

## Why healable composites are key to sustainability

**In Europe, one third of the GFRP materials produced is used in the transport sector. CompPair has developed a new composite material able to repair itself that has an improved propensity for recycling. Inspired by nature, the company offers healable and sustainable composite material solutions to extend the lifetime of parts, to close the loop of circularity in the industry.**

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CompPair Technologies Ltd. is the result of 12 years of thorough research in self-healing composites in the Laboratory for Processing of Advanced Composites (LPAC) at the Ecole Polytechnique Fédérale de Lausanne (EPFL). CompPair's one-of-a-kind approach enabled the creation of a semi-autonomous healing system, triggered by moderate heat (100°C). Repair takes place on site for one to two minutes, the part keeps its structural properties during and after repair. It recovers all its initial properties after the matrix has been repaired, or with barely visible damage events. To make this technology available, CompPair offers innovative pre-impregnated textiles, providing a circular solution to the composites market (Figure 1), called HealTech™. CompPair's strategy is to bring circularity to the industry by combining repair and recycling, bringing new standards to the industry.

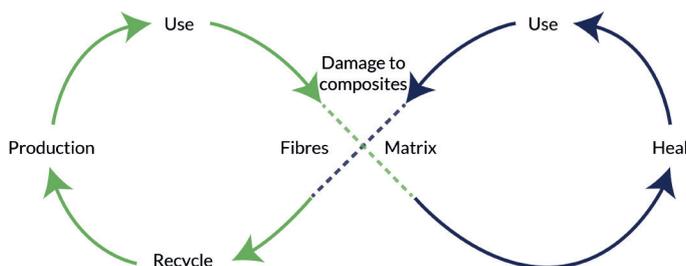


Fig. 1: HealTech™ brings circularity to the composites industry

The current trends of the composites market are focused on lightweight and high strength requirements; however, there is also a high demand for sustainable materials, arising from end-users desiring smarter materials for greener products. CompPair offers its innovative solution in this context. The first product family, HealTech™, is a series of pre-impregnated textiles made of standard carbon and glass fibres with various architectures (Figure 2). The Swiss company's solution has been produced on a larger scale and is now used for various part application implementations. HealTech™ is adapted to typical industry applications using pre-impregnated textiles.

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Fig. 2: CompPair's pre-impregnated textiles in carbon and glass

### Benefits

CompPair's pre-impregnated textiles provide a 360° solution for composites, which act on three levels: production, lifetime, and end-of-life.

# II. Conception and Raw Materials

### Production

HealTech™ can provide improved operational efficiency, via a standard manufacturing process, compatible with industry practices. CompPair products make it possible to build composite structures matching typical strength and stiffness requirements, together with above-average toughness values (+30% crack resistance). Regeneration already occurs during production, providing low potential for defects, improved geometrical stability, and reduced internal stresses. HealTech™ can also make production more efficient, with ultra-fast and non-invasive repair, all while maintaining the product's integrity.

### Lifetime

In case of delaminations and matrix damage events, CompPair composites' ability to heal multiple times has been tested up to 60 times on the same area. Products keep their structural properties during healing and all repairs can be done on site. This avoids cumbersome and timely repairs, allowing in-situ healing in all scenarios. Repair potential has been demonstrated for static and fatigue damage events; more information can be provided upon request.

### End-of-life

HealTech™ has high added value in terms of sustainability, drastically reducing CO<sub>2</sub> emissions, with the potential to save Mtons of CO<sub>2</sub>, and cut resources needs by up to 50%.<sup>[1]</sup> (Figure 3).

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### 3R Framework

The key element of CompPair's innovation is to extend the lifetime of products by repairing them, to reduce material waste. This contributes to saving primary resources, but also to developing industrial circularity, which is the company's vision. With benefits for manufacturers, users, and the planet, CompPair takes action specifically in four areas, which cover the 3R framework (Reduce, Reuse, Recycle), and contribute to SDG 9, 12 and 13. (Note: Environmental impact data were assessed internally based on specific case studies.)

