

flexprint



Printed/coated functionalities

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Technology
Agency
of the Czech Republic

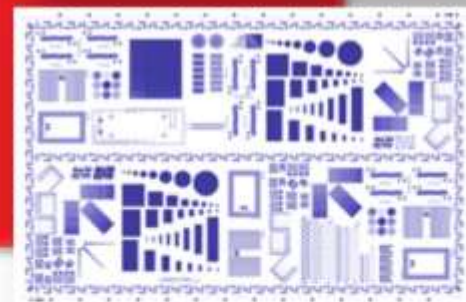
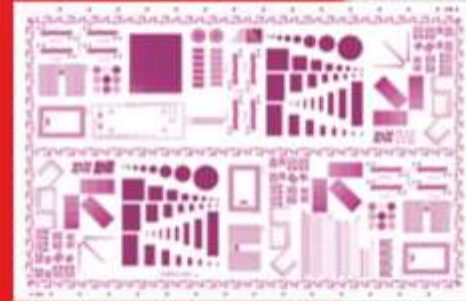
Program **Centra kompetence**

Program **Alfa**



Outline

- UPCE/Department of GAP
- Luminiscent layers/materials
- Photochromic layers/materials
- Simple functional layers
- Activities in printed/coated functionalities
- Drying/Sintering techniques



Pardubice



University of Pardubice

- 1950 – Institute of Chemistry
- 1994 – University of Pardubice
- 2014 – 7 Faculties
 - Jan Perner Transport Faculty
 - Faculty of Economics and Administration
 - Faculty of Electrical Engineering and Informatics
 - Faculty of Arts and Philosophy
 - Faculty of Chemical Technology
 - Faculty of Restoration
 - Faculty of Health Studies
- www.upce.cz

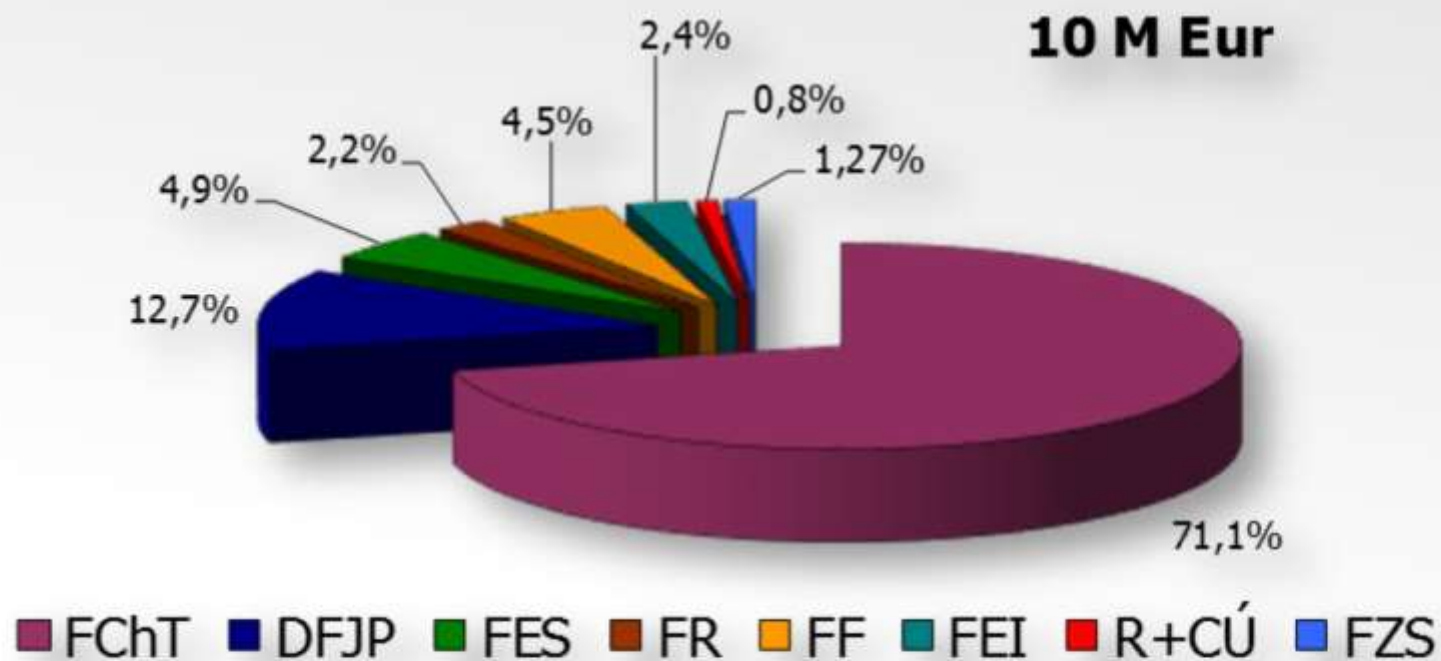


Faculty of chemical technology

- 12 Departments and Institutes
- Joint Laboratory of Solid State Chemistry (with Institute of Macromolecular Chemistry of Academy of Sciences of the Czech Republic)
- Centre of Materials and Nanotechnologies



