Laboratoire MatéIS, UMR 5510

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Strength of the fiber/matrix interface of composites

PhD starting in spring 2021

at the MatéIS Laboratory, Lyon, France

Solvay is a major supplier of fibre reinforced polymer composites to the aerospace and automotive industries, with "light weighting" as the primary benefit. The use of composites in structural applications demands high performance mechanical properties and exceptional durability. Their composites also find applications where high temperature performance and solvent resistance are required. This project is focused on composites with a thermoplastic matrix and carbon fibre (CF) reinforcement. Understanding and optimizing the structure, properties, and performance of the composite material requires multi-scale experiments aimed at characterizing the fracture behaviour of the materials and their constituents at different scales, from the single fibre embedded in a matrix to the final composite sample. The fibre/matrix interface plays a key role on the fracture behaviour. The aim of this project is to characterize the mechanical properties of CF/thermoplastic matrix interphase. It will involve preparation of the samples and the study of their properties. Suitable experimental methods and set-ups will be developed in order to be able to make the link between the mechanical properties at the micro-scale (single fibre embedded in a matrix) and the properties of a Uni-Directional composite samples. The polymer/matrix interface will be studied first with single fibre model samples, in different orientations. One of the goals will be to observe whether the fibre fragments before a crack propagates within the matrix, or not. In situ observations will be performed by X-ray tomography in lab and at synchrotron, or by SEM, jointly with acoustic emission measurements. The objective is to describe how the damages are initiated and how they grow until failure of the samples, with sufficient details in order to feed numerical models able to reproduce the observations.

This experimental PhD project is suitable for applicants graduated in material science and/or polymer science and/or chemical physics.

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