ITI HiFunMat Master Internship Proposal

☐ M 1 ☒ M 2

Title Aligned blends of polymer semiconductors for the design of new efficient thermoelectric materials

Internship supervisor

Name, first name	Brinkmann Martin
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Laboratory	ICS
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	Preliminary experience in polymer and/or material design/analysis is requested.

Internship description

Polymer semiconductors are ubiquitous in materials science. Recent progress has been made in the use of doped polymer semiconductors for the design of thermoelectric (TE) generators that have the capability to transform a temperature gradient to an electrical current. Given the large amount of wasted heat in the environment, it is essential to find effective means to recover waste heat and transform it to electricity in cars and buildings for example. Polymers are particularly attractive since they are facile to process in strong contrast to inorganic materials.

Still, the performances of doped polymers need to be improved. In this perspective, our group uses the crystalline structure and the chain alignment as handles to improve transport properties in doped polymer films. In this internship, we want to investigate how the orientation of a polymer blend can help enhance TE properties. Our strategy is to design a highly organized heterojunction of two polymer semiconductors using new alignment and growth methods. In particular, we will use the method of high temperature rubbing. Transmission Electron Microscopy (diffraction and high resolution) will be used to probe both the crystallization of the two polymers and the structural evolution upon doping. The student will perform an experimental work with the typical equipment used in organic electronics (glove box) as well as electron microscopy. The student will participate to a funded ANR project (Tripode) with the possibility to pursue for a PhD. A CV shall be sent to the supervisor.

References:

(1) Zhong, Y.; Untilova, V.; Muller, D.; Guchait, S.; Kiefer, C.; Herrmann, L.; Zimmermann, N.; Brosset, M.; Heiser, T.; Brinkmann, M. *Advanced Functional Materials* **2022**, *32* (30), 2202075. https://doi.org/10.1002/adfm.202202075.

(2) Durand, P.; Zeng, H.; Biskup, T.; Vijayakumar, V.; Untilova, V.; Kiefer, C.; Heinrich, B.; Herrmann, L.; Brinkmann, M.; Leclerc, N. *Advanced Energy Materials* **2022**, *12* (2), 2103049. https://doi.org/10.1002/aenm.202103049.