R&D Budget by Faculties



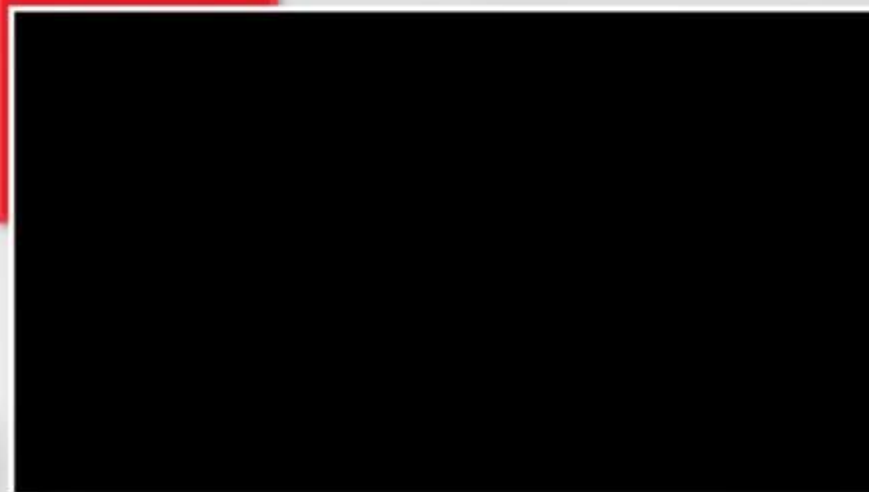
Department of graphic arts and photophysics

- 1984 – Founded
- 2013 – 170 students
- 10 academics, 2 researchers, 6 lab. and admin. staff
- The only department in the Czech Republic providing university studies, research, and testing in the whole field of printing
- Close cooperation with the industry
- Member of IARIGAI, IC (of Educational Institutes for Graphic Arts Technology and Management), OE-A



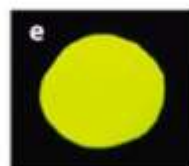
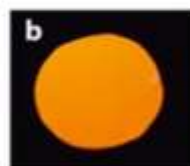
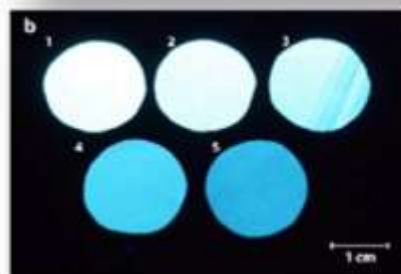
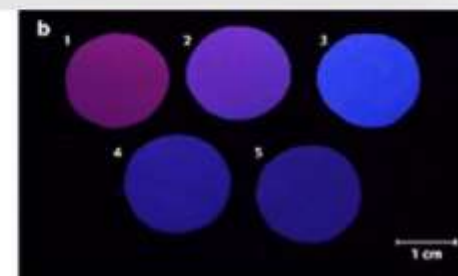
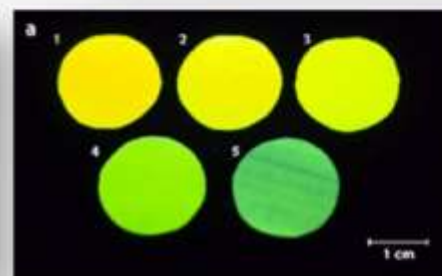
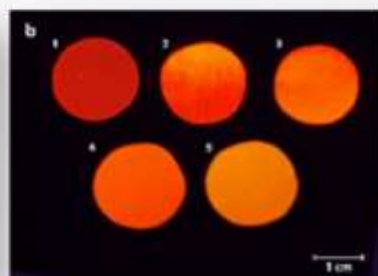
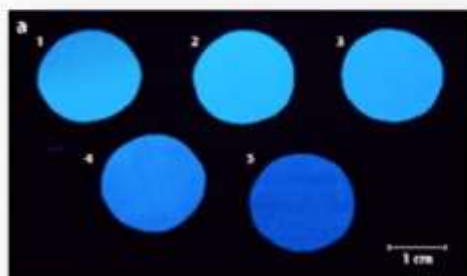
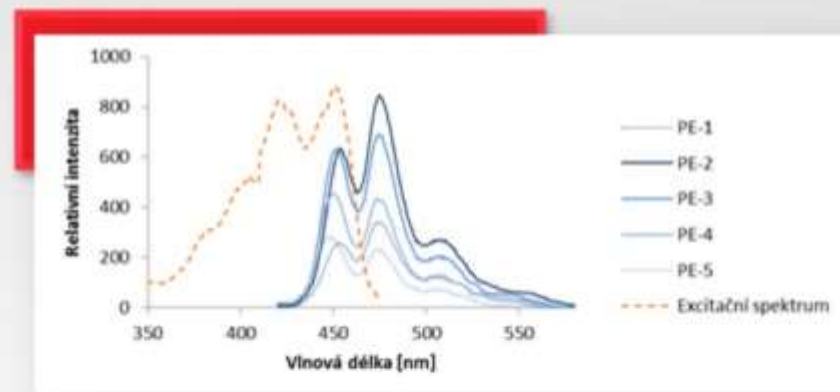
Activities in area of simple functional layers

