ITI HiFunMat Master Internship Proposal

☐ M 1 ☒ M 2

Study of the electrospun nanofibers morphology obtained from liquid-liquid dispersions containing fluorophore-labelled polymers for biomedical applications

Internship supervisor

Name, first name	LOBRY Emeline and FIGLIOLA Carlotta
E-mail, Telephone	elobry@unistra.fr and figliola@unistra.fr.
Laboratory	ICPEES
Collaboration with a HiFunMat member (*please indicate their name*)	☐ No ☐ Yes :

Student profile looked for

Master program (*more than one box can be ticked)*	☒ Material science and engineering ☒ Chemistry ☐ Physics
Other indications if necessary	

Internship description

Contexts and missions

The work will be carried out at the Institute of Chemistry and Processes for Energy, Environment and Health (ICPEES UMR7515) as part of a collaborative project between the COMBO (https://icpees.unistra.fr/chimie-moleculaire-et-analytique/mari/themes-de-recherche/) and the POLYFUN team (https://icpees.unistra.fr/en/polymer-engineering/electrospinning/.)

Electrospinning can be used to produce polymer nanofibrous materials. The architecture of both the mat and the fibre can be controlled to be used for a variety of applications (air filtration, biomedical, energy, etc.). Traditionally, nanofibres are obtained by solubilising the polymer in a mixture of organic solvents that are often toxic to health and the environment. In addition, the polymers used are sometimes not very soluble and the production of nanofibres is limited by the rheological properties of the solutions, making it difficult to obtain average submicron diameters. To overcome these limitations, this project involves formulating liquid-liquid dispersions, in which each phase will be labelled with a fluorophore to characterise the nanofibers.

The project will be divided in three tasks:

1) The synthesis of biocompatible polymers covalently functionalized by a fluorophore. These polymers will be then electrospun to form fluorescent fibrous mats whose photophysical properties will be studied for further studying specific cell development.

2) the study the photophysical properties of model liquid-liquid dispersions and their electrospinning. The aim here is to identify the operating conditions (droplet size, dispersed phase concentration, nature

of the phase solvents) that will enable the structuring of the fibres (morphology, distribution of the different phases within the fibre) to be controlled.

3) the combination of the previous two points to prepare nanostructured materials for biomedical applications (drug delivery, anti-cancer treatment, etc.).

Required skills

- Strong background in organic synthesis
- An interest in polymer science and photochemistry
- Rigorous experimental work
- Curious and proactive.
- Ability to work in a team and communicate results

Skills to develop during the M2 internship

- Synthesis of fluorophores
- Polymer functionalization by covalent grafting of fluorophores
- Formulation
- Electrospinning
- Characterisation techniques (SEM, NMR spectroscopy, UV/Visible spectroscopy, confocal fluorescence microscopy)