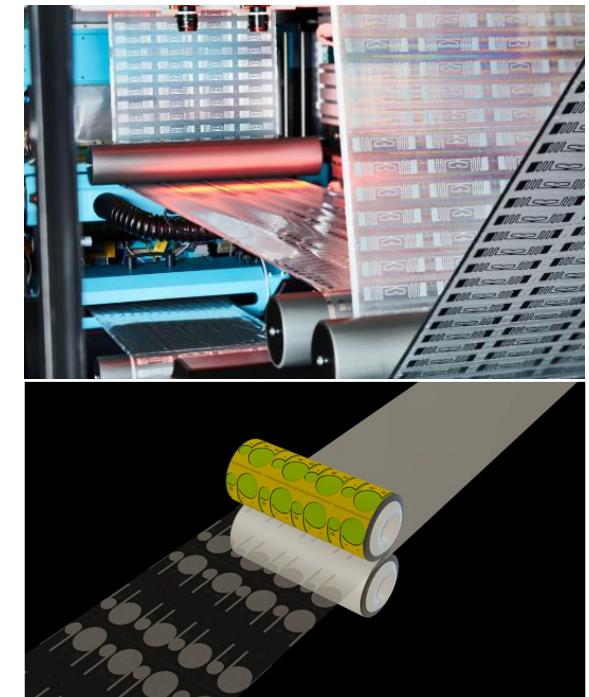


LASER cutting & engraving

- TROTEC LASER cutter and engraving system
- FC2250 Cutting plotter



Novel patterning method Dry Phase Patterning



3D printing

Formlab 3 Stereolithography



- Fast prototyping
- Same day iterations
- Filament creations

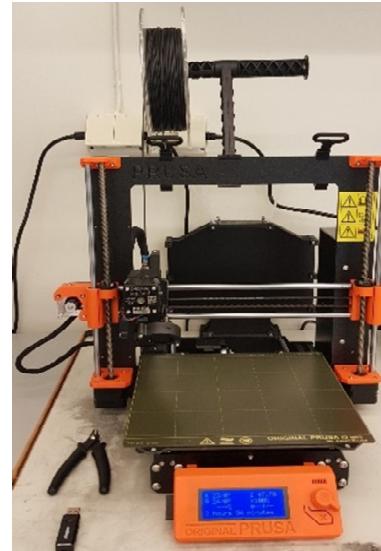
Examples:

- Electronics casing
- Mock up demonstrators

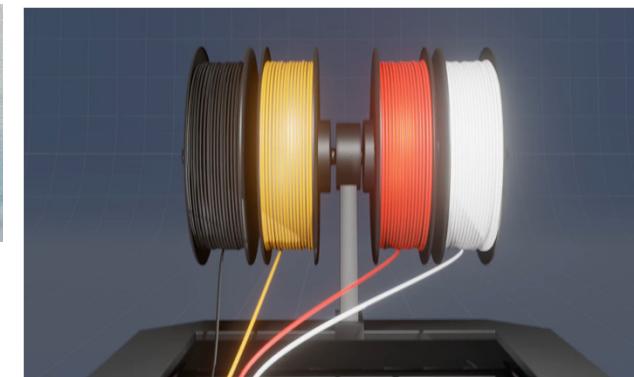
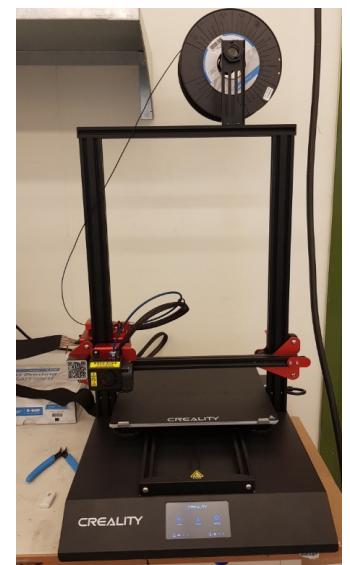


Filament based FDM printers

Prusa i3 MK3S



Creality 10S Pro V2

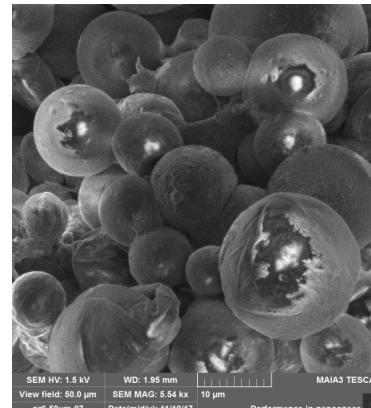


Ink and adhesives development

- Ink formulation capability
- Ink pilot production (up to 10 kg/batch)
- High shear mixing
- Speed mixing
- Probe sonicator
- Powder milling
- Rheology measurements

