



**Laboratory : Center for Materials & Processes**

**Line Manager : Dr. SAMUEL Cédric**

**Workplace : Douai**

**Type of contract and duration : PhD contract, 36 month**

## **CONTEXT :**

Public establishment belonging to IMT (Institut Mines-Télécom), placed under the supervision of the Ministry of Industry, IMT Nord Europe has three main objectives: providing our students with ethically responsible engineering practice enabling them to solve 21st century issues, carrying out our R&D activities leading to outstanding innovations and supporting territorial development through innovation and entrepreneurship. Ideally positioned at the heart of Europe, 1 hour away from Paris, 30 min from Brussels and 1h30 from London, IMT Nord Europe has strong ambitions to become a main actor of the current industrial transitions, digital and environmental, by combining education and research on engineering and digital technologies.

Located on two main campuses dedicated to research and education in Douai and Lille, IMT Nord Europe offers research facilities of almost 20,000m<sup>2</sup> in the following areas:

- Digital science,
- Processes for industry and services,
- Energy and Environment,
- Materials and Processes.

For more details, visit the School's website : [www.imt-nord-europe.fr](http://www.imt-nord-europe.fr)

A PhD position is offered on the formulation and processing of a next-generation of piezoelectric polymers specifically made from renewable resources (research program funded by ANR, GENEPI project, Energy  $\mu$ -Generation using Biobased and Piezoelectric Polylactides). We are looking for a highly-motivated candidate with a Master degree in the field of Polymer Science. Theoretical / practical knowledge on melt-state processing and structural characterizations of thermoplastic polymers are mandatory. Specific knowledge on 3D printing, biobased polymers and modification / functionalization of polymers will be appreciated. Candidates must be fluent in English with writing / communication skills. The annual salary is between 25 – 30 k€. Various international travels will be required according to project needs.

## **BRIEF:**

The development of autonomous or self-powered *IoT* sensors represents a key challenge and energy harvesting technologies based on piezoelectric materials are attractive to convert vibrational mechanical energy into electrical energy. A next-generation of piezoelectric materials with a better balance between environmental footprints, materials / processing costs and technical performances is required for a large-scale deployment of vibrational energy harvesters. In this context, the Institute Mines Telecom Nord Europe is involved for several years into various research projects (for example, BIOHARV INTERREG project) dealing with the processing of piezoelectric poly(L-lactic acid) (PLA), an environmental-friendly thermoplastic material made from annually-renewable resources. Piezoelectric performances of PLA are theoretically interesting and this material

represents an ideal candidate for the development of low-cost piezoelectric materials by conventional processing tools of the plastic industry (extrusion – machine-direction orientation, MDO) without any high – voltage poling. However, modest performances are still observed (max  $d_{14} \approx 8 - 9$  pC/N vs. 20 pC/N expected) and the GENEPI project aims to lift various locks associated to the piezoelectricity of PLA with an ambitious research plan.

The PhD candidate will be integrated to the “Center for Materials and Processes” and more specifically into the research team on functional thermoplastic polymers to conduct various aspects of the GENEPI project. The principal mission first deals with the optimization of shear piezoelectric properties of PLA by playing on material / processing parameters. An in-depth understanding of structure – properties relationships is expected based on model experiments coupled to advanced structural characterization. The use of various functional additives and scale-up to pilot extrusion-MDO processing will be also explored. Several complementary challenges (extension to other processing tools for PLA orientation, development of ferroelectric PLA by corona poling, integration of electrodes by 3D printing, development of proof-of-concepts) will be finally attempted. Valorization activities are also expected and teaching opportunities at L2 to M2 levels will be also possible in the frame of the IMT Nord Europe formations.

**REQUIRED PROFILE :**

Skills	Knowledge
Processing of thermoplastic polymers (mainly extrusion and injection), physico-chemical characterizations of polymers (mainly DSC, FTIR, RX), oral & written communication of R&D results	Physics and chemistry of polymers, structural characterization of polymers, biobased polymers, modification / functionalization of polymers

**CONDITIONS :**

The job is to be filled as to 01/10/2022 for a period of 36 month (temporary contract).

**INFORMATION AND APPLICATION METHODS :**

For any information on the missions, please contact: **SAMUEL, Cédric, Assistant Professor, [cedric.samuel@imt-nord-europe.fr](mailto:cedric.samuel@imt-nord-europe.fr)**

For any administrative information, please contact the Human Resources Department: [jobs@imt-nord-europe.fr](mailto:jobs@imt-nord-europe.fr)

To apply, please connect to our recruitment platform via the following link:

**DEADLINE DATE FOR SUBMISSIONS : 24/06/2022**