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Ph.D. thesis (2022-2025)
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Thèse confidentielle

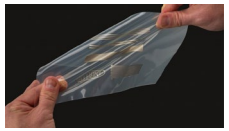
Development of stretchable conductive inks

Développement d'encres conductrices étirables

Funprint / MatBio

Context / Objectives

Stretchable electronics field



- Growing market
- Applications in healthcare, safety, e-textile…

Most of current stretchable conductive inks :

- Are only flexible
- Have a high resistance increase under stretching
- There is an uniformity of used materials (PDMS, PU)

Challenges:

- Formulation of a stretchable printable fluid
- Adapt and optimize the printing process
- Maintain a good adhesion and functional properties of the ink while stretching the printed pattern
- Ecodesign: use of biobased alternatives for the matrix and decrease of the amount of metallic material

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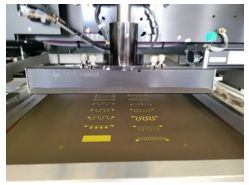
Methods

Formulation of stretchable fluids

- Silver particles with different morphologies
- Biobased matrix
- Water and co -solvent
- Additives

Printing process

Screen-printing



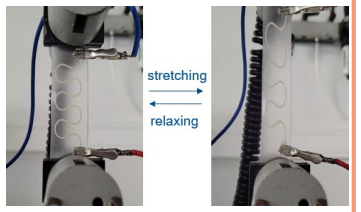
Speed: medium
90-grade mesh
Thickness : 10 µm
Substrates: PET, TPU

Electrical characterization under stretching

Records electrical resistance of the conductive sample while being deformed

Parameters:

- Sample shape (pattern, size, line width)
- Elongation rate
- Speed of deformation
- Unique or cyclic deformation

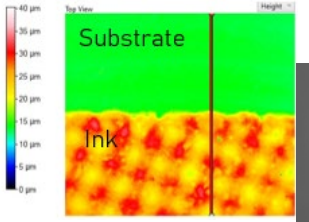


Results

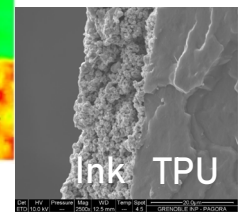
Imagery of the printed pattern

Morphological analysis of the ink at different scales (surface and inside the layer)

Binocular magnifier



Optical profilometer



MEB images

Performances of conductive inks under streching

- Inks are still conductive after 100 cycles at 25% elongation
- Observation of a hysterisis phenomenon