Materials examples:

- Graphene and graphene coatings
- Metal and metal-oxide nanoparticles
- Functional printing materials
- Nanoparticle inkjet inks



Graphene coated polymer spheres for non-metal ACA



Rheometer



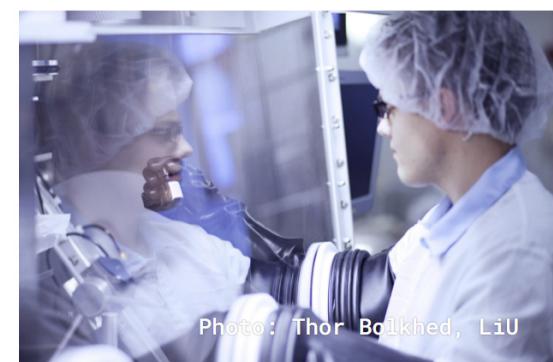
Powder milling system



At the Printed Electronics Arena in Norrkoping, Sweden, we move with ease from molecule synthesis in cleanrooms to small series production of printed electronics components and prototyping of hybrid circuits.

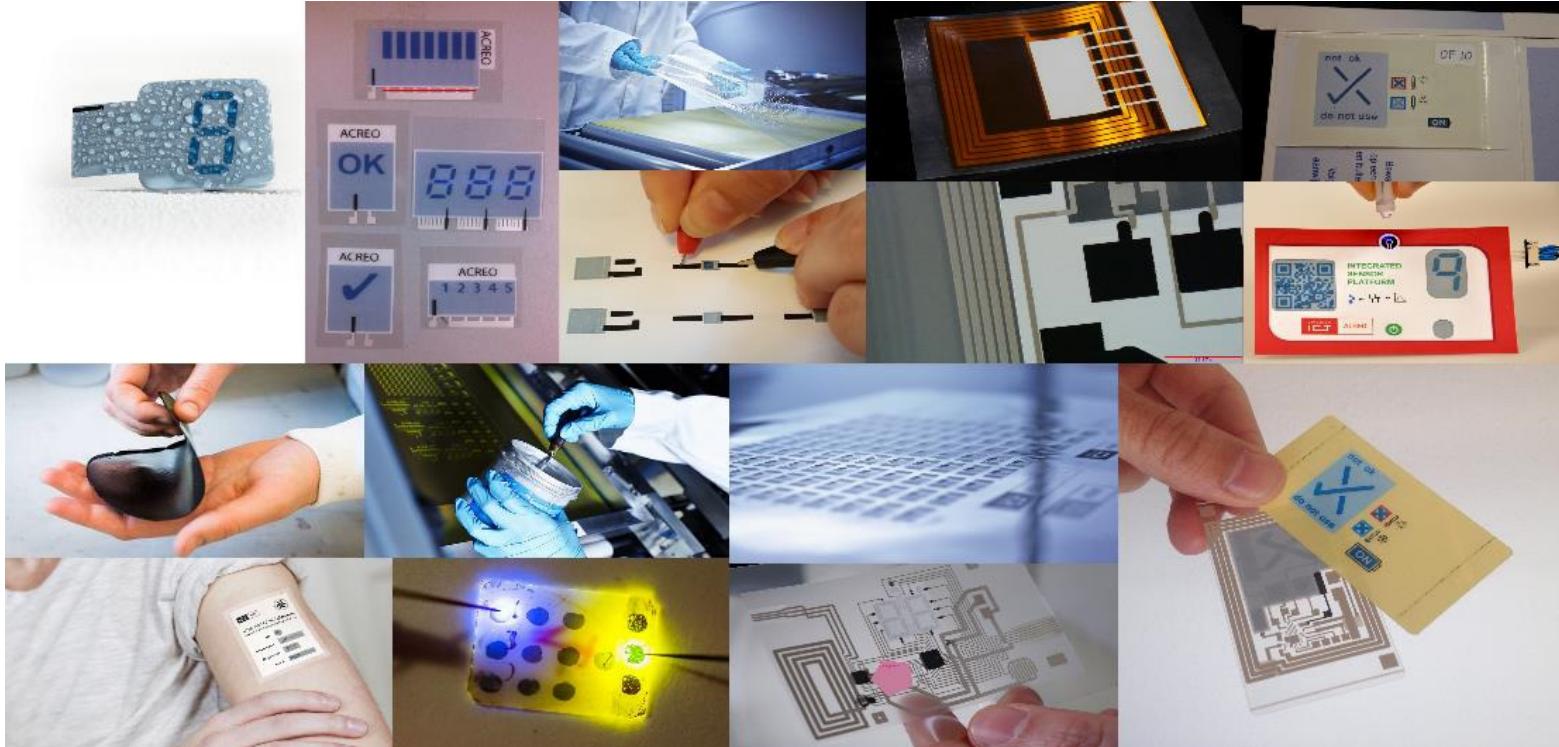


Developement of inks, electrolytes and organic materials for printed electronics components



Chemical synthesis and characterisation

Thank you!



