Project updated: 02.12.2019

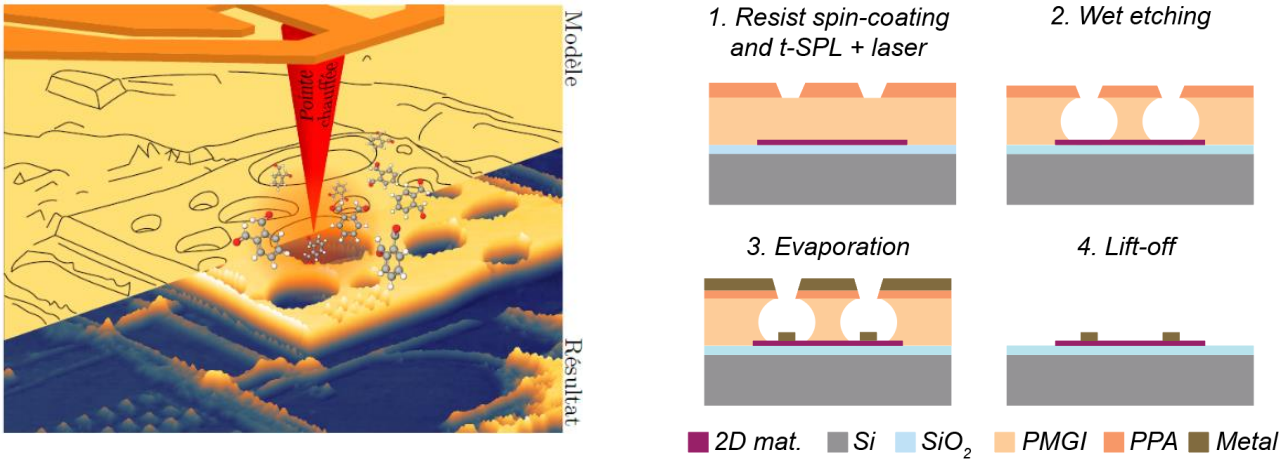
# Contact resistance optimization between 2D materials and metals

## Semester project / Master Thesis

(Section: microengineering, material science)

One major issue in devices containing 2D semiconductor materials is the large contact resistance between 2D materials and metal electrodes. To exploit the full potential of these devices, keeping this resistance as low as possible is critical.

The goal of this project is to study the quality of the contact between electrodes and 2D materials using thermal scanning probe lithography (t-SPL) and lift-off. t-SPL is an advanced lithography in which a heated AFM probe is used to create nanoscale structures into temperature sensitive materials. Different materials will be evaluated to find the optimum conditions.




*t-SPL working principle (left) and process flow (right).*

Work description:

- Thermal patterning with our t-SPL tool (NanoFrazor)
- Spin coating
- Optimization of lift-off process
- Metal deposition
- Electrical measurements


École polytechnique fédérale de Lausanne

Microsystems Laboratory 1
(Prof. J. Brugger)

