Smart welding of sustainable composites for medical applications (SmartWeld