Welcome to PEA!

www.printedelectronicsarena.com

www.ri.se

ursula.hass@ri.se, duncan.platt@ri.se

Extra slides

Some examples
—
from idea to product

RISE – Absorbest AB



Drymax Sensor - wound care product

Challenge

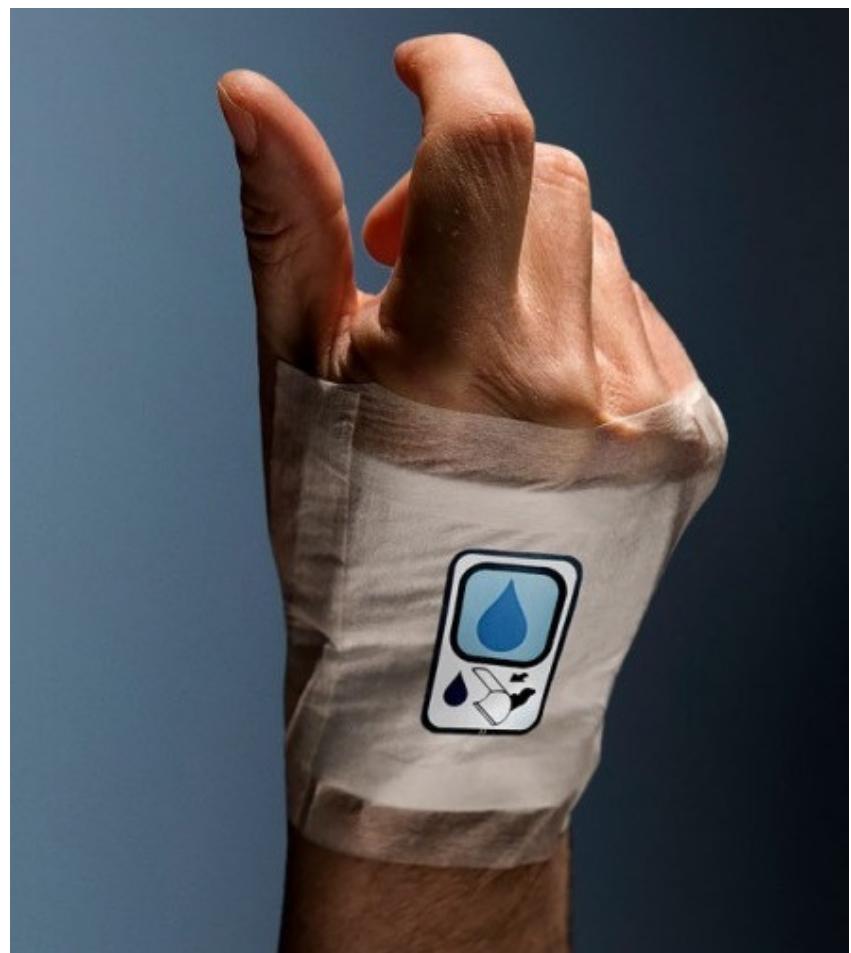
Is it possible to produce an intelligent bandage that indicates when it needs to be changed?

Solution

The combination of the company Absorbest's knowledge of super-absorbent wound-care products and RISE's research into printed electronics, made it possible to create an all printed intelligent bandage

The smart bandage is now on its way to the market.

<https://www.youtube.com/watch?v=Xu3I5wHTzE&feature=youtu.be>



Smart Label for temperature monitoring – with on-board display for last mile handling

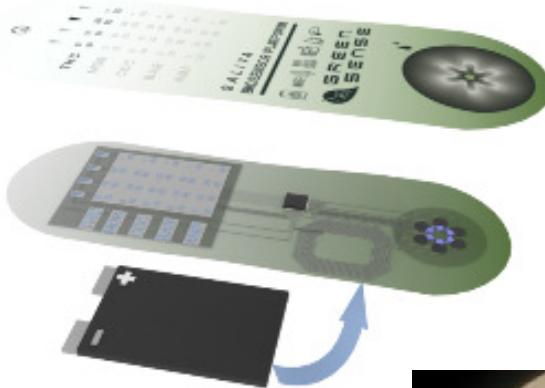


Cold Chain Indicator for vaccines and similar
Electrochromic Display
NFC readout
Flexible formfactor
Printed Battery
Printed circuitry
Hybrid construction