- Antistatic
- Antimicrobial
- Luminescent
- Photochromic
- Security

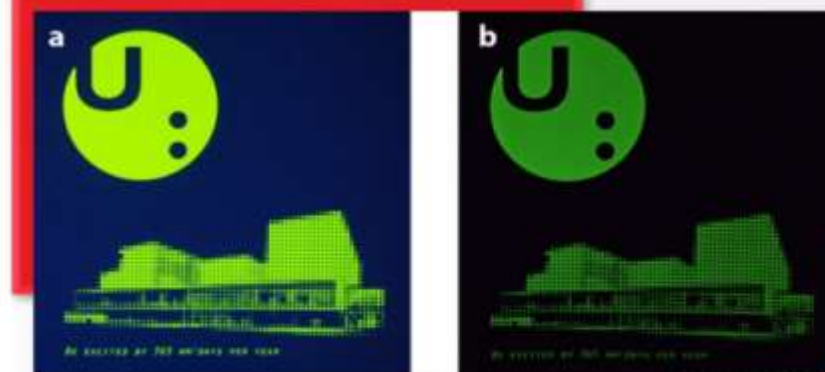
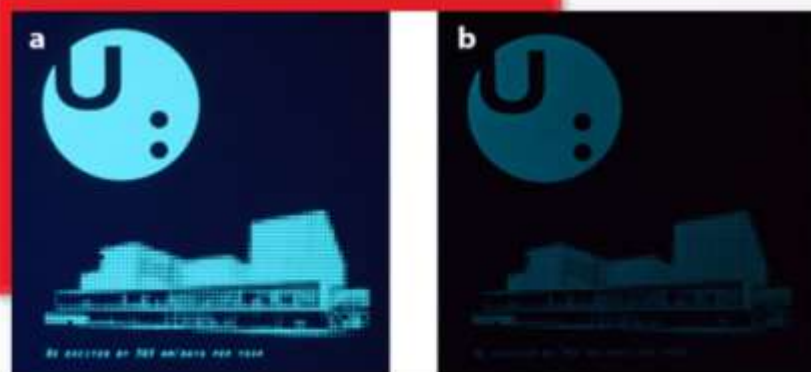
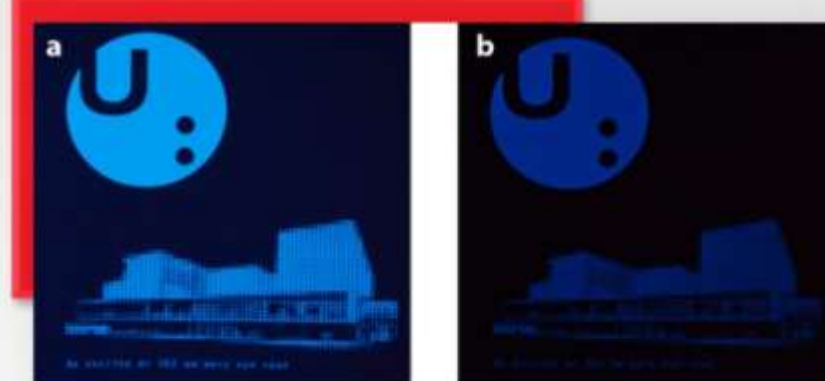
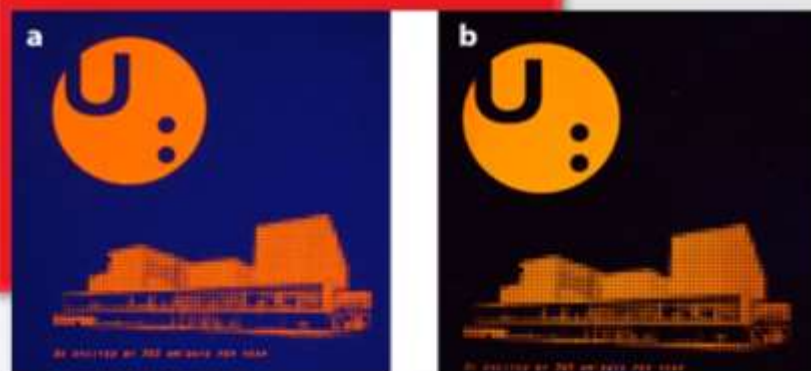


