

Nantes, 15 June 2023

PhD offer - BIA Nantes unit For the recyclability of composite materials

The recyclability of composite materials is a major issue, particularly when their components are of non-renewable (fossil) origin and represent sources of pollution and greenhouse gases. Recycling them requires innovation, because due to the strong interactions between matrices and components (materials), most of them cannot be separated from each other without energy, environmental or financial costs. The result is inefficient recovery of the high added-value components they may contain, and a missed opportunity to reduce environmental impact through circularity in the life cycle of materials. The programmed separation of end-of-life components for recycling remains a technical and industrial challenge.

The RECYCOMP project, part of the national 'Recycling, Recyclability and Re-use' programme (PEPR), aims to improve the recyclability of materials from industrial sources that pose major end-of-life problems. The aims of this thesis are twofold

- to help design systems that will enable better separation of the various constituents of composites following external 'debondable on demand' stimulation,
- to promote the substitution of fossil components by plant biomass products in composites.

This study, developed in interaction with the other teams in the RECYCOMP consortium, will address three main types of reinforcing fiber: natural fibers (hemp, flax), glass fibers and carbon fibers. The thermosetting or thermoplastic matrices used in the composites will also be studied according to the same criteria: 'debondable on demand' and biosourced.

The candidate will study how to improve the separation of the fiber/matrix constituents of composites from the wind energy, automotive, end-of-life pleasure craft and construction sectors, present in the composite material deposits of today and of the years to come. Following the separation stage, new composites based on recycled materials (fibers and recycled raw materials obtained from the transformation of polymer matrices) will be developed. New bio-based functionalities will be incorporated into the new composite materials to facilitate both fiber/matrix separation and the recovery of recycled raw materials from the matrix. This project will be based on the complementary skills of the partners, who are specialists in recycling processes, polymer materials, composite materials and advanced material characterization at different scales, from the fiber/matrix interface to composite materials.

Techniques : The PhD student will use the instruments available in the BIA unit to characterize biobased materials: microscopy (SEM, TEM, confocal microscopy, AFM), X-ray diffraction (XRD), ¹³C NMR, rheology, mechanical stress, nanosizer, measurement of zeta potential and all other techniques available from partners in the RECYCOMP Consortium.

Profile required: Physical chemist, polymer chemist or materials scientist. Knowledge of polysaccharides would be appreciated. Fluency in spoken and written English.

Salary approx. 2100 - 2300 euros gross, i.e. approx. 1700 - 1900 euros net per month

Practical information: The person recruited will be based at INRAE in Nantes in the Biopolymers Interactions Assemblies unit. The BIA unit, with its 110 permanent staff dedicated to biopolymer research, hosts more than 80 non-permanent staff (M2, theses, post-docs, etc.), in a dynamic international working environment. Occasional travel throughout France is to be expected. Applicants must submit a CV with a covering letter and contact details for referees **by midnight on 10 July 2023**.

To apply and for further information, please contact: johnny.beaugrand@inrae.fr and isabelle.capron@inrae.fr