EPFL STI IMT LMIS1
(Batiment BM)
Station 17
CH - 1015 Lausanne

Phone : +41 21 693 10 59
E-mail : ana.conderubio@epfl.ch
Office : BM 3.114

Project updated: 02.12.2019

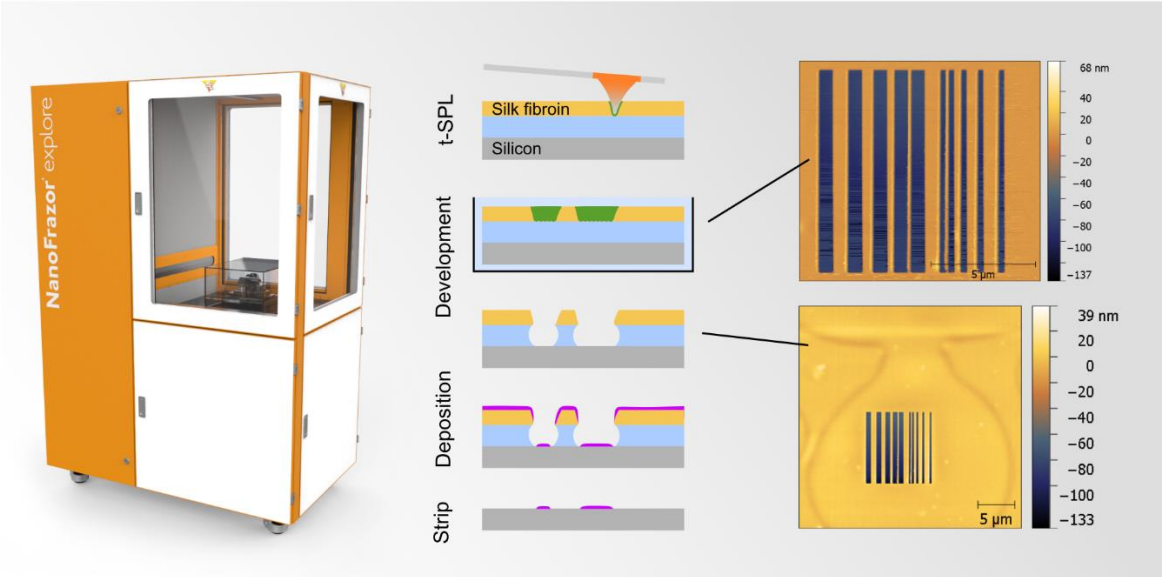
# Development and optimization of a lift-off process using water-developable silk fibroin

## Semester Project

(Section: microengineering, material sciences, engineering)

Thermal scanning probe lithography (t-SPL) is an advanced lithography technique in which a heated AFM probe is used to create nanoscale structures into temperature-sensitive materials. Our group recently discovered that silk fibroin can be used as a water-developable temperature-sensitive resist by applying microsecond heat pulses with a heated probe, which induces a solubility change in the thermally exposed area.

The goal of this project is to optimize a lift-off process using silk fibroin in order to evaporate metals onto a silicon substrate. Preliminary experiments showed promising results.




**Work description:**

- Thermal patterning with our t-SPL tool (NanoFrazor)
- Spin coating
- Optimization of lift-off process
- Metal deposition

**Contact:** Samuel Zimmermann *(samuel.zimmermann@epfl.ch)*

École polytechnique fédérale de Lausanne

Microsystems Laboratory 1
(Prof. J. Brugger)

EPFL STI IMT LMIS1
(Batiment BM)
Station 17
CH - 1015 Lausanne

Phone : +41 21 693 67 80
E-mail : samuel.zimmermann@epfl.ch
Office : BM 3.109

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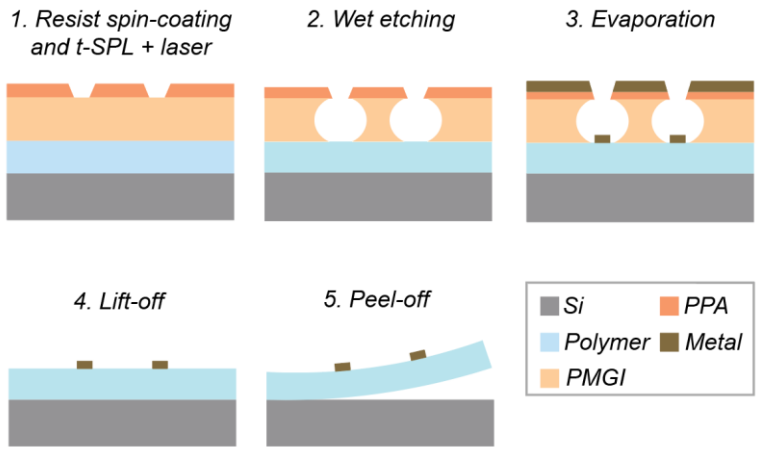
# Thermal scanning probe lithography for transparent and stretchable devices

## Semester project / Master project / Internship

(Section: microengineering, material science)

Recently, advances in device fabrication, flexible circuits and material research have enabled huge advances in the field of wearables. The final aim of the project would be the fabrication of transparent and stretchable nanoelectronic devices that could eventually be implemented in wearable technologies.

These devices would be fabricated by means of thermal scanning probe lithography, an advanced lithographic technique in which a heated tip is used to create nanoscale structures into temperature sensitive materials. This tip is electrostatically actuated and hence working with dielectric materials is not straightforward. For this reason, the first step of the project would be the optimization of the lift-off process for polymeric substrates.