Luminiscent materials

- R&D of specific effect layers
 - Fluorescent

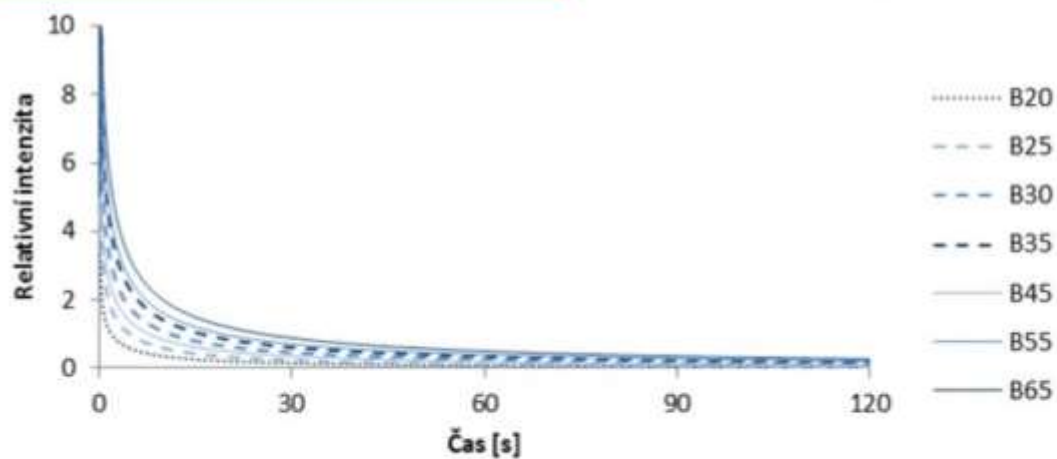
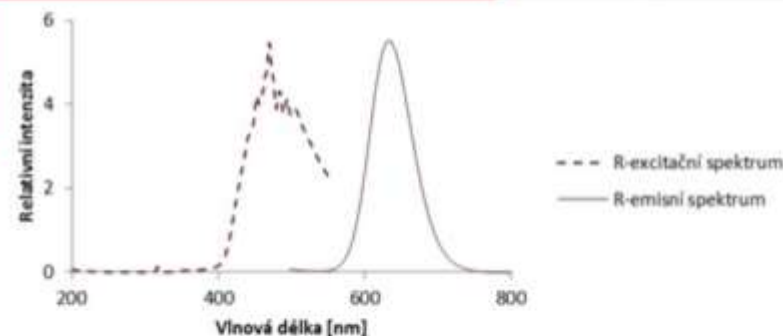


