

## PhD position starting in the autumn of 2024

*Center for Materials Forming, MINES Paris – PSL University*

### **Composite hydrogels for dual drug delivery**

A controlled drug delivery system (DDS) facilitates the sustained release of a biologically active agent to decrease the number of administrations, to allow for low doses and to protect the drug from degradation. The development of innovative delivery systems is essential for the treatment of many diseases as biochemical cues in the form of drugs can provide a decisive role in the therapeutic outcome. Protein drugs now play a significant role in almost every field of medicine. Moreover, combination therapy with drugs having different therapeutic effects has shown great promise for the treatment of various diseases as it may exhibit exceptional synergy with reduced side effects compared to monotherapy; it may also be an asset to overcome the challenge of drug resistance. Combination therapy with a protein and a small molecule drug (SMD) is particularly useful in view of their different, synergistically operating action mechanisms. However, achieving co-delivery is challenging because of the often distinct physical and chemical properties of both drug classes, hindering their integration into a single carrier.

The objective of the proposed project is to develop a dual DDS facilitating simultaneous, independently controllable release. To this aim, hydrogels will be prepared from bio-based, renewable polymers and loaded with a protein as well as drug-loaded microparticles. The structural and physico-chemical properties of the DDS will be systematically varied by adjusting the preparation conditions. The drug release profiles will be correlated with the hydrogel properties. Various kinetic models will be tested to identify the main physical mechanisms governing the release.

This interdisciplinary project is located at the interface of materials science, polymer chemistry & physics as well as biomedical applications. The majority of the work will be performed in the Center for Materials Forming (CEMEF) of MINES Paris, which has significant expertise in the preparation and physico-chemical characterization of polymer-based materials, including bio-based hydrogels. Secondments in terms of e.g. biomedical characterizations may take place in partner laboratories in France or abroad.

**Keywords:** Polymers, hydrogels, physico-chemical properties, biomaterials, controlled drug delivery

**Profile:** Knowledge of materials science, polymers as well as biomedical applications; fluent in English; highly motivated; pro-active; MSc thesis completed

**Duration:** 3 years, starting in autumn 2024

**Locations:** CEMEF (MINES Paris in Sophia Antipolis, France)

**People involved:** Dr. Sijtze Buwalda, Dr. Tatiana Budtova (MINES Paris)

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Please send your detailed CV, motivation letter, marks of your Bachelor and Master and at least two e-mail addresses of reference persons to [sijtze.buwalda@minesparis.psl.eu](mailto:sijtze.buwalda@minesparis.psl.eu) before July 6<sup>th</sup>, 2024.

*Please note: this project is open to applications but subject to final validation by the direction of CEMEF depending on the quality of the match between topic and candidate.*