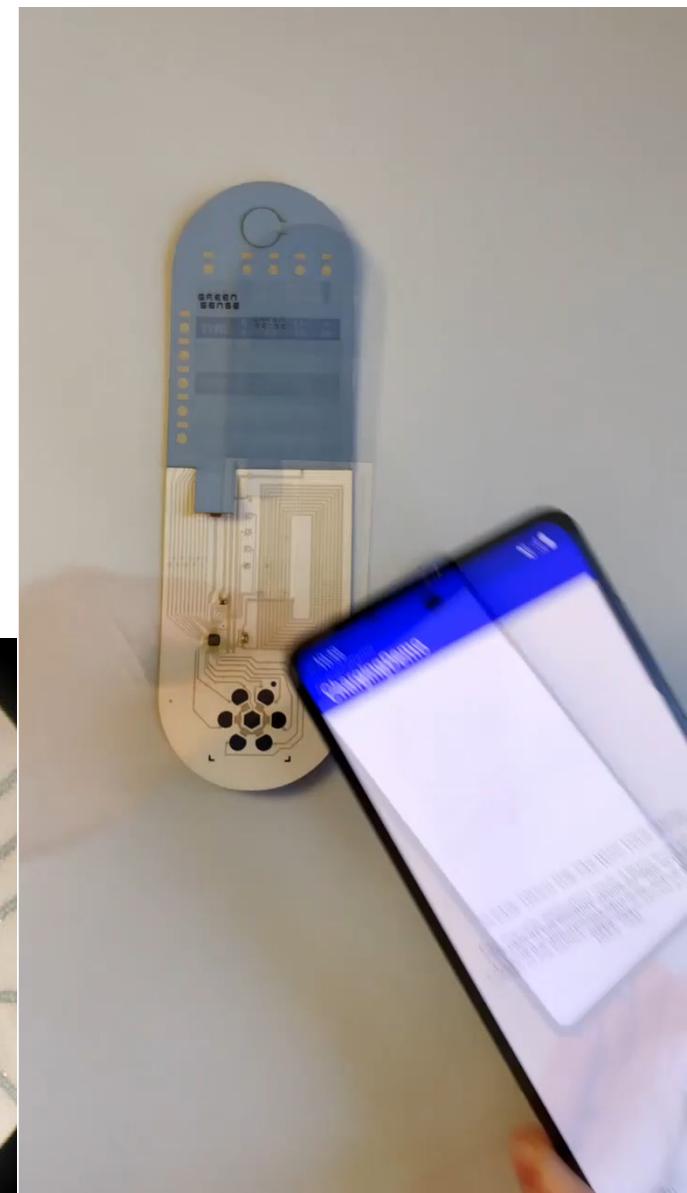
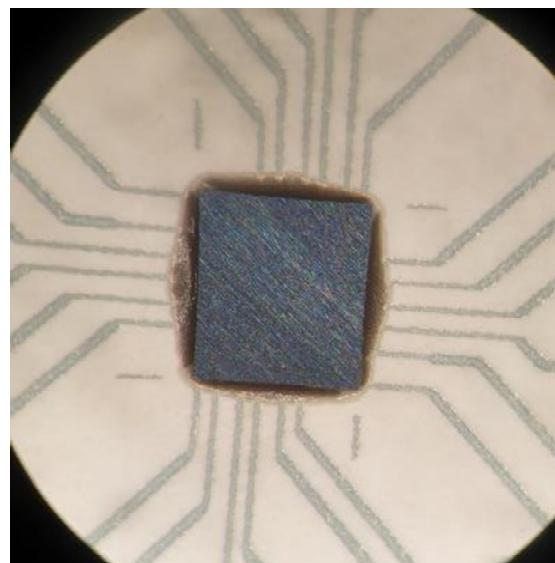


GreenSense

A Sustainable,
Wireless, Autonomous
Nanocellulose-based
Quantitative Drug-of-
Abuse Biosensing
Platform



