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Ph.D. thesis (2022-2025)
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Development of stretchable conductive inks

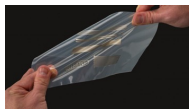
Développement d'encres conductrices étirables

FunPrint
MatBio

Thèse confidentielle

Context / Objectives

Stretchable electronics field



Growing and emerging market
Applications in :

- healthcare, safety, wearables,
- energy, automotive...

Current stretchable conductive inks :

- Are using petroleum-based elastomers (PDMS, TPU)
- Have heterogeneous performances (from one to another) and lack of characterization

Challenges:

Technical

> Maintaining a functional conductive printed track under strain: adhesion, mechanical failure, electrical percolation

> Tuning ink properties to screen printing technology

Scientific

> Understanding physico-chemical interactions between ink components

> Developping tools to characterize the behavior of the printed track under deformation

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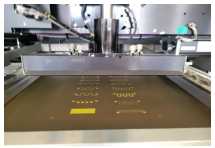
Methods

Formulation of stretchable fluids

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

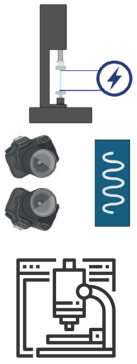
Printing process

Screen-printing



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

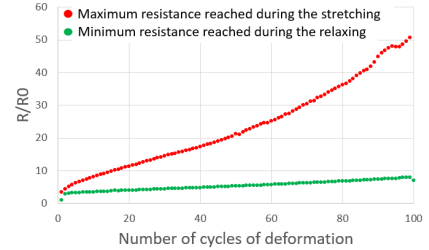
Behavior of the printed track under deformation



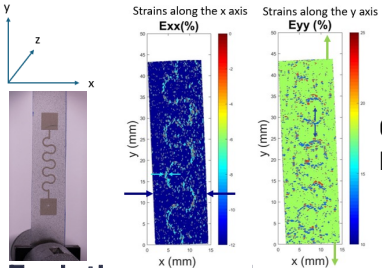
- Monitoring electrical resistance change under deformation
- Characterizing the mechanical deformation with Digital Image Correlation
- Understanding the formation of micro cracks using tensile testing under SEM

Results

Electromechanical characterization



Mechanical deformation characterization



Compression along x
Extension along y

Evolution of cracks under deformation