*Scheme of the process.*

Work description:

- Thermal patterning with our t-SPL tool (NanoFrazor)
- Optimization of lift-off process (spin coating, wet etching, evaporation…)
- Electrical measurements

**Contact:** Ana Conde Rubio *(ana.conderubio@epfl.ch)*

École polytechnique fédérale de Lausanne

Microsystems Laboratory 1
(Prof. J. Brugger)

EPFL STI IMT LMIS1
(Batiment BM)
Station 17
CH - 1015 Lausanne

Phone : +41 21 693 10 59
E-mail : ana.conderubio@epfl.ch
Office : BM 3.114

Project updated: 02.12.2019

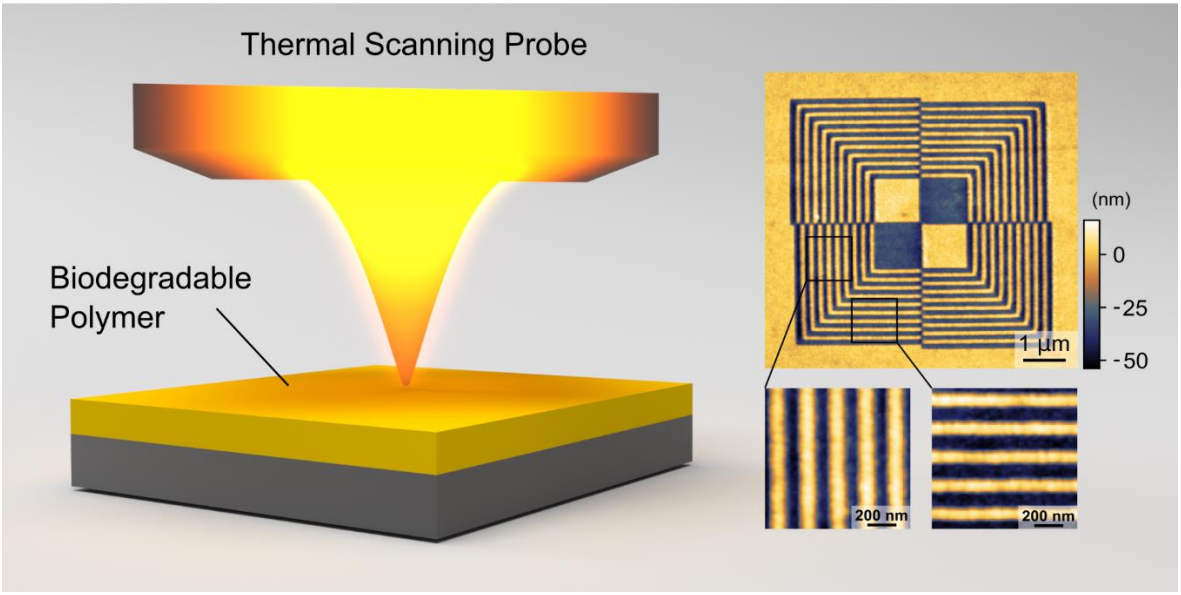
# Probe-based Thermal Degradation of Biodegradable Polymers

## Master Thesis / Internship

(Section: microengineering, material science, engineering)

Biodegradable polymers are an emerging class of materials which find applications in various fields of research such as sensing and drug release. While biodegradable polymers are used to fabricate macroscale structures via molding or 3D printing, little work is found about nanopatterning. Due to the incompatibility of biodegradable polymers with CMOS fabrication techniques, we are exploring new ways to create nanostructures into biodegradable materials. One promising technique is thermal scanning probe lithography (t-SPL), an advanced nano-lithography technique which uses a heated atomic force microscopy tip to thermally modify a substrate material.

The goal of this project is to explore the response of various biodegradable polymers to short heat pulses on the order of microseconds provided by the thermal scanning probe. Hence we are looking for a motivated student with a background in micro/nanoengineering or material science.




**Work description:**

- Material characterization (DSC or TGA)
- Thermal patterning with our t-SPL tool
- Atomic force microscopy

**Contact:** Samuel Zimmermann *(samuel.zimmermann@epfl.ch)*


École polytechnique fédérale de Lausanne

Microsystems Laboratory 1
(Prof. J. Brugger)

EPFL STI IMT LMIS1
(Batiment BM)
Station 17
CH - 1015 Lausanne

Phone : +4121 693 67 80
E-mail : samuel.zimmermann@epfl.ch
Website : www.lmis1.epfl.ch