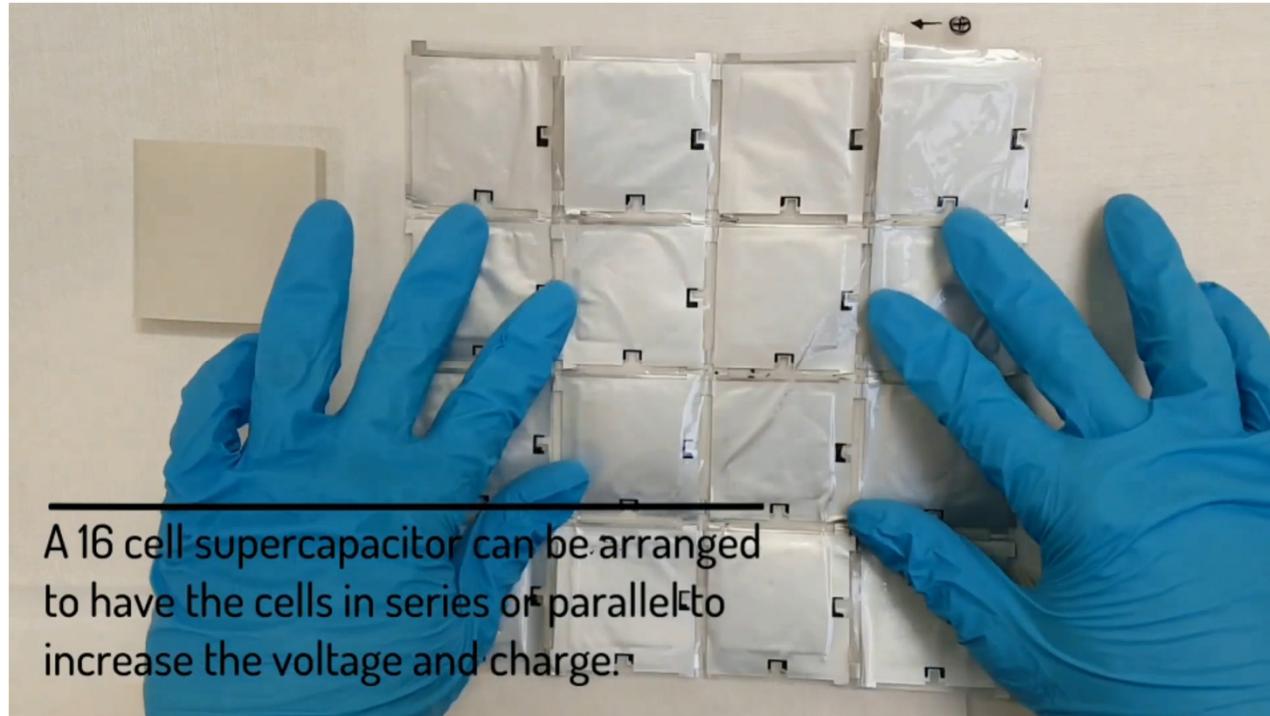
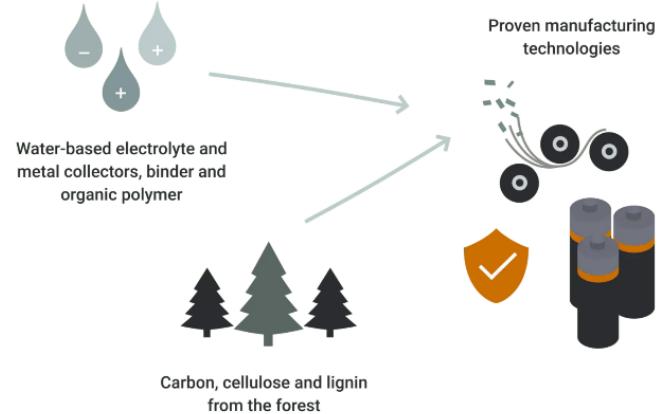
Nanocellulose:
Substrate
Lamination
Encapsulation
Active component in functional inks





LIGNA ENERGY

Disruptive energy storage technology from the forest.





SEGMENT DISPLAY KIT

Evaluate the ultra-low-power, thin and flexible Segment Displays. Each kit contains different display designs and includes a manual display driver as well as a display driver with I2C interface.

[OPEN DISPLAY DATASHEET](#)[GUIDE & INSTRUCTIONS](#)

- Secure card payment
- Free international shipping
- Documentation and support

€ 190 EUR

Quantity

1

BUY



DESIGNER KIT

Try the designer kit to get inspired on how you can play with different forms, colors, and cut-out shapes. It comes with an easy-to-use driver that has pre-programmed driver sequences for all of the displays in the kit.

