

## Part I: General introduction

In the last decade, lightweight fibre-reinforced composites have allowed the sustainable development of modern society by, for example, enabling more efficient wind turbines and making our vehicles lighter. Unfortunately, these materials are challenging to recycle: most composite parts are still incinerated or landfilled, two very polluting practices.

The FibReLoop project is a Marie Skłodowska-Curie (MSCA) Doctoral Network that aims to promote the industrial implementation of circular economy strategies for composites. Fourteen doctoral candidates will be trained to tackle the recycling of a composite part all the way to the design and production of new recycled components. The topics include the evaluation, enhancement, and development of current and new recycling technologies; the experimental assessment of the behaviour of the recycled materials; the development of material models and design approaches for recycled composites and parts; and the implementation of recycled composites and circular economic practices into real-life industrial cases. FibReLoop involves 18 European universities and companies.

Applications are invited for fourteen PhD positions in the field of recycling of composites, leading to the award of a PhD degree. The recruited researchers will be trained for 3 years to become interdisciplinary and multi-talented experts. They will develop advanced simulation tools to predict optimal microstructures for recycled composites, manufacture these microstructures and then verify them in industrial applications. The researchers will have a unique opportunity to be trained by world-leading experts in cutting-edge technologies, supported by a strong network and extensive industry participation.

Please note that some of the positions are hosted by an industrial partner. In this case, the researcher will also be enrolled in a PhD program at a university.

## Part II: Detailed description of individual positions

**Title of the position:** Variability and characterisation of recycled composites and reclaimed constituents

**Host organization (country):** Mines Paris – PSL University (Paris/France)

**Duration:** 3 years

### Description

The process of carbon fibre reclamation from organic composite materials involves the degradation of the matrix by thermal or chemical processes, which preserves the stiffness of the fibres but generally reduces their strength and failure strain. The use of these reclaimed carbon fibres therefore has a direct impact on the performance of the newly produced composites.

The aim of this PhD is to experimentally establish a physical link between the modified morphological and physical properties of the recycled composites and their mechanical performance. To this end, advanced experimental work will be performed on both the constituents and the composite material. The damage and failure mechanisms associated with different recycling approaches will be identified, allowing future tailored improvement of the recycling processes themselves. More details about the position (methodology, expected results, ...) can be found at:

<https://www.mat.minesparis.psl.eu/formation/doctorat/propositions-de-sujets-de-these/>

The work will be performed at the Materials Centre of Mines Paris – PSL University (Satory/France). You will be supervised by Dr. Sébastien Joannès, Dr. Cristian Ovalle and Prof. Lucien Laiarinandrasana.

The work requires a strong background in materials science, composite mechanics and/or solid mechanics as well as a mindset for personal development. This project has a primarily experimental component, but data processing requires theoretical skills in statistics and data analysis. It is therefore essential that applicants are interested in such a combination. Proficiency in a programming language such as Matlab, Python or R is highly desirable.

During the appointment, two secondments are planned:

- 2 months to Fibreuse Tech (Italy) – to obtain recycled fibres via High Voltage Fragmentation.
- 2 months to Politecnico di Milano (Italy) – to obtain recycled fibres via microwave-assisted processes.

During this PhD project, the researcher will:

- Acquire leading-edge knowledge of recycled composites and their behaviour, particularly at the constituent level;
- Develop an improved characterisation protocol adapted to recycled carbon fibres;
- Implement innovative Bayesian approaches to process data and make them more efficient;
- Carry out advanced in-situ experimental testing at the composite level to identify damage and failure mechanisms associated with different recycling approaches;
- Participate in the dedicated training programme organised by FibReLoop (including technical, communication, career management and business skills) and in six-monthly project meetings;
- Write scientific papers for publication in top-level journals in materials science/mechanics;
- Present his/her research in project meetings, international conferences and outreach events;
- Work in close collaboration with supervisors while being the driving force for his/her own PhD.

### **Expectations and requirements**

A good candidate should be an enthusiastic and self-motivated person with an attitude towards personal development. The candidate should meet the requirements for enrolment in a doctoral programme at Mines Paris – PSL University. This means having at least a B2 level of English and he/she has obtained (or is about to obtain) good grades for a master degree in Materials Science, Mechanical Engineering, Aeronautics, or similar. Eligible applications will be assessed on the applicant's (1) academic qualifications, (2) technical skills, (3) background on modelling, (4) communication skills, and (5) motivation for the project. PSL University has an equal opportunities and diversity policy, and we welcome applications from candidates with diverse backgrounds.

The post is supported by an allowance provided by the European Commission. The EU Researcher Allowances will be used to cover both the employee's as the employer's mandatory charges. The fellows are assigned full-time with a PhD scholarship with full social security.

Candidates must fulfil the eligibility criteria:

1. You do not have a PhD degree yet at the start of your assignment.
2. You must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary (France) for more than 12 months in the 36 months immediately before their date of recruitment.

This means that your nationality is not relevant for your eligibility.

## Procedure

Applicants should supply the following to [recrutement\\_these@mat.mines-paristech.fr](mailto:recrutement_these@mat.mines-paristech.fr):

- a detailed resume
- a copy of the identity card or passport
- a covering letter explaining the applicant's motivation for the position
- detailed exam results
- two references : the name and contact details of at least two people who could be contacted to provide an appreciation of the candidate
- Your notes of M1, M2
- level of English equivalent TOEIC

Please add the label “[FibReLoop DC4]” to the subject line of the e-mail you send.

The cover letter should clearly indicate for which FibReLoop position(s) you are applying, as it is possible to apply for multiple. We kindly ask you not to include a photograph in your CV or cover letter. We are committed to equal opportunities, and by removing these details, it helps us to evaluate people on their skills and experience instead of factors that can lead to unconsciously biased decisions.

Applications sent to addresses other than the recruitment address ([recrutement\\_these@mat.mines-paristech.fr](mailto:recrutement_these@mat.mines-paristech.fr)) will not be accepted. More details can be found at:

<https://www.mat.minesparis.psl.eu/formation/doctorat/propositions-de-sujets-de-these/>

Based on the resumé and cover letter, we will invite shortlisted applicants for an interview. This will be held online via Zoom. The interview will consist of three parts and last for about 1.5 hours in total:

1. You will be asked to prepare a small task beforehand and present your approach to the task.
2. You will present a paper relevant to the PhD topic, and assess its strengths and weaknesses.
3. We will ask for clarifications about your background and gauge your motivation and skills.

For further details about this specific position or the procedure, please contact [sebastien.joannes@minesparis.psl.eu](mailto:sebastien.joannes@minesparis.psl.eu). For general information on Mines Paris – PSL University, please go to <https://www.minesparis.psl.eu/en/home/> and <https://www.minesparis.psl.eu/en/mines-paris-psl/psl-our-university/>

Closing date: until filled

Starting date: 1<sup>st</sup> of October 2024 the earliest and 31<sup>st</sup> of March 2025 the latest