Luminiscent materials - Fluorescence

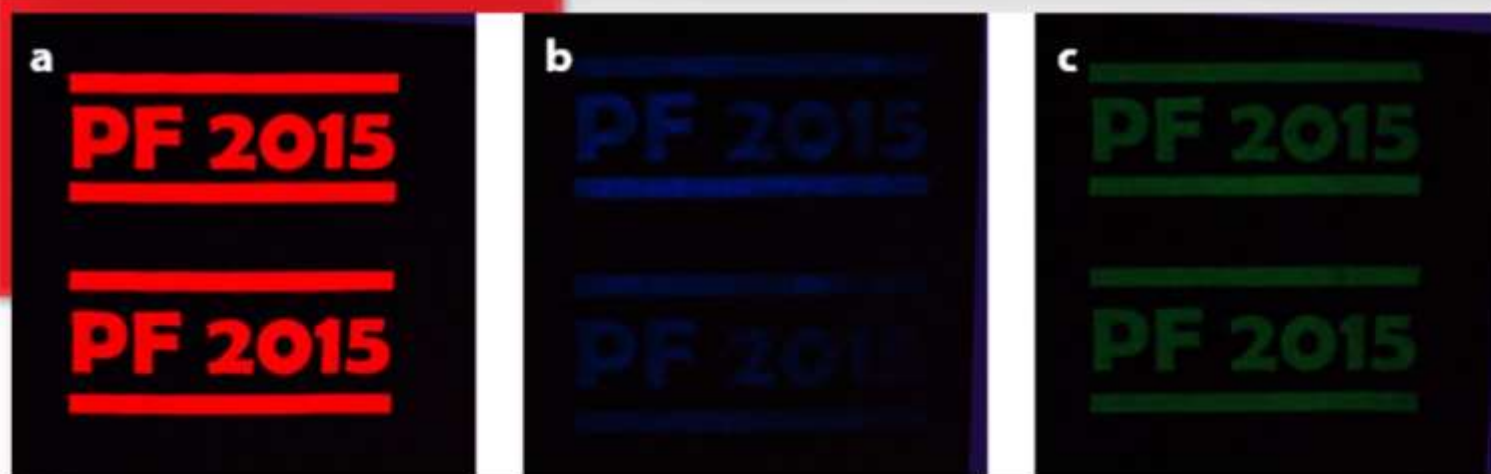
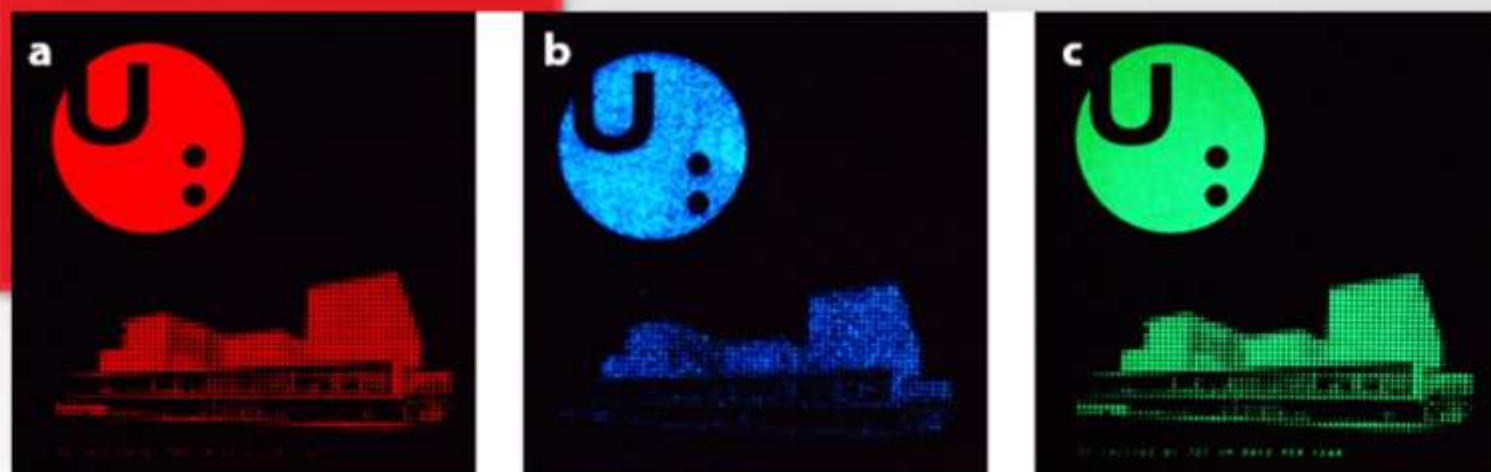


Luminiscent materials

- R&D of specific effect layers
 - Phosphorescent
 - Study of kinetics
 - Emission time