- Secure card payment
- Free international shipping
- Documentation and support

€ 190 EUR

Quantity

1

BUY

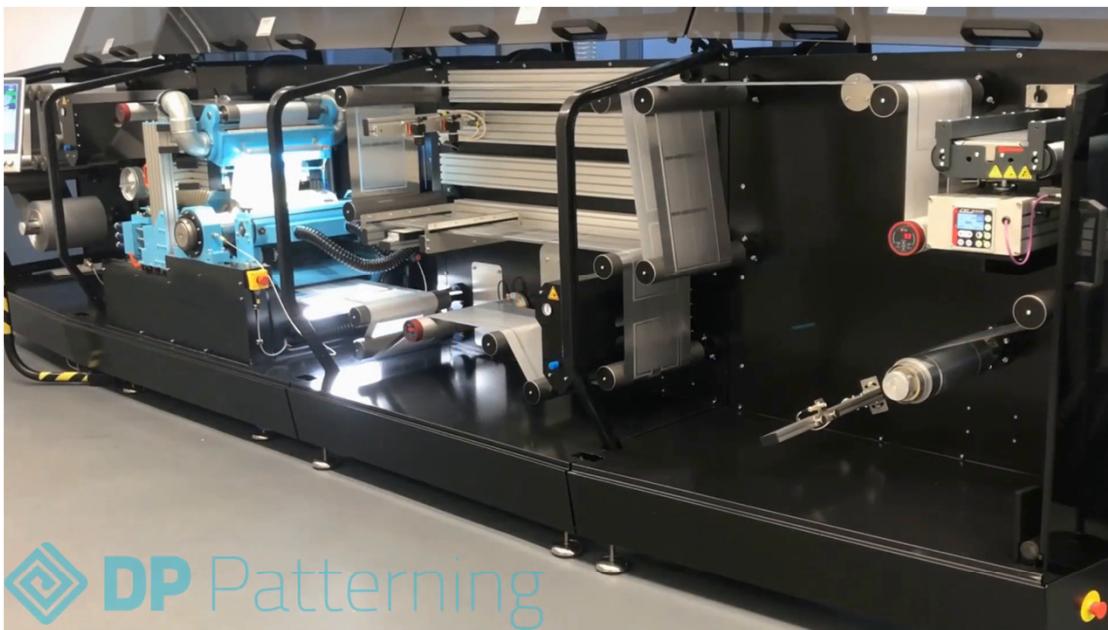


Ynvisible

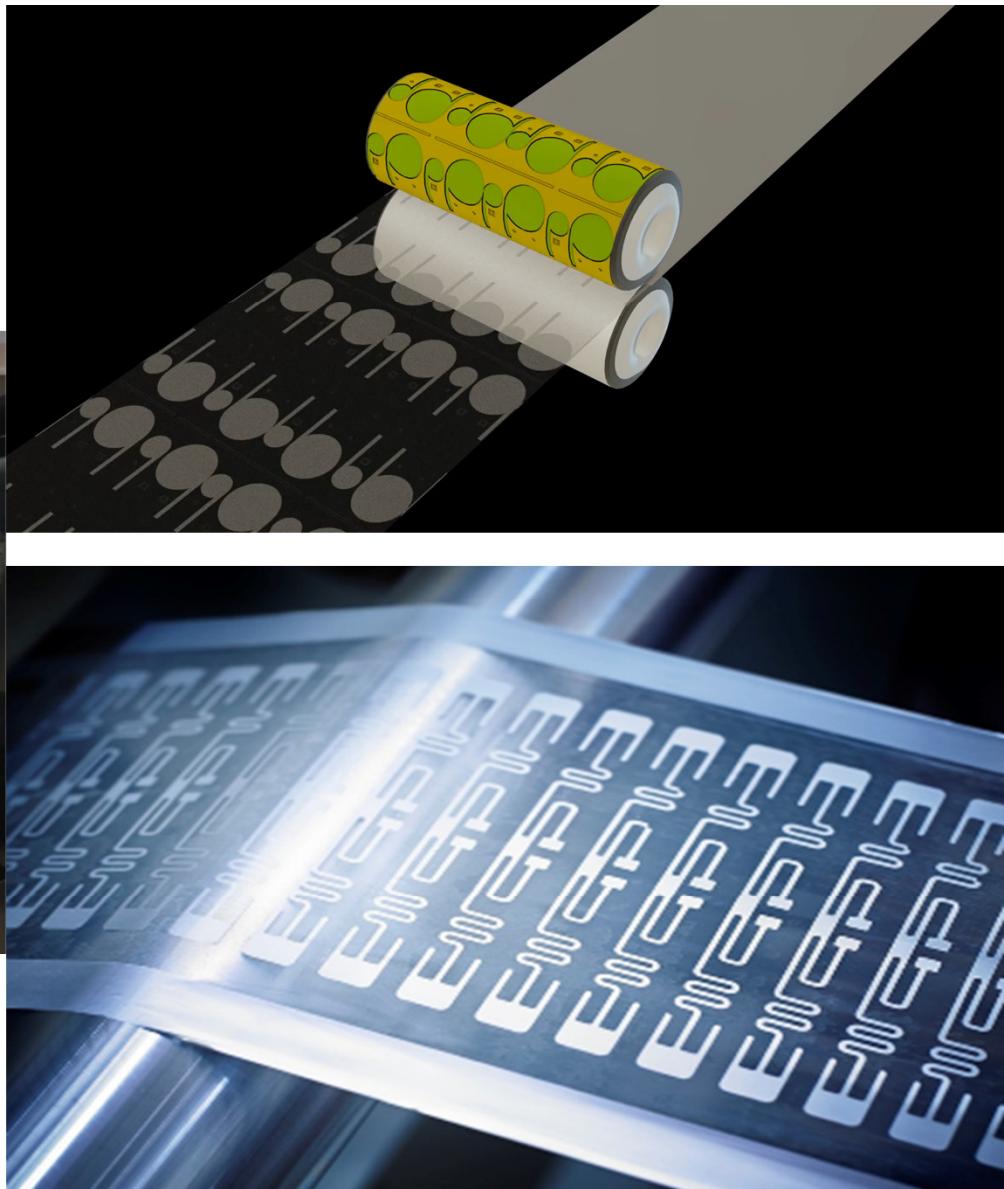




**Revolutionizing electronic
circuitry manufacturing**

