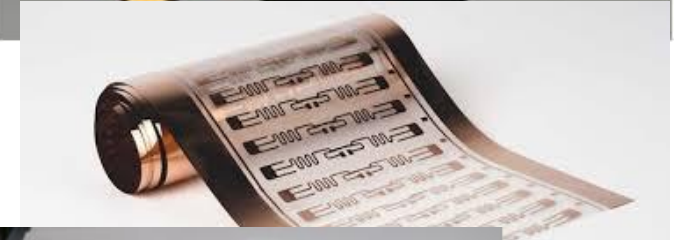
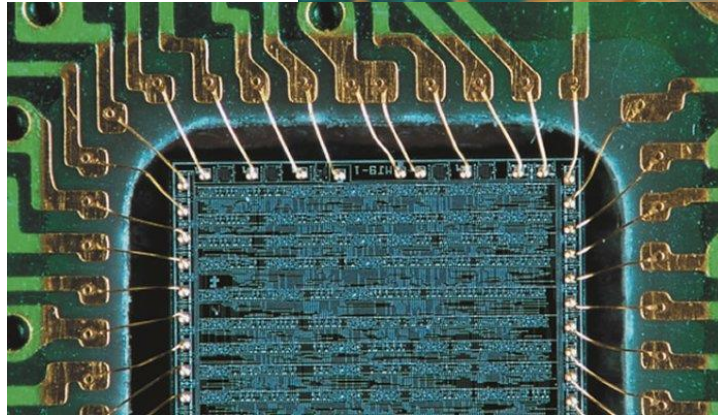
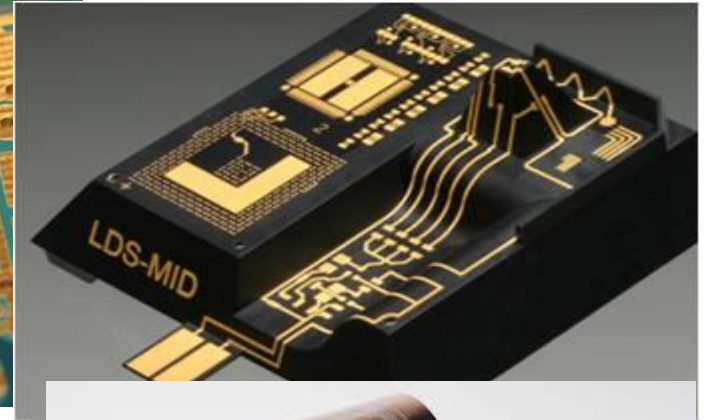


Selective metallisation of textiles achieved using a magnetic field

by S. Danilova, A. Cobley

The Importance of Selective Metallisation in the Electronics Sector

- Printed Circuit Boards
- Molded Interconnect Devices
- Micro-electronics
- Printed Electronics
- Wearable Technology
- RFIDs
-and many more



Lithography

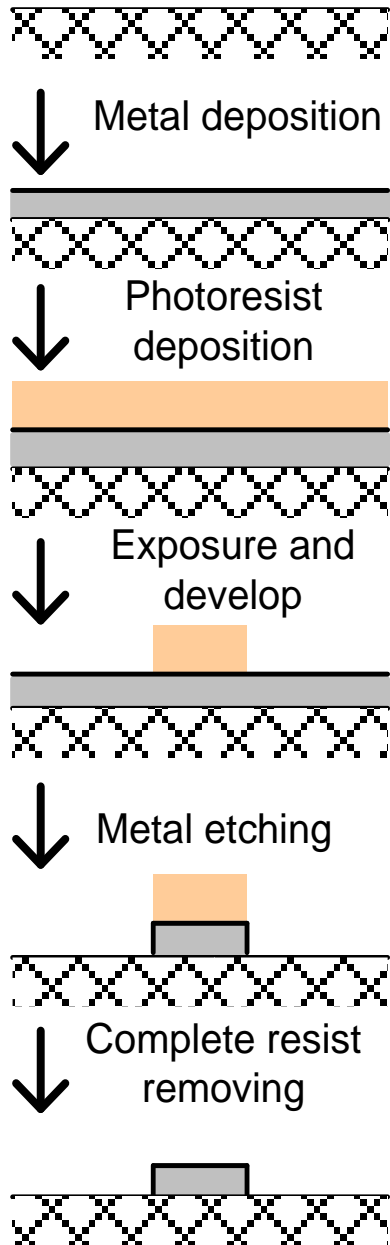
30-40% of total electronic device manufacturing cost is due to lithography!

Lithography steps:

- spinning resist,
- pre-bake,
- exposure,
- development,
- post bake,
- etch,
- resist strip

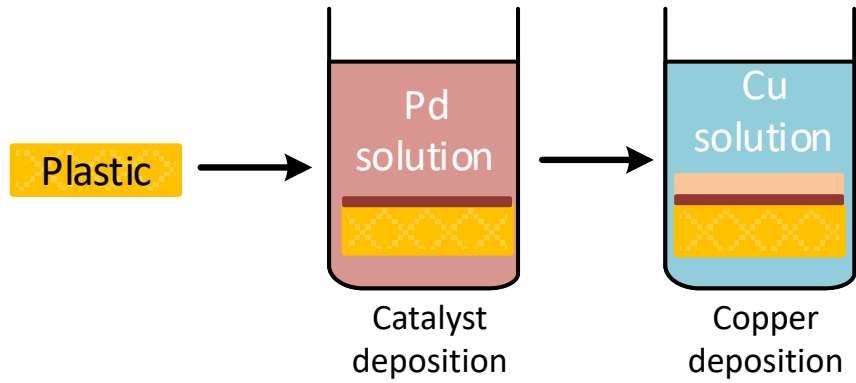
Main disadvantages of lithography:

- requires heating;
- use hazardous chemicals;
- requires qualified staff;
- high material waste due to entire surface coating
- high cost
- long process

