ITI HiFunMat Master Internship Proposal

☒ M 1 ☒ M 2

Title: Synthesis of conjugated polymers for doped electronic applications

Internship supervisor

Name, first name	MERY, Stéphane
E-mail, Telephone	mery@ipcms.unistra.fr, 03 88 10 7165
Laboratory	IPCMS, Strasbourg
Collaboration with a HiFunMat member (*please indicate their name*)	☐ No ☒ Yes : N. Leclerc, O. Bardagot (ICPEES) and M. Brinkmann (ICS)

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

Since the Nobel Prize in Chemistry awarded to Heeger, MacDiarmid and Shirakawa on conducting polymers in 2000, conjugated polymers are today the focus of intense research for their application in organic electronics, and in particular the realization of lightweight, flexible and low-cost devices.

Good conduction properties arise from the self-assembly of π-conjugated polymers, achieved by microsegregation between conjugated polymer backbones and the presence of flexible side chains [1]. The addition of doping molecules to these polymers considerably amplifies the electrical conductivity of these systems [2]. However, the doping process and its mechanisms are still poorly understood. In particular, it is difficult to control the localization of dopants and avoid the destruction of self-assemblies.

The aim of the internship project is multidisciplinary and consists of synthesizing new high-performance π-conjugated polymers for doping. The molecular engineering work involves tailoring the side chains to (i) control the position of the dopant and (ii) stabilize the organization of the polymers in the solid state as thin films. Two applications in particular are targeted: electrochemical organic transistors [2] and thermoelectric devices [3,4].

In practice, the candidate will work essentially on the synthesis of organic conjugated systems and on polymerization. If interested, the candidate could also participate in the characterization of the physicochemical, electrical and charge transport properties in collaboration with other teams at the Cronenbourg Campus. The host team already has a thesis grant on this subject for the start of the 2024 academic year.

Selected publications by the host teams in the field: [1] N. Kamatham et al. *Adv. Funct. Mater.* **2021**, *31*, 2007734. Link; [2] O. Bardagot et al., in Review in *Nature Materials*, **2023**. Link; [3] P. Durand et al. *Adv. Energy Mater.* **2022**, *12*, 2103049. Link; **[4]** V. Vijayakumar et al. *J. Mater. Chem. C* **2020**, *8*, 16470. Link.