Luminiscent materials - Phosphorescence



Passive electronic components

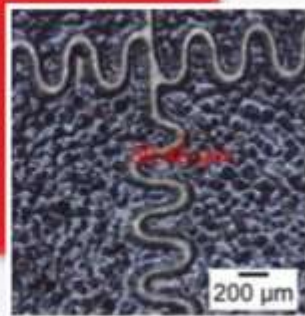
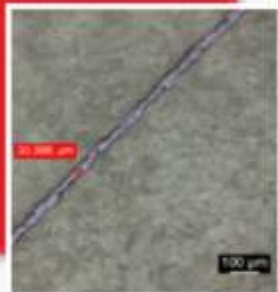
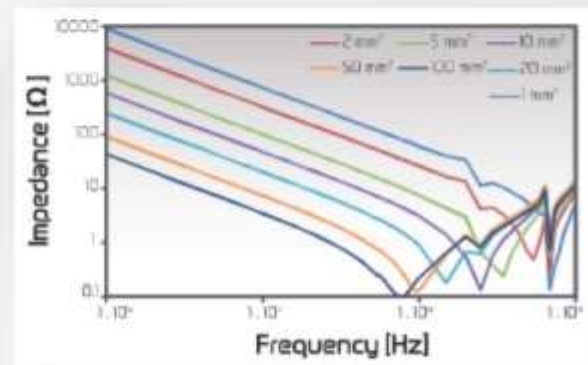
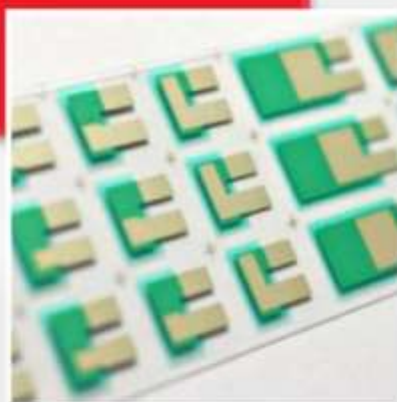
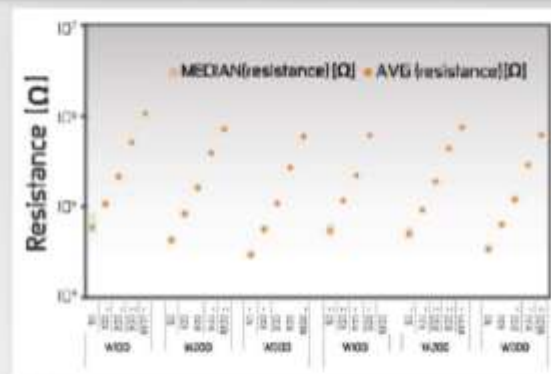
Resistors

Capacitors

Circuits and conductive structures

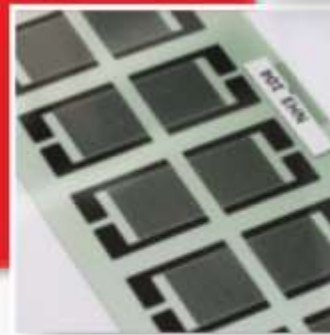
Transparent conductive electrode

- (Semi)conductive polymers
- Metals nanowires layers



Sensor elements

- Temperature (resistors, thermistors PTC/NTC)
- Relative humidity (different active layers)
- Gas detection – NO_2 , NH_3 , Ethylene
- Air/Gas flow sensor, acceleration sensors
- Tactile sensors
- Light sensors
- Heavy metal sensor elements



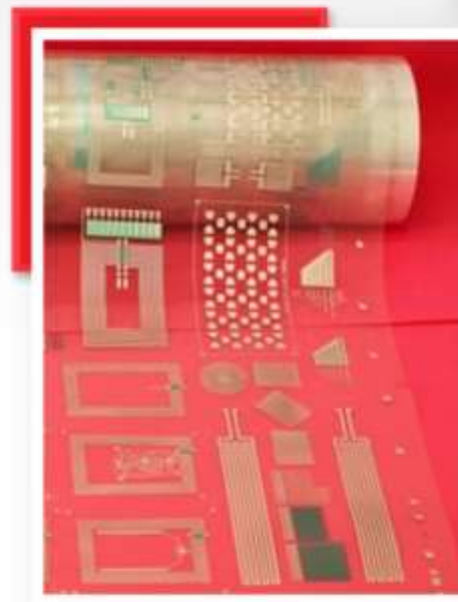
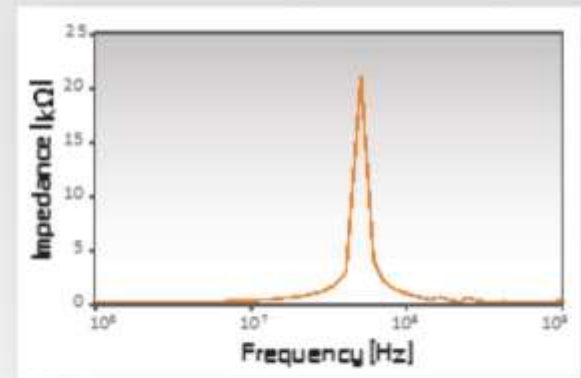
Why we are developing the sensors?

- Smart Labels with sensing capabilities.
- Monitoring of climate condition or/and other parameters according customers needs.
- Fully programmable logging management over NFC with Android based devices.
- Autonomous logging, storing to clouds.
- R2R technology process.
- Actually developed sensors
 - Temperature – NTC/PTC
 - Relative humidity
 - Ammonia
 - NO₂
 - Gas flow (coop. with external partner)
 - Acceleration (coop. with external partner)
 - Tactile sensor
 - Visible light, UV radiation (coop.), etc.



