Investigating the recyclability of healable composites

Project type: Master Thesis project in Industry
Start date: February 2023
Duration: 25 weeks
Location: EPFL-LPAC (Ecublens) and CompPair Technologies SA (Renens)
Direction: Véronique Michaud (LPAC), Eléonore Wild & Robin Trigueira (CompPair)
Contact: eleonore@comppair.ch

Description :

The current structural product market requires high strength/stiffness materials with low weight to reach high efficiency in many industrial applications. Fibre-reinforced polymer composite materials, which fulfil this requirement, are thus increasingly used in mobility, energy generation, or sports equipment. However, these are marked by a design limitation: the brittleness of the thermoset matrix results in sensitivity to small damage events. These damage events need to be repaired to prevent their propagation, thus avoiding failure of the structure. CompPair has developed a commercially available healable resin system providing a sustainable solution to the composite industry, which allows to extend the lifetime of products and reduce waste through fast and easy on-site repair.

Shifting from a linear to circular economy system requires efficient and viable recycling routes to tackle the current challenge of end-of-life composite waste management. Through processes such as chemical or thermal treatments, valuable fibres can be recovered and reused in new parts, closing the loop. However, most recycled materials have downgraded mechanical properties and can not be used in structural applications. Preliminary studies performed at LPAC have demonstrated the improved recyclability of healable resins compared to standard thermosets. Yet, a deeper understanding of the recycling conditions of such systems is required before performing their treatment at an industrial scale.

This Master Thesis is a work at the crossroad between research and applications of innovative composite products, through a collaboration between CompPair Technologies and the Laboratory for Processing of Advanced Composites (LPAC) at EPFL. The project will mainly focus on the following activities:

- Investigation of recycling processes on healable composites made from different types of reinforcement such as glass, carbon and natural fibres.
- Optimization of recycling conditions and parameters.
- Manufacturing of composites with recycled fibres and characterization of mechanical properties.

The project is linked with an industrial partner and the student will have to sign a non-disclosure agreement before starting the project.