Completely shape-tunable polymersomes *via* ‘click’ chemistry (ComPoClick)

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Since the 90s, the creation of advanced micro- and nano-objects for various utilizations, such as electronics, textiles, pharmaceutical applications, food processing or automotive, is of high interest for researchers and engineers. Above all objects, polymersomes, hollow spheres using amphiphilic block copolymers that enclose a solution, raise enthusiasm because of their versatility and their propensity to form biologically stable systems. Indeed, these copolymers tend to self-assemble in water under a large variety of morphologies (membranes, cylindrical or spherical shape) [1]. Moreover, their properties, and potential drug encapsulation and release capabilities for example, can be easily tuned by using various stimuli-responsive copolymers, making them one of the most interesting structures for potential applications in the emerging area of nanomedicine.

In this project, we are more particularly interested in smart polymersomes that respond to thermal and/or light stimulation(s). Nevertheless, there is a wide range of polymers used to make polymersomes, leading to various properties (stability, permeability, etc.). In order to to apply the developed system to depollution or biomedical applications, the “ComPoClick” project will focus on biocompatible polymers, such as poly(ethylene oxide) or poly(lactic-*co*-glycolic acid).

This Ph.D. thesis will thus aim to investigate the production of smart polymersomes (Figure 1) by integrating functional groups with the ability to form covalent bonds and then to break them easily (reversible reaction) under stimulation [2,3]. The main steps will consist in *(i)* investigating the various functional groups able to react by “click” (thermal or light) reactions, *(ii)* synthesizing (non-)responsive copolymers, *(iii)* deeply investigating the ‘‘click” reactivity, *(iv)* producing (non-)responsive polymersomes in batch, and *(v)* developing a microfluid device to produce the functional polymersomes in continuous flow.

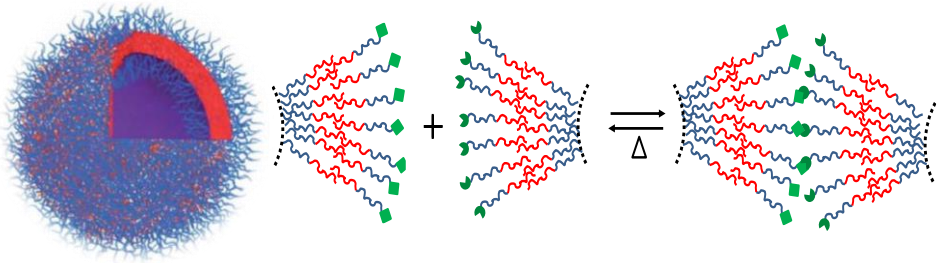

Figure 1. Polymersomes‘ behaviours aimed in this Ph.D. thesis.

[1] Y. Zhu *et al. Chem. Sci.* **2023**, *14*, 7411–7437.
[2] B. Briou *et al. Chem. Soc. Rev*. **2021**, 50, 11055-11097.
[3] M. Vauthier, C..A. Serra. *Coll. Surf. A: Phys. Eng. Aspects* **2022**, *648*, 129321.

Possible starting date: October 1st, 2025