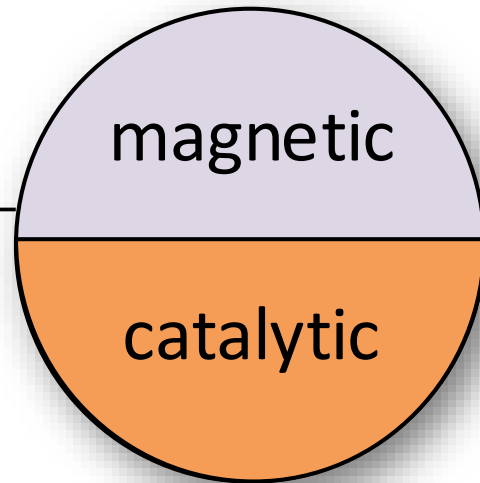


Novel technology

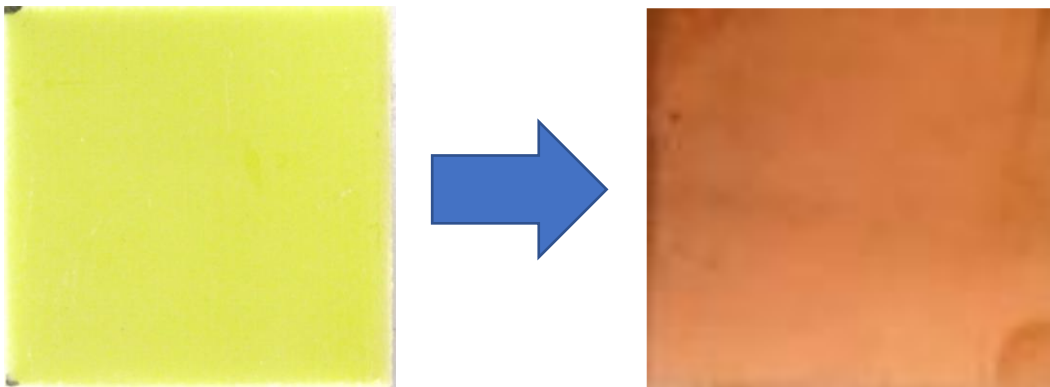
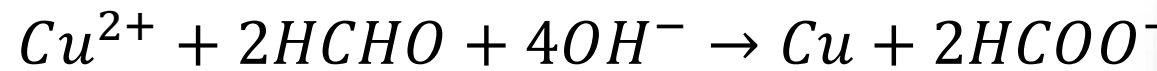
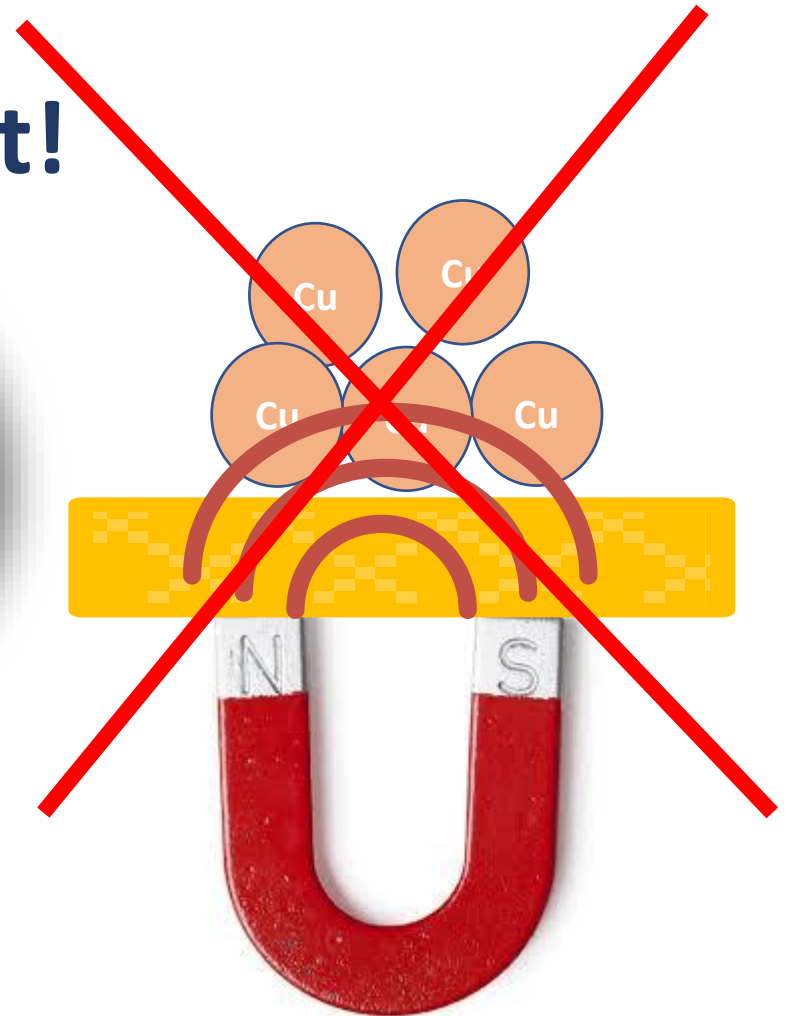
Electroless plating process



Novel catalyst!

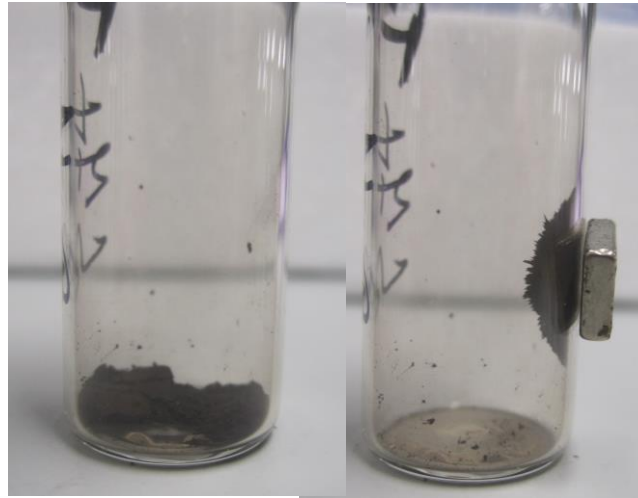
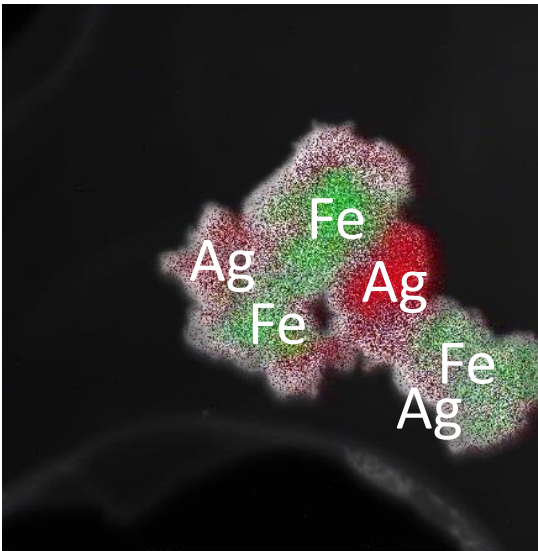
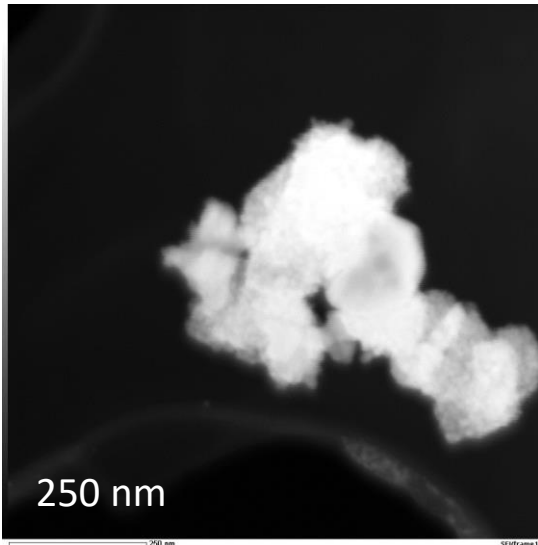


