

MASTER THESIS M2 CDM (5 months, Feb. - June)

2025-2026

Title of the project: Formulation of functional polymer films through the solution-casting method for fiber sensor applications

Supervisor(s): Clément STRUTYNSKI / Claire-Hélène BRACHAIS

Location/ Laboratory / Department / Team: 3rd Floor Physics department / ICB Laboratory / SAFIR Team

Collaborations:

Summary:

In recent years, multimaterial fibers have enabled the development of a large number of novel optoelectronic devices with tremendous innovative potential in numerous domains, such as biophotonics, environmental science, remote sensing, medicine and so on. The elaboration of such small-scale objects relies on the ability to combine through the thermal drawing process several materials (glasses, metals, polymers, semi-conductors, etc.) and, by extension, several functionalities within the same elongated structure. From a fabrication standpoint, the use of new materials with original properties is always sought in order to create increasingly innovative fiber architectures, thus solving modern technological challenges. Polymers are widely used for fiber fabrication due to their remarkable properties, such as low-temperature processing, elasticity, biocompatibility, shape memory and many others. Although they are abundantly available at the industrial level, they are most often found in non-functionalized forms, that is, without specific loads. Yet, the incorporation of such additives is essential to confer the sensitivity required for sensing applications.

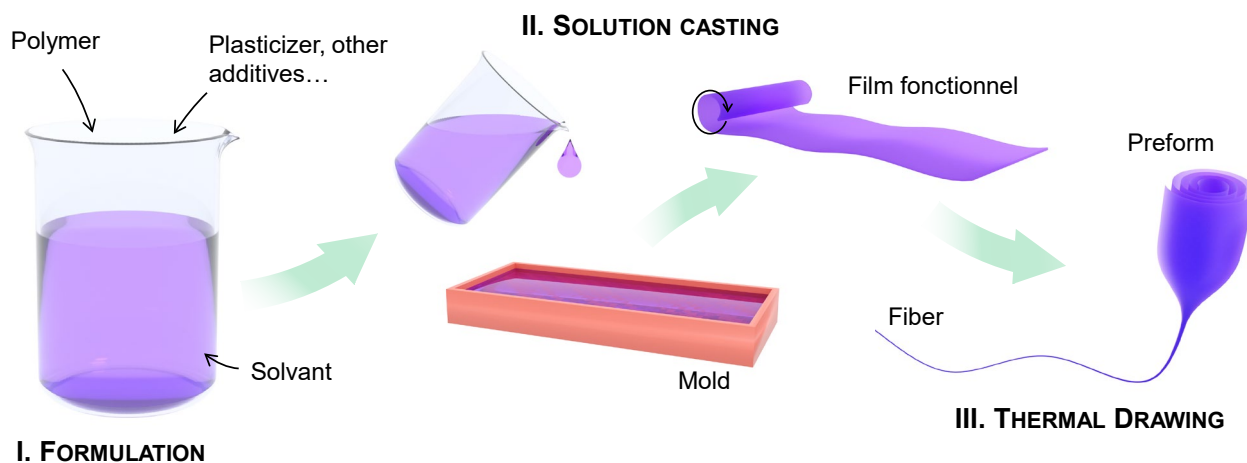


Figure 1: Diagram describing the fiber fabrication strategy.

In this context, the aim of the present project is to develop new formulations of thermoplastics both suitable for the thermal drawing process and containing a functional load. These materials are intended for integration into fiber architectures designed for chemical sensing. The methodology will rely on the fabrication of polymer films through solution-casting as described on **Figure 1**. The candidate will pursue the following objectives:

- Bibliographic study to (i) identify relevant polymer matrices adapted to the solution-casting method and (ii) select organic or inorganic additives with relevant properties for sensing applications (halochromy, luminescent properties, etc.)

- Choice of few potential polymer matrices and implementation of the fabrication protocol of films (solution casting)
- Physicochemical characterizations (thermal analysis, optical characterizations, etc.) of the fabricated materials.
- Preform assembly and assessment of the fiber-drawing ability of the polymer formulations.
- Characterizations of the fabricated fibers (thermo-mechanical characterizations, SEM observations, Optical properties, etc.).

The candidate will have the opportunity to explore the entire processes required for fiber fabrication (polymer formulation and shaping, fiber drawing) as well as to discover various material or fiber characterization techniques (DSC, TGA, optical microscopy, SEM, etc.).

This project fits within the scope of the first-semester laboratory projects (bibliographic, exploratory, etc.)

Type of project (theory / experiment): experiment

Required skills:

To send to Virginie Bourg (Virginie.Bourg@ube.fr) or Jean-Marc Simon (jmsimon@ube.fr) head of the master M2 CDM.