### Semi-product production

CompPair's materials have a lower environmental footprint thanks to the resin's chemistry. During the composite production, the resin's footprint is up to 9% lower than standard epoxy resin. Bio-based chemistry formulations could reduce the environmental impact of those products even further.

### Composites production

HealTech™ prepregs are compatible with out-of-autoclave (OOA) processing, a manufacturing process that is less energy-intensive, compared to other processes for high performance composites. Through composite applications, CompPair has observed that over 15% of CO<sub>2</sub> emissions eq. can be reduced with the HealTech™ solution by adapting the design of parts and limiting the quantity of materials needed.

### Lifetime extension

The unique solution developed by CompPair enables intrinsic repair of damaged composites without input of extra raw materials. While preserving fossil resources, such technology can heavily cut down the impact on climate change. Life cycle assessment showed the potential for a CO<sub>2</sub> footprint 250 times lower than a scenario in which a damaged part is replaced, and 120 times lower compared to a conventional repair method. Considering a 10 Mt composites market [2], CompPair has the capacity to save Mtons of CO<sub>2</sub> equivalent.

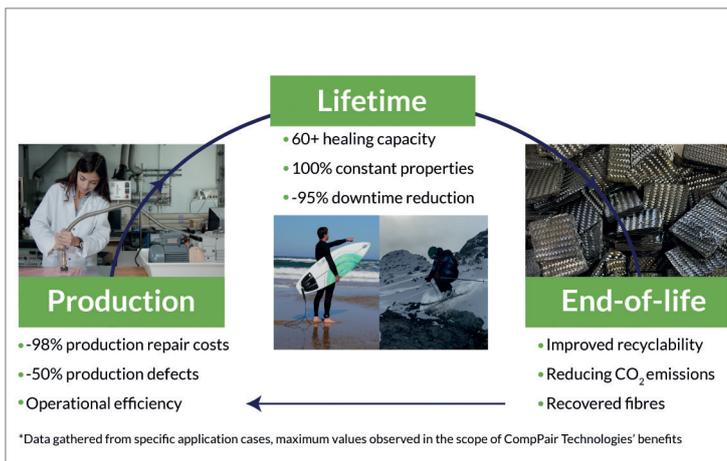


Fig. 3: CompPair's solution provides benefits at each step of a composite product's life

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### Recycling

Currently, the composites industry rarely recycles. Instead, composite parts most commonly end up in landfills, or are incinerated. However, recycled carbon fibres have 10 times less of an impact than virgin fibres when manufacturing a composite part. [3]

CompPair's recycling goals are twofold: reuse recovered materials in their product line and an efficient process for the end-of-life of composites made with CompPair products.

The company's objective is also to act on the footprint of the fibres at the beginning of the composite's lifetime by offering recycled fibres in their product line. Internal projects to validate this goal are currently ongoing. CompPair is continuously seeking new opportunities to bring efficient recycling to the industry.

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CompPair is, in parallel, reaching the next steps of its composites recycling upscale. The company has demonstrated that composites made with its prepregs have an improved propensity for recycling, which is environmentally efficient, with large CO<sub>2</sub> emissions eq. reductions. Recycling of HealTech™ has shown high potential. For example, specific cases have demonstrated reductions of 13% for climate change and 72% for mineral resources (when comparing CompPair's recycling treatment with standard incineration of composite waste). CompPair would like to thank Switzerland Innovation and the Tech4Impact initiative for the support within the recycling project.

### Future developments

CompPair's vision is to continuously improve its products to reduce their carbon footprint as much as possible. The team is developing more product families, each adapted to specific use cases, and thus working towards having a sustainable solution for different types of composite applications. Bringing full circularity to the composites industry, CompPair's goal is to broadly penetrate composite applications by addressing current challenges.

#### References:

- [1] European Technology Platform for Sustainable Chemistry, Suschem. (2018). Polymer Composites Circularity
- [2] JEC Observer 2020-2025
- [3] <https://www.sciencedirect.com/science/article/abs/pii/S1359836821001608>

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More information: [www.comppair.ch](http://www.comppair.ch)