The idea



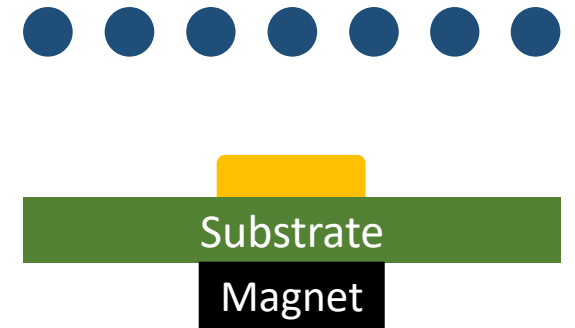
Magnetic catalyst

Test of magnetic properties of particles



 - Silver (Ag)

 - Iron (Fe)

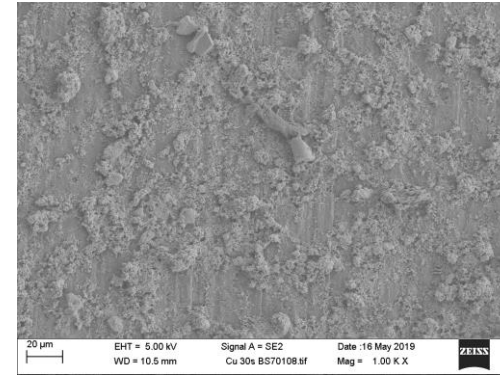
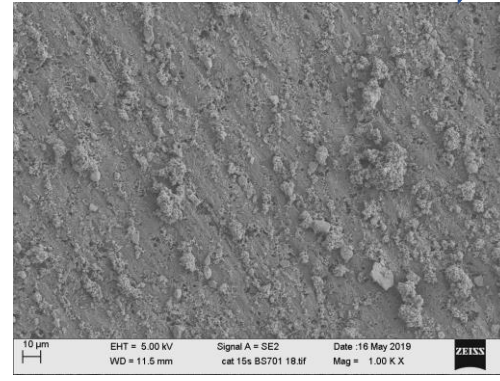
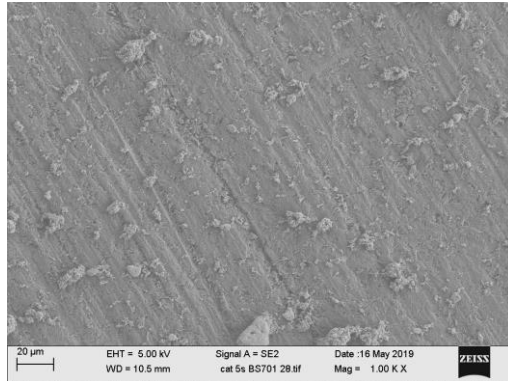


Optimisation of catalyst deposition

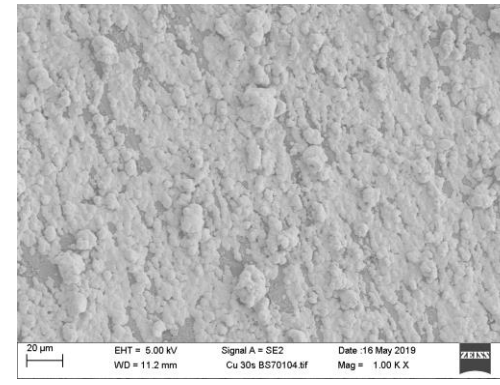
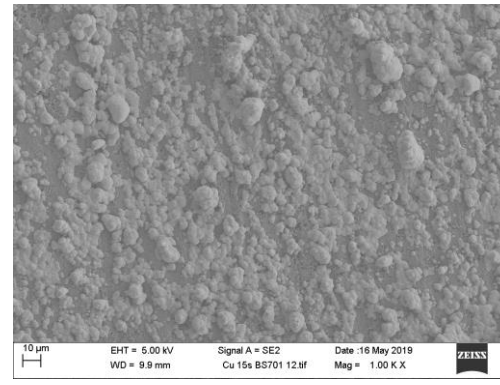
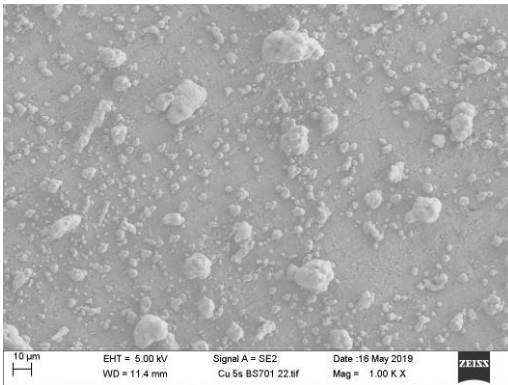
Time of catalyst deposition



