


IMT Mines Alès
École Mines-Télécom


SCIENCE & CREATIVITY TO INVENT A SUSTAINABLE WORLD

PhD Position in

Contribution to the Study of the Durability of Repairable Eco-Composite Structures

Institution	IMT Mines Alès (Ecole Nationale Supérieure des Mines d'Alès)
Main job assignment	Teaching and Research center on WWW.
Administrative residence	Alès (Département du Gard – Région Occitanie)
Starting date	October 2025

1. Context

The Institut Mines-Télécom (IMT), a major institution within the meaning of the Education Code, is a public scientific, cultural and professional institution (EPSCP) placed under the principal supervision of the ministers responsible for industry and digital technology. It is the largest group of engineering schools in France, with 11 public engineering schools spread across the country, which train 13,500 engineers and PhDs each year. The ITM employs 4,500 people and has an annual budget of €400M, 40% of which comes from its own resources. IMT has 2 Carnot institutes, 35 industrial chairs, produces 2100 A rank publications annually, 60 patents and carries out 110M€ of contractual research.

Created in 1843, IMT Mines Alès currently has 1,400 students (including 250 foreigners) and 380 staff. The school has 3 research and teaching centres of high scientific and technological level, which work in the fields of materials and civil engineering (C2MA), environment and risks (CREER), artificial intelligence and industrial and digital engineering (CERIS). It has 12 technological platforms and has 1,600 partner companies.

2. Research project

Project title : DuRéCoS (Durability and Repairability of Welded Composite Structures)

Keywords : Durability, bio-composites, repairability, pultrusion, predictive modelling

Positioning and Objectives of DuRéCoS project :

DuRéCoS project aims to develop eco-designed composite materials from plant-based reinforcements and thermoplastic resins for structural applications. Although these composites generally have lower durability and mechanical properties compared to petroleum-based composites, primarily due to the hydrophilic nature of plant fibres, their fatigue resistance remains interesting and inherent to the accommodating nature of the fibre/matrix interface. Additionally, the thermosoftening behaviour of the matrix allows for their repairability and potential assembly through welding to form structures without adding material.

The project's objective is to study the service life, repairability, and weldability of eco-designed composites based on flax fibres and acrylic matrix. This type of composite is highly anticipated in the

transportation sector as a substitute for composites based on glass fibre and thermosetting resins (polyester, vinylester, epoxy).

The pre-industrial manufacturing of the materials is entrusted to IRT M2P in Metz, which supports this study. This collaboration will enable the optimized production of composites with varying reinforcement ratios, a crucial parameter for the properties of the studied composites.

Two doctoral positions are allocated to the realization of this project: one carried out by IMT Mines Alès focusing on the durability of bio-sourced composites, and the other by the Laboratoire Génie de Production at the Université de Technologie Tarbes Occitanie Pyrénées focusing on the weldability of bio-sourced composites.

Scientific Project Details :

The thesis proposed at IMT Mines Alès within the DMS team (LMGC UMR5508) aims to study the service life of pultruded or RTM-moulded composites produced by IRT M2P with varying reinforcement ratios.

Plant-reinforced composites can indeed compete with synthetic fibre composites at equivalent reinforcement ratios due to their significant specific mechanical properties. However, most manufacturing processes do not allow for satisfactory reinforcement ratios for bio-composites due to the variability in the shape of plant fibres, which does not permit sufficient compaction. Processes such as pultrusion or resin transfer moulding (RTM) can achieve volumetric ratios of 65%. The higher the reinforcement ratio, the higher the intrinsic properties of the composites.

An accelerated aging campaign will be conducted to simulate the progressive degradation of the intrinsic properties of eco-composites over long periods. A fatigue study will also be undertaken before and after aging to quantify the effects of hygro-thermo-mechanical coupling on material damage. The concept of composite repairability using ultrasound/laser will also be studied following aging and fatigue tests with our partner at UTTOP.

These experimental campaigns will feed into a predictive model of the service life of these bio-sourced reinforced composites. This modelling will be based on a morphological description of the materials and the definition of a representative elementary volume.

3. Team supervision and PhD registration

Research and Teaching Centre: C2MA / IMT Mines Alès

Research Unit: DMS Team (LMGC UMR5508)

Thesis supervisors: Patrick IENNY, Benoit COSSON (LGP) or Christian GARNIER (LGP)

Thesis advisors: Romain LEGER, Stéphane CORN

Doctoral School: I2S

4. Candidate profile

Holder of a Master's degree or an engineering degree, the candidate must have strong knowledge and experience in the mechanics of polymer matrix composite materials. The candidate is expected to have skills in writing a comprehensive literature review, conducting an experimental campaign to characterize the behaviour of a material, and constructing a finite element numerical model. Experience in developing test benches would also be highly appreciated.

The selected candidate for the PhD position will participate in the DuRéCoS project in collaboration with the academic partner LGP/UTTOP. Autonomy, dynamism, and teamwork are assets for the profile. The

recruited individual will be enrolled in the I2S Doctoral School (specializing in Mechanics and Civil Engineering) at the University of Montpellier and IMT Mines Alès (co-accredited institution).

The contract duration is 36 months starting from October 2025.

5. To apply for the position

The application package must be sent before April 4th 2025 and must include the following documents :

- CV and cover letter
- Diplomas, transcripts, and rankings
- Letter(s) of recommendation with the signatory's contact details

6. Contacts

- PhD content: romain.leger@mines-ales.fr, stephane.corn@mines-ales.fr, patrick.ienny@mines-ales.fr , benoit.cosson@uttop.fr or christian.garnier@uttop.fr
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