



Internship offer - Master 2 or equivalent

Synthesis and evaluation of new bio-based intrinsic flame-retardant monomers and additives to enhance wood resistance to wildfires

Institution: Centrale Lille Institut

Laboratory: UMET, team PrEF, CNRS UMR 8207

Supervision: Sabatino Carolini (2nd year PhD student)

Deadline: Until position is filled

Context & Project aim: The Intergovernmental Panel on Climate Change (IPCC) estimated that the probability of catastrophic wildfires will increase up to 60% by the end of the century, with an improvement in intensity and frequency, leading to a major safety problem. These wildfires are increasingly present in the Wildland-Urban Interface (WUI) areas, often spread by flammable materials like dead vegetation and wooden structural elements (e.g., shutters, doors, balconies), transforming the WUI areas themselves in a source of fire spread. Several prevention strategies have already been evaluated and diffused to mitigate the risk but, between them, wood protection still represents a challenge. Statistics indicate that the presence of wood elements in buildings is increasing over the years, probably due to the great structural properties of this material, thus leading to an even more urgent need of valid solutions. Flame-retardants (FR) coatings have already been widely studied but, biomass-derived FR compounds have not been completely investigated yet. Thus, this work aims to use wine-industry waste derivative compounds to synthesize novel intrinsic FR polymers and innovative FR additives to protect wood from fire. The resulting compounds will be implemented in different coating formulations and tested to the Mass Loss Cone-calorimeter (MLC) and other eventual benches to evaluate their efficacy.

Acquirable skills: This internship provides the opportunity to work at the intersection of organic synthesis, polymer chemistry and fire chemistry and engineering. Upon completing this experience, the candidate will have developed independence in several key areas, including: conducting chemical reactions and product purification; performing radical polymerisation reactions; evaluating and identifying chemical structures through NMR (Nuclear Magnetic Resonance) and FT-IR (Fourier Transform Infrared Spectroscopy) techniques; conducting thermal characterisation through TGA (Thermogravimetric Analysis) and DSC (Differential Scanning Calorimetry); developing coating formulations and conducting fire tests.

Candidate profile: The desired profile is a Master 2 or a 3rd year engineering school student with a specialization in the field of materials chemistry/organic chemistry and previous experience and knowledge in organic synthesis and/or polymer synthesis. The student has to be motivated, characterized by a desire to learn, curiosity and proactivity. A good understanding of spoken and written English is essential for literature research and interaction within the team.

Period and application: 5/6 months starting from February/March 2025. To apply, please, send a motivation letter and your CV to sabatino.carolini@centralelille.fr.

About UMET laboratory: This internship will take place at UMET (Unité Matériaux et Transformation), in Villeneuve d'Ascq (Lille), a research unit focused on materials science. Among its different teams, PrEF is an interdisciplinary group engaged in specific research fields, from functional surfaces to ecodesign, the development of flame retardant materials and polymer recycling.