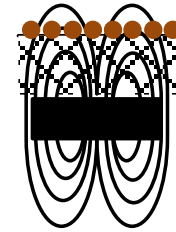
Catalyst



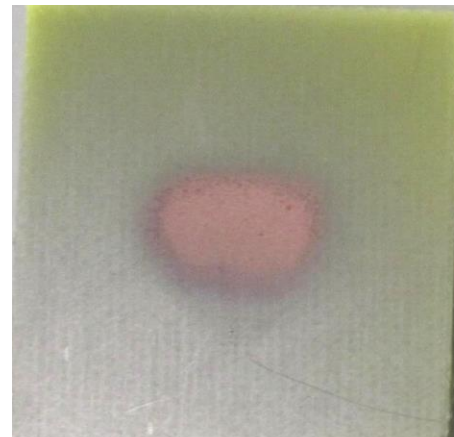
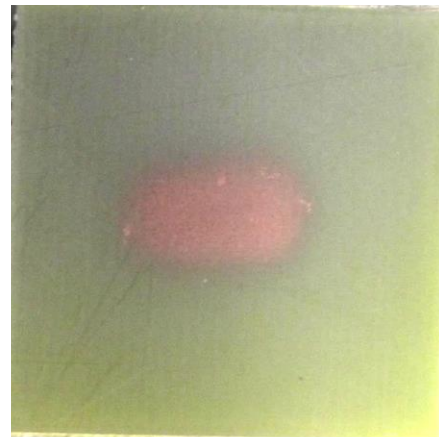
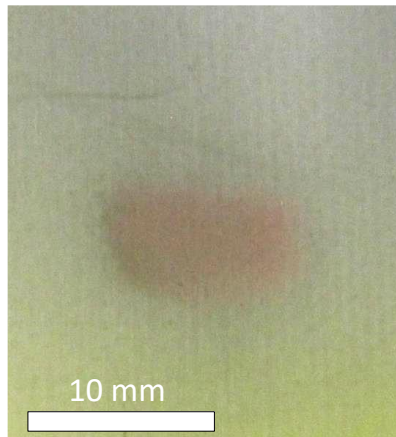
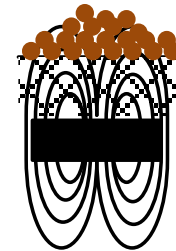
Electroless copper



Desired catalyst deposition

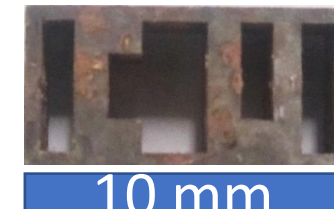
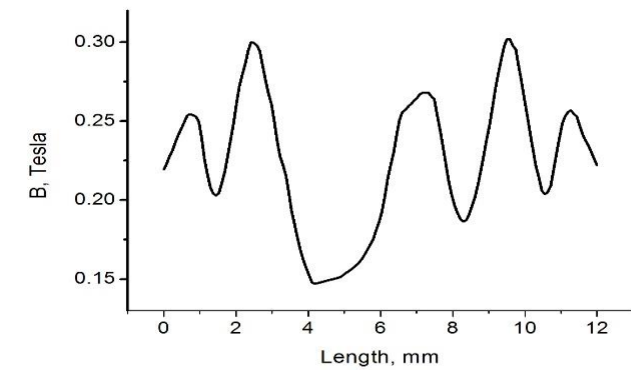
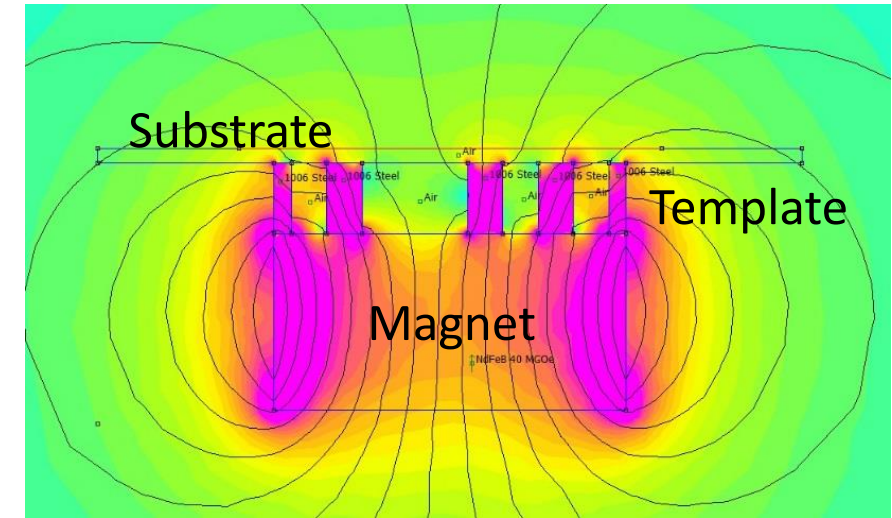
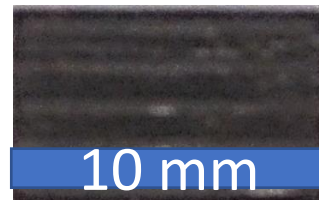
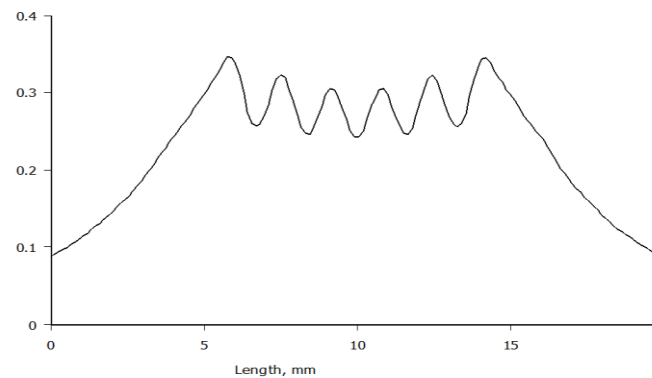
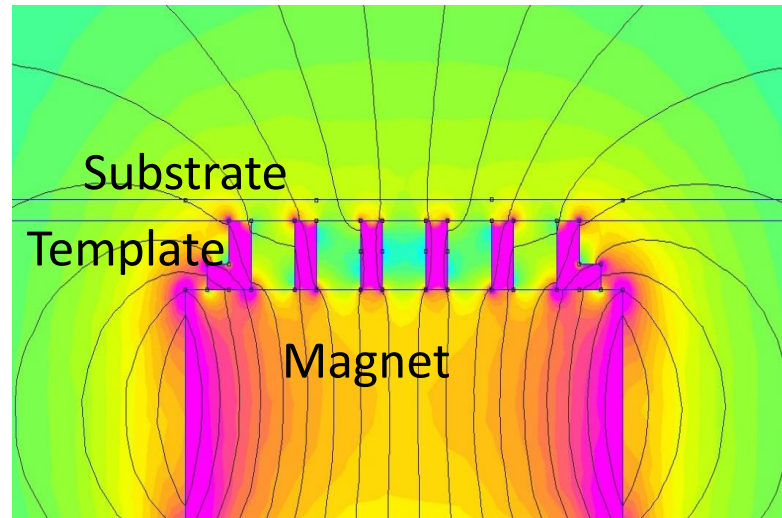
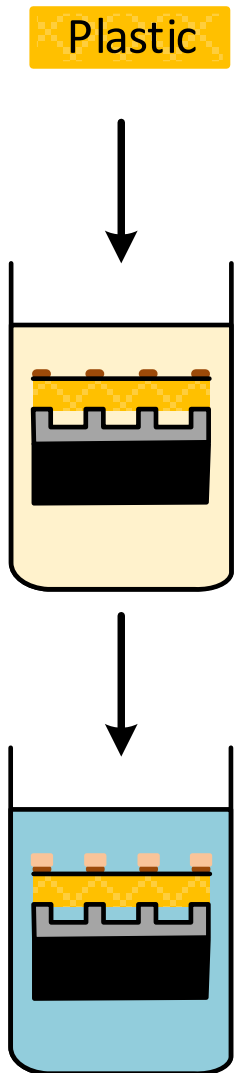


