Laboratoire MatéIS, UMR 5510

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Optimization of the fiber/matrix interface strength - numerical simulation of debonding in thermoplastic composites

PhD starting in spring 2021

at MatéIS Laboratory, Lyon, France

Solvay is a major supplier of fibre reinforced polymer composites to the aerospace and automotive industries, with "light weighting" as primary benefit. The use of composite materials structural parts requires 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 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 properties may thus be optimized in order to control and improve the macroscopic behaviour of the composite. The objective of this project is to set-up numerical tools for the determination of fiber/matrix properties in CF/thermoplastic matrix, which could be used further on in order to control the fiber-matrix interface to optimize the composite fracture properties. The link between the fibre-matrix properties and that of a unidirectional ply or yarn will be investigated. Numerical simulations of the fiber/matrix interface are envisioned in order to set-up post-processing approaches of dedicated micro-mechanic tests (*e.g.* single fibre embedded in matrix under various solicitations). Numerical simulations will be based on in-situ (X-ray tomography, SEM), multi-instrumented (acoustic emission, digital image correlation) experiments

This experimental PhD project is suitable for applicants graduated in material or mechanical science.

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