INTERNSHIP OPPORTUNITY

For master/engineering student	*Duration: 4-5 months*	*Beginning: March 2026*
Title: **Data-driven formulation of flame-retardant polymer systems for recycled plastics**		

Recycled plastics from Waste Electrical and Electronic Equipment (WEEE) are complex materials made of polymer and additives that must meet strict flame-retardancy requirements. Designing efficient flame-retardant formulations for these materials is challenging, as their fire behavior depends on many parameters such as polymer composition, additives and interactions between them. At the same time, a large amount of experimental and literature data on flame-retardant formulations is available but remains under-exploited.

The objective of this Master's internship is therefore to combine polymer formulation science with AI data analysis to support the development of flame-retardant formulations for complex polymer systems, with a particular focus on recycled materials from WEEE. The work will aim to structure and analyze large formulation databases, create and characterize new polymer formulations, correlate compositional and processing parameters with fire performance and use data-driven approaches to guide the development of optimized flame-retardant formulations for recycled polymer systems.

The research work will be carried out within the framework of the regional RIPEEE consortium (Recyclage Innovant des Polymères issus des déchets d'Equipements Electrique et Electronique), which brings together four partners from the Auvergne–Rhône-Alpes region. Each partner contributes in complementary fields ranging from waste collection and treatment to formulation, characterization, production and processing of recycled polymer materials

The internship will include:

i. **Database construction**
   - Collection of experimental data from literature and internal laboratory results
   - Structuring of formulation parameters (polymer matrix, additives, loadings, processing conditions)
   - Data cleaning, normalization, and descriptor definition

ii. **Experimental work**
   - Preparation of flame-retardant polymer formulations
   - Characterization of thermal and fire behavior (TGA, DSC, LOI, UL-94)
   - Morphology observation (MEB)
   - Mechanical and rheological characterization

iii. **AI and data analysis**
- Exploratory data analysis and visualization
- Application of machine learning methods (regression, classification, clustering)
- Identification of formulation-property relationships and synergies
- Assessment of model limitations and interpretability

iv. **Scientific analysis**
- Comparison between AI predictions and experimental results
- Critical discussion of results in the context of polymer science and flame retardancy

This internship will be carried out at the IMP Laboratory in INSA Lyon. The candidate might require to travel to other INSA sites (Oyonnax) for some experimental activities.

Candidate profile and expected skills:

- **Master or engineering student in**:
  - Materials Science
  - Polymer Engineering
  - Chemical Engineering
  - Data science applied to materials (or equivalent)

- **Strong interest in polymer formulation and material science**

- **Basic knowledge in Python / data analysis / machine learning**

Other expected skills:
- Curious and team working,
- Ability to independently conduct and develop an individual research project
- Strong synthesis and organizational skills
- Proficiency in written and spoken English

Applications (CV and cover letter) should be sent before **March 1st 2026**

Supervision and Contacts:

- **Khalid LAMNAWAR**, Professor, IMP, site INSA Lyon, Khalid.lamnawar@insa-lyon.fr

- **Louis CHARTON,** PhD student, IMP, INSA Lyon, louis.charton@insa-lyon.fr