Excessive catalyst deposition



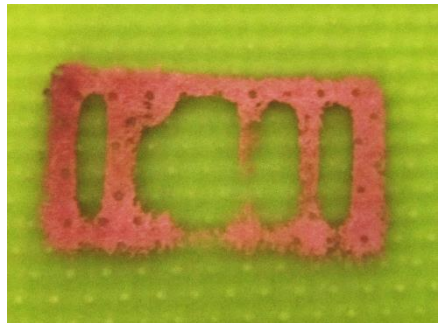
Magnetic template fabrication

Simulations of magnetic field distributions made in FEMM software



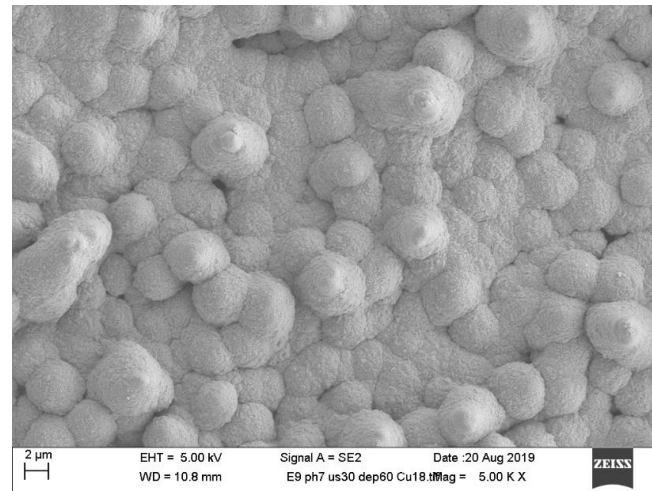
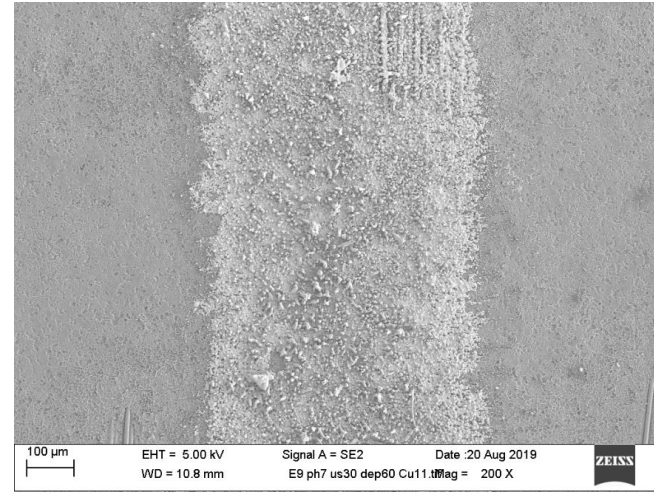
Selective deposition

Digital photos of selectively deposited copper

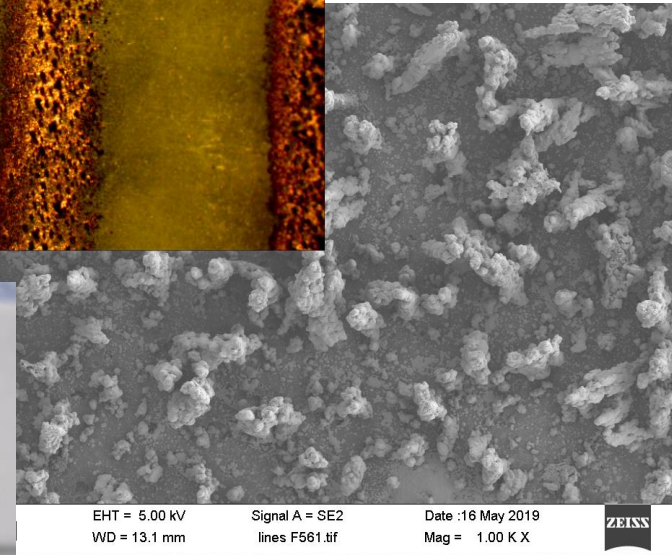
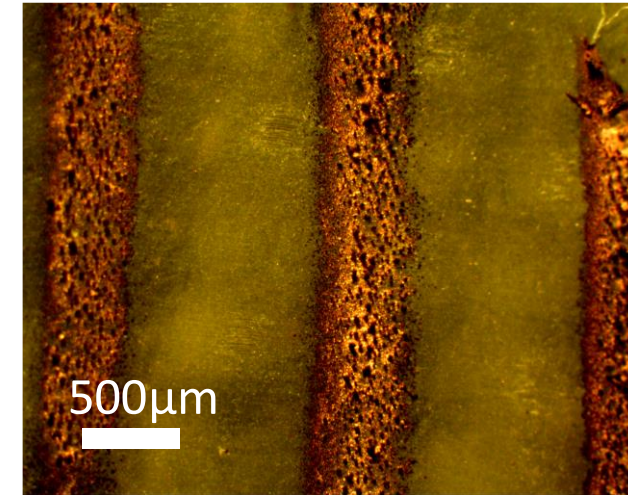


