

PhD proposal - 2024-2027

Syensqo offers a broad portfolio of advanced materials to develop sustainable and efficient mobility systems. In the aerospace market, we provide composites for aerospace, adhesives, aircraft film, and specialty polymers for fixed-wing aircraft, rotorcraft, aircraft propulsion and systems, space and launch, and advanced air mobility applications. In the same time, our Syensqo's composite materials and specialty polymers are critical for automotive components to creating lighter, safer and more efficient electric and hybrid vehicles. We are also a global leader in specialty chemicals, offering customized and sustainable solutions thanks to a strong expertise in organic chemistry, a strong formulation know-how and application knowledge.

Transportation is essential to our society but it is critical to reduce its energy consumption. One effective way to achieve this is by light weighting materials used in vehicles. To meet these lightweighting expectations, both the aerospace and automotive markets are substituting steel by aluminium and they are adding more and more polymer based materials. Therefore, one of the main current technical challenges in these fields is the joining of these disymmetric materials.

To ensure good adhesion between aluminum and polymer materials, it is essential to properly prepare the surfaces. The notion of surface preparation covers a large number of processes or treatment ranges whose objective is to confer to the treated surface either particular physico-chemical properties, or specific mechanical or geometric properties (roughness, surface stresses, etc.) which will allow satisfactory wettability and adhesion to be achieved.

Syensqo is providing a range of functional water-soluble polymers specifically designed to promote adhesion between metal surfaces and polymer materials. These bonding layers have been extensively studied between aluminium substrates and adhesives ~~which are~~ in the case of reactive thermoset polymers [see for example Layec et al International Journal of Adhesion & Adhesive 117 (2022) 103006 or Layec et al The Journal of Adhesion (2024) 100(8), 765-790]. The aim of this PhD is to investigate the impact of of these bonding layers on the adhesion of thermoplastic polymers to aluminum substrates for transportation applications.

As thermoplastic polymers generally exhibit lower surface energy and less chemical reactivity than thermoset adhesives precursors, the objective will be to understand which are the relevant mechanisms of adhesion in these systems and to identify relevant technical levers to optimize thermoplastic polymer/aluminium adhesion thanks to Syensqo's chemical solutions. After the design and preparation of metal/thermoplastic polymer samples, a multi-scale structural characterization of the surfaces and interfaces will be performed (microscopy, XPS, surface energy, surface roughness...) and specific tests will be developed to determine the micro-mechanical properties of the metal/polymer interfaces or interphases (mechanical test(s) to be developed). This multistep methodology intends to make the link between reactions and interactions at molecular level, surface energy, surface roughness and the mechanical performances of the final multi-material.

This PhD subject is distinguished by its multidisciplinary: materials (polymers and metals, polymer processing, characterization of the mechanical properties of materials and interfaces, etc.), physico-chemistry (pretreatment of surfaces by various chemical and mechanical means, study of interactions between thermoplastic polymers and metal surfaces: wetting, surface energies), surfaces and interface/interphases analysis using advanced techniques.

The PhD will be a CIFRE PhD funded by SYENSQO. It will be mainly performed at the Centre Inter-universitaire de Recherche et d'Ingénierie des Matériaux - UMR 5085 CNRS UT3 Toulouse-INP (CIRIMAT). Polymer processing will be performed at Syensqo's Research and Innovation Center

located at Saint-Fons close to Lyon. It will be supervised by Maëlénn Aufray and Sandrine Duluard at CIRIMAT situated either in Toulouse INP-ENSIACET (PPB team) or UPS University part (RTS team) of the CIRIMAT laboratory and by Lise Trouillet-Fonti at SYENSQO. It is expected to start by the end of 2024.

This experimental PhD project is suitable for applicants graduated in material science and/or polymer science with an interest for mechanics and/or chemical physics with background in surface/interface analysis.

At CIRIMAT there is a strong expertise in characterizing surfaces and interfaces : the RTS (Coatings and surface treatments) team show a multidisciplinary approach of the physico-chemical modifications of materials surfaces by specific treatments, or by the deposition of coatings (of metallic, ceramic or composite nature) in view of their application and adaptation to various functions and sollicitations The PPB (Phosphates, Pharmacotechnics, Biomaterials) team possesses strong expertise in polymer characterization, particularly in their interactions with metal surfaces.

Syensqo is a science company developing groundbreaking solutions that enhance the way we live, work, travel and play. It is the newly established standalone company resulting from the recent spin-off of Solvay. Inspired by the scientific councils which Ernest Solvay initiated in 1911, we bring great minds together to push the limits of science and innovation for the benefit of our customers, with a diverse, global team of more than 13,000 associates. Our solutions contribute to safer, cleaner, and more sustainable products found in homes, food and consumer goods, planes, cars, batteries, smart devices and health care applications. Our innovation power enables us to deliver on the ambition of a circular economy and explore breakthrough technologies that advance humanity.

Requirements

The candidate must have strong background and skills in polymers and/or surface treatments and analysis.

Application

Please send full CV including reference and research interests to Sandrine DULUART, Maëlénn AUFRAÏ and Lise TROUILLET-FONTI. Then, job interviews will be organized by visio-conference.

sandrine.duluard@univ-tlse3.fr, maelenn.aufray@ensiacet.fr, lise.trouillet-fonti@syensqo.com