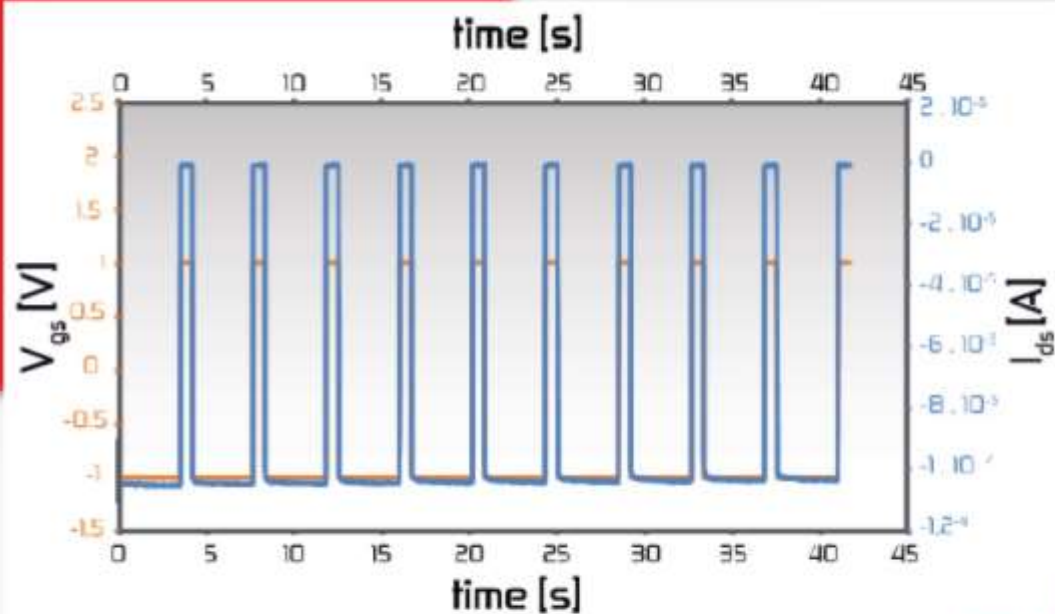
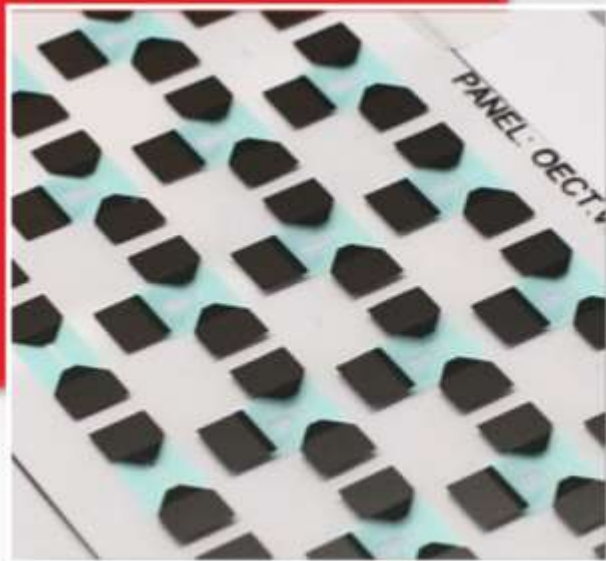
RFID

- Semipilot plant
- RFID – HF, UHF
- Printing technique
 - Silver based inks
 - Developed Cu based
 - Screen printing
 - Flexography, Gravure



Transistors - OFET, OECT

- OECT - response time ~ 10 ms



Display elements

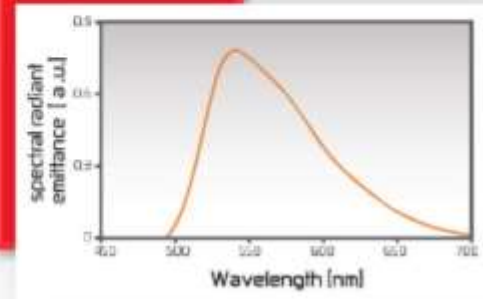
- LEC

- Threshold voltage [V] 5 V
- Luminance at 110 V 340 cd.m⁻²



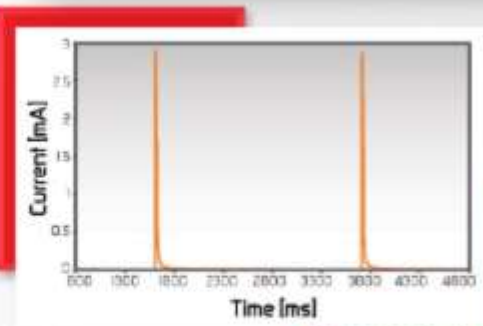
- OLED

- Threshold voltage [V] 2.5 V
- Luminance at 9 V 285 cd.m⁻²



- ECD

- Operation voltage 1-1.5 V
- Current peak consump. 1 mA/mm²
- Response time ≈ 30 ms