Catalyst deposition time ↑

10 mm

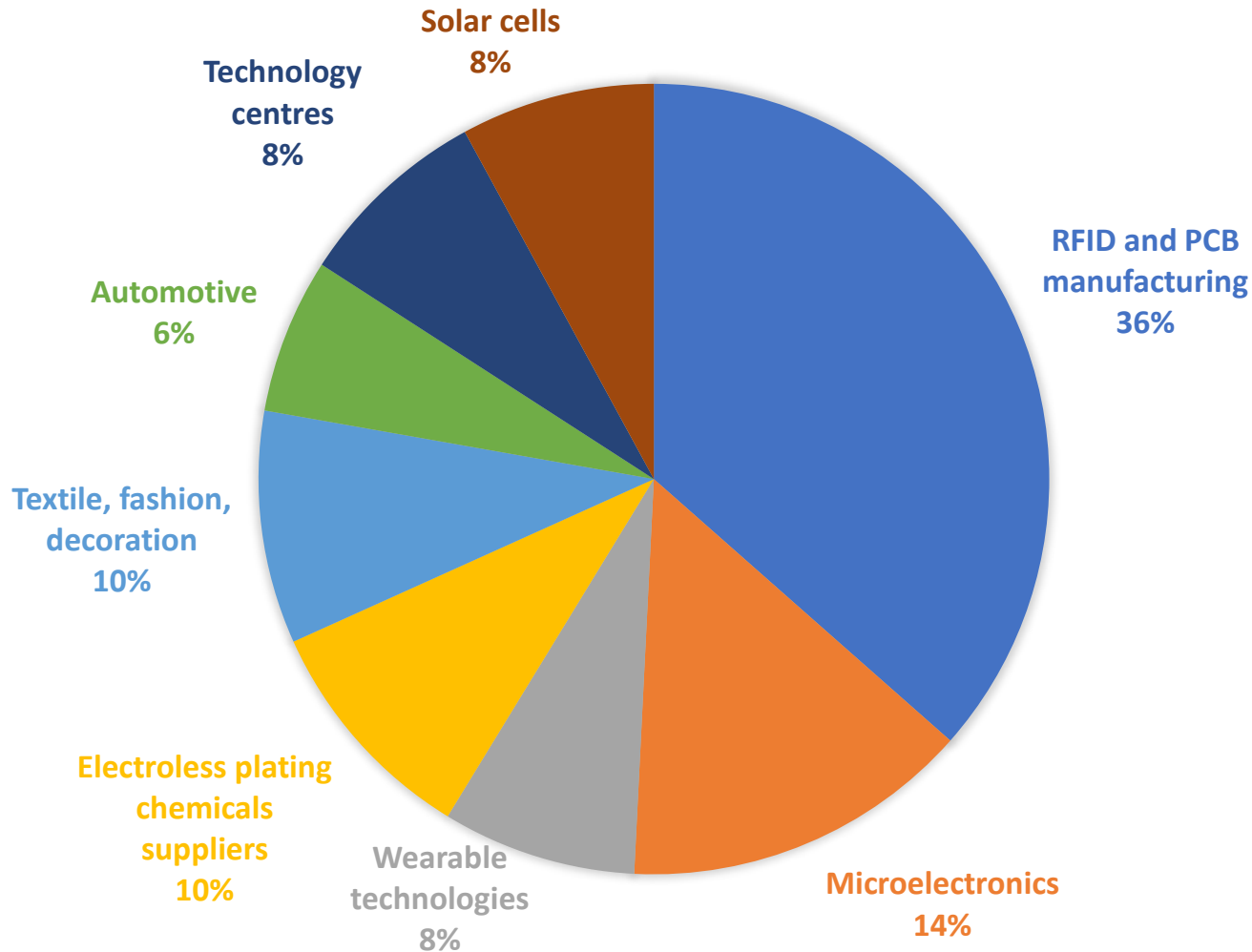


Optical microscopy images of selectively deposited copper



Scanning electron microscopy images of selectively deposited copper

Potential Market Sectors



Advantages of using magnetically directed deposition

- ✓ Cost-effective reduces cost approximately by 30%;
- ✓ Shorter production time reduces production time approximately by 50%;
- ✓ Low temperature maximum operating temperature 46 °C;
- ✓ Less waste no lithography-associated waste such as organic solvents, resist and removed metals.

