

ITI HiFunMat Master Internship Proposal

M 1

M 2

Synthesis of stimuli-responsive copolymers

Internship supervisor

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Laboratory	Institut Charles Sadron
Collaboration with a HiFunMat member (<i>please indicate their name</i>)	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes :

Student profile looked for

Master program (<i>more than one box can be ticked</i>)	<input checked="" type="checkbox"/> Material science and engineering <input checked="" type="checkbox"/> Chemistry <input type="checkbox"/> Physics
Other indications if necessary	We are looking for a highly motivated Master 2 student interested in polymer chemistry and polymers' behavior in solution.

Internship description

Stimuli-responsive materials are undeniably attractive since they are able to adapt to their surrounding environment^{1,2} by creating reversible and specific interactions. This reversibility can be triggered by different environmental factors such as the pH, the light, a mechanical stress or temperature modifications for instance.

In this project, we are more precisely interested in the functionalization of copolymers to make them respond to a thermal stimulus. Thermally reversible materials fit in two categories: the ones based on reversible weak interactions³ and those based on reversible covalent bonds.⁴ The last ones are based on the reversible formation of covalent bonds according to the temperature of the system. Even though many studies report an effect of the temperature on the reversibility of a reaction, few reactions can be classified as thermoreversible reactions, in the sense that they lead to the formation of covalent bonds that are reversible only *via* a thermal stimulus. The Diels-Alder reaction⁵ is one of them and will be the topic of this internship. Since, in solution, copolymers tend to self-assemble to form micelles, cones or polymersomes.⁶ A look at the influence of temperature on the copolymers' aggregation behavior will also be investigated.

References

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- 2) Alarcón, C. de las H. *et al. Chem. Soc. Rev.* **2005**, 34 (3), 276–285.
- 3) Amendola, V.; Meneghetti, M. *CRC Press*, **2011**.
- 4) Vauthier, M. *et al. Adv. Funct. Mat.* **2019**, 29 (10), 1806765.
- 5) Diels, O.; Alder, K. *Justus Liebigs Ann. Chem.*, **1928**, 460 (1), 98–122.
- 6) Discher, D. E. *et al. Progress in Polymer Science* **2007**, 32 (8), 838–857.