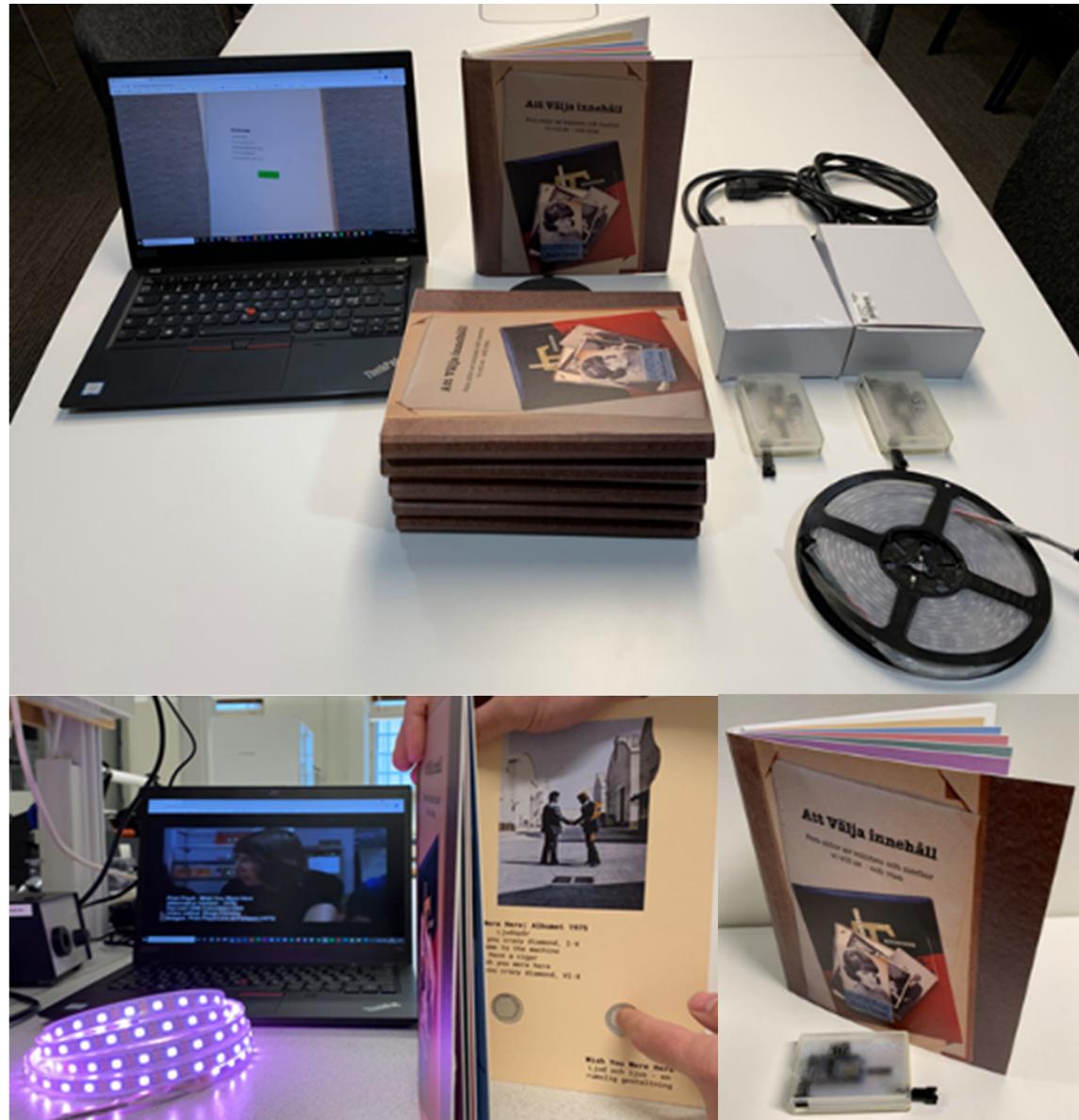


DP Patterning

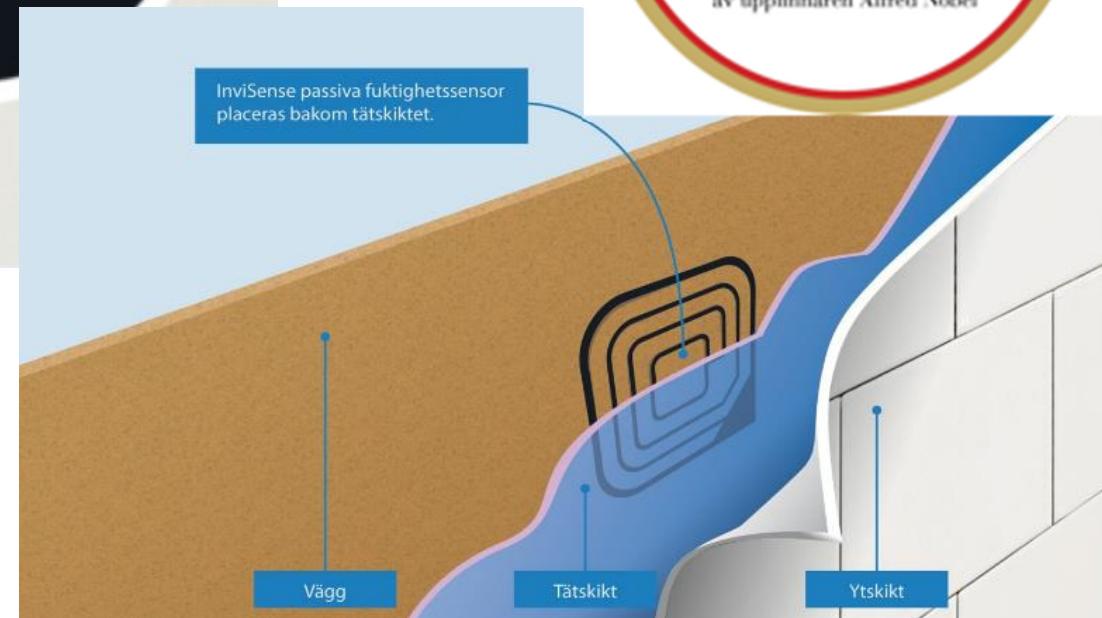


Media Book

Hybrid tryckt elektronik är integrerad i en bok för att skapa en lätthanterlig, intuitiv, interaktiv hjälpmittel för t ex äldrevårdpatienter att aktivera media.



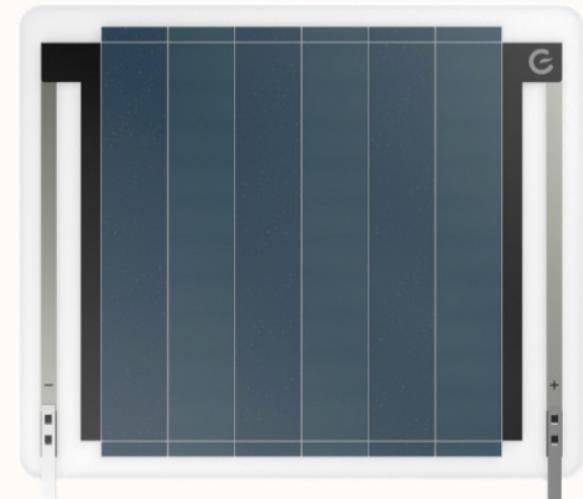
Spinout Invisense – Printed humidity sensors





epishine

WE ARE DEVELOPING THE MOST
SCALABLE, RESOURCE EFFICIENT
AND AFFORDABLE SOLAR CELL IN
THE WORLD.



Epishine's modules (LEH3) for light energy harvesting