Printed batteries

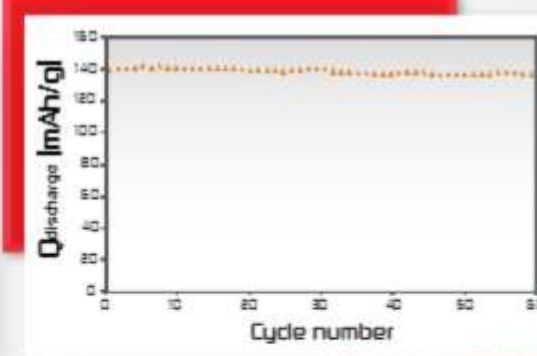
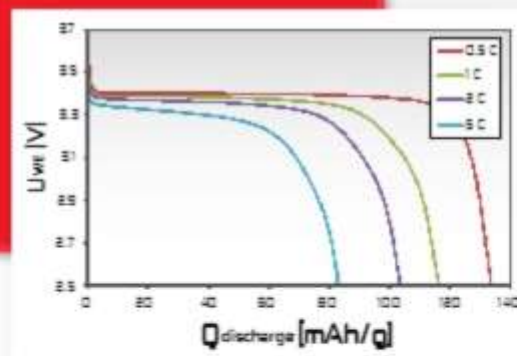
Primary

- Zn/MnO₂
- 3V battery



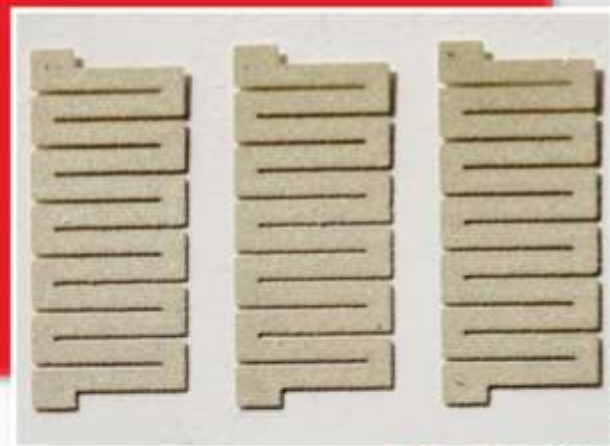
Rechargeable

- Lion battery
 - Cathode ~ 150 mAh/g
 - Anode ~ 260 mAh/g



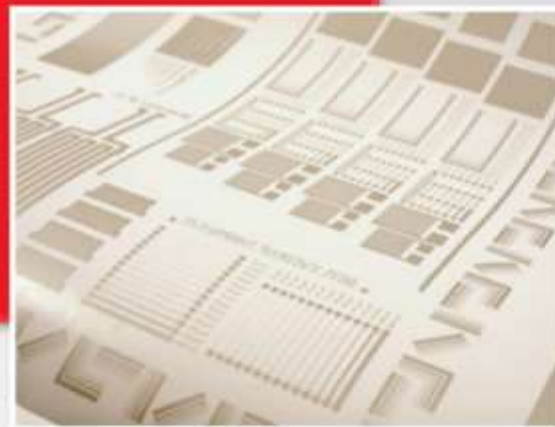
Photonic sintering experiences

- Experiences with Xenon pulse power sources, laser sources (UV, VIS, IR)



My ActInPack mission

- Be even more deeper in R&D, of above listed structures, on paper based substrates.
- Cooperation with new partners within new products.



COST Action FP1405
Active and intelligent fibre-based packaging –
innovation and market introduction (ActInPak)



ActInPak is a pan European (COST) network of the leading experts in active and Intelligent packaging of over 50 institutes and universities of 28 different countries.

The main objective is to develop a knowledge-based network on sustainable, active and intelligent fibre-based packaging in order to overcome current technological, industrial, and social limitations that hinder the wide deployment of existing and newly developed solutions in market applications.

http://www.cost.eu/COST_Actions/fps/Actions/FP1405

<http://www.actinpak.eu>

<https://www.linkedin.com/groups/COST-FP1405-ActInPak-8254568/about>

flexprint



Program **Centra competence**



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Thank you for your attention

Acknowledgments

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