Selective metallisation of textile using a magnetic field

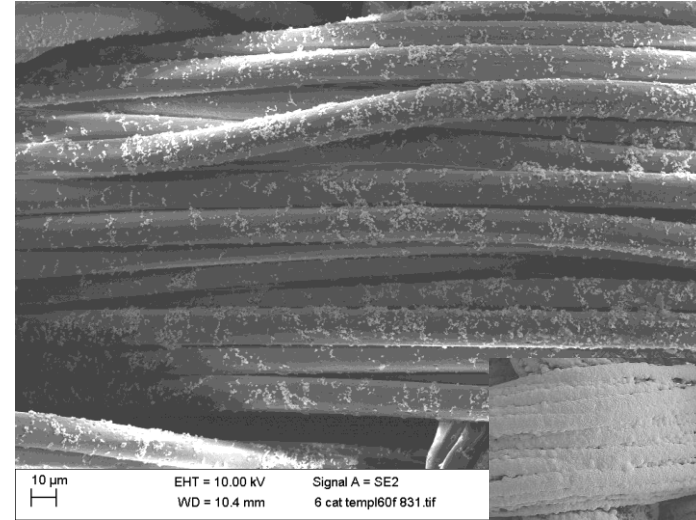
SMMF on plastic



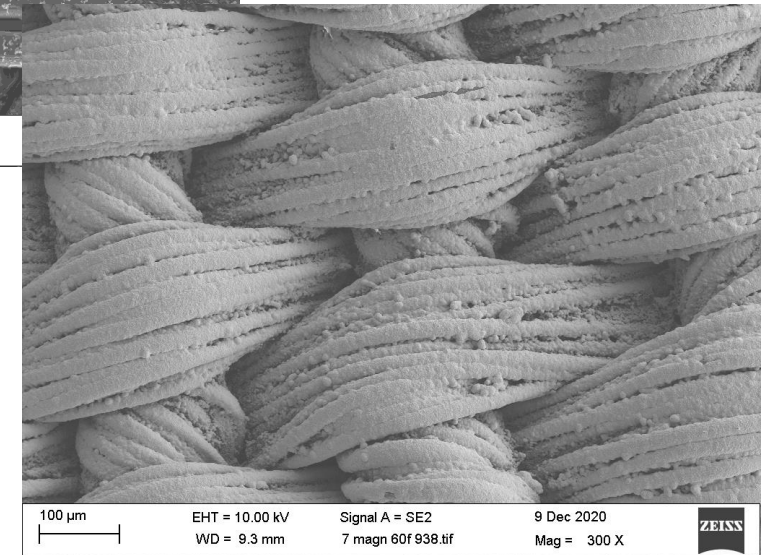
SMMF on textile



Catalyst deposited on polyester



Electroless copper

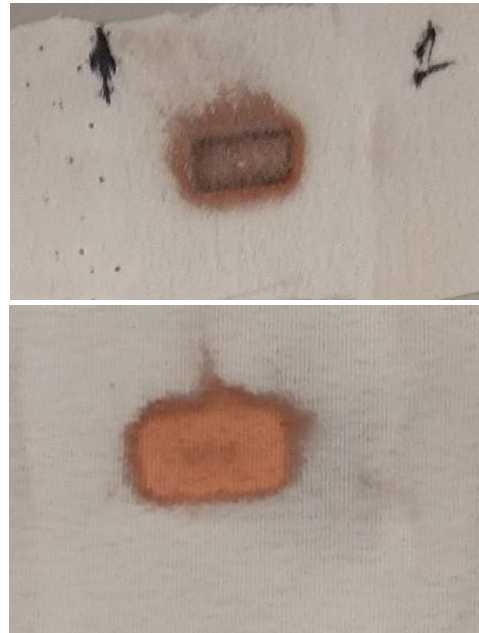


Challenges of selective metallisation of textile

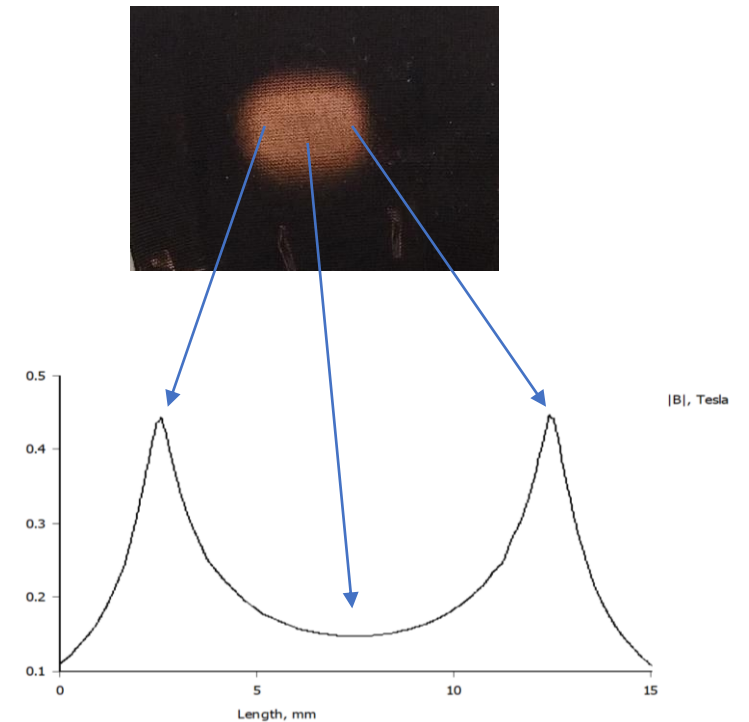
- Pre-treatment of textile is important



- Stirring method can affect the results

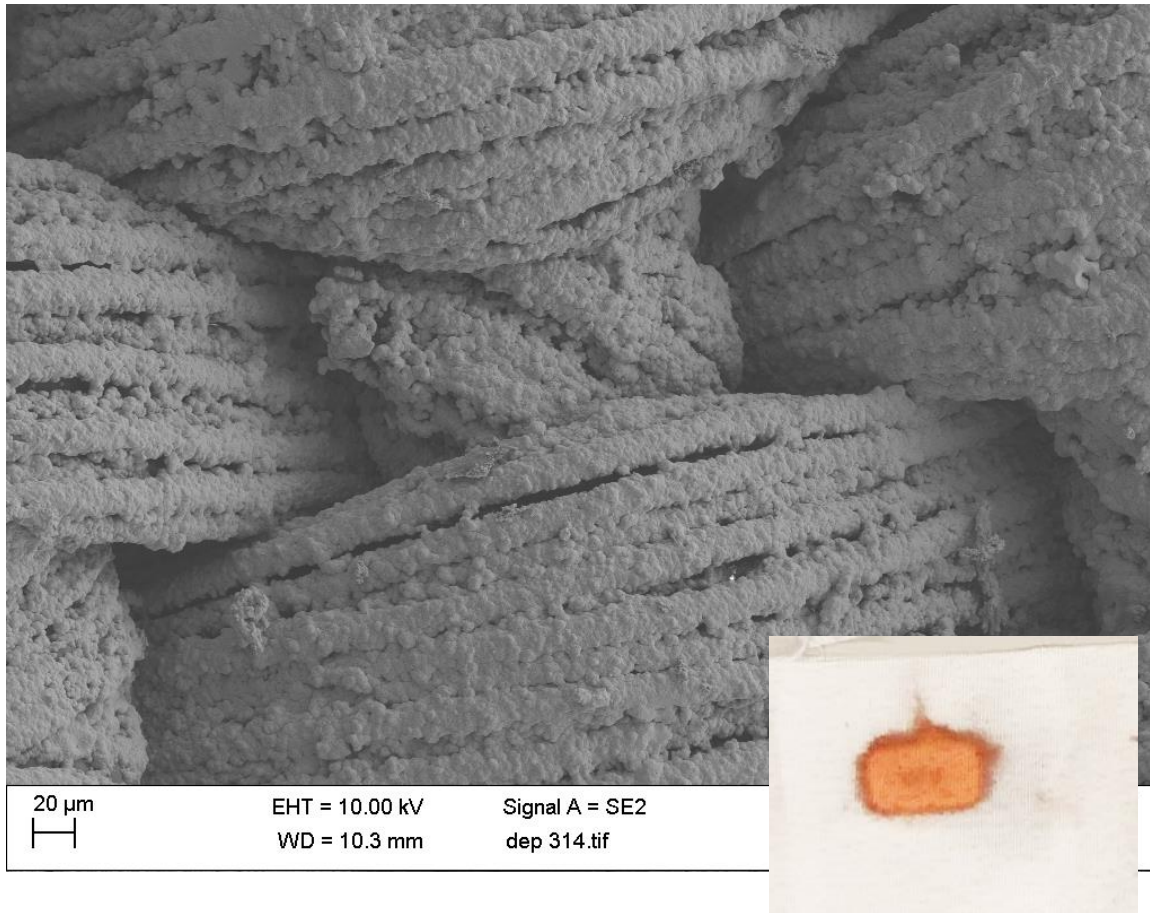


- Magnetic field distribution varies along magnet surface

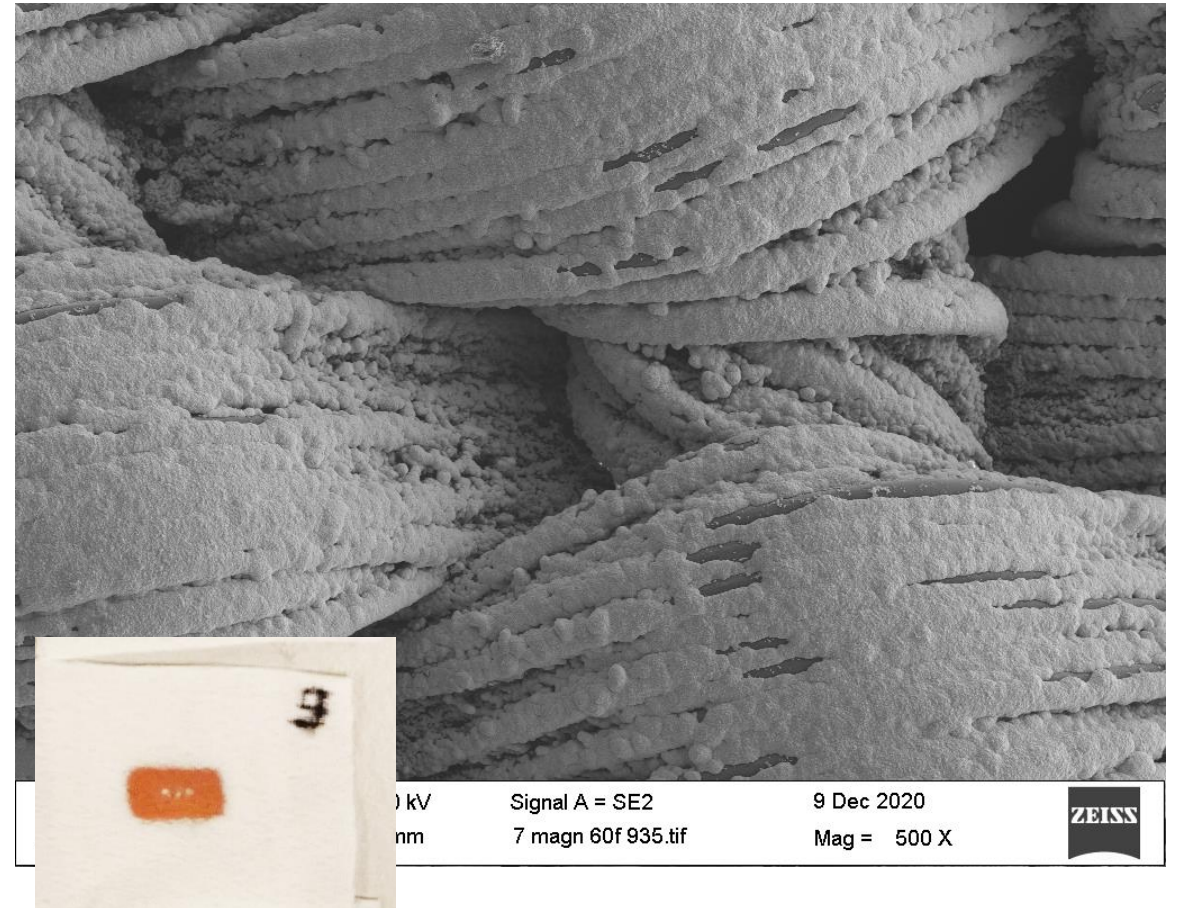


Catalyst filtration

Catalyst was not filtered

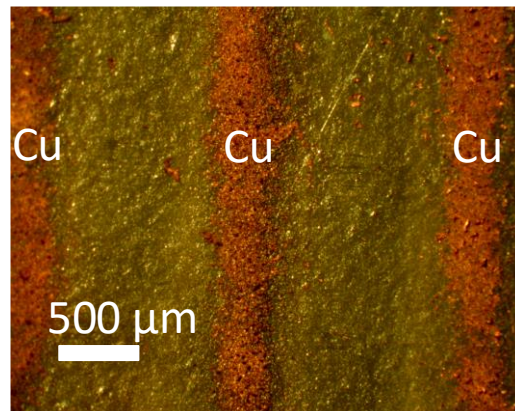


Catalyst was filtered



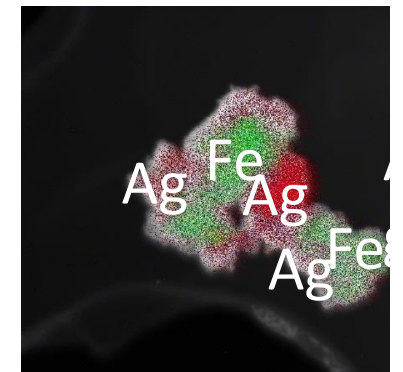
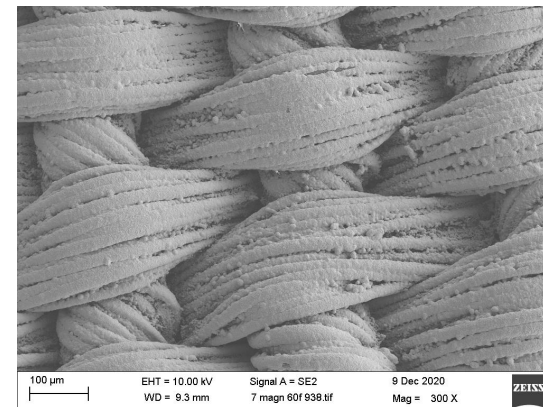
Conclusions

- 1) In 3 years, the research was taken from idea to proof of concept;
- 2) A novel magnetic catalyst was created;
- 3) Selective metal deposition was achieved on plastic (FR4) and polyester materials



Future work

- 1) Conduct reliability tests of metallised textile;
- 2) Explore further the properties of metallised textiles with high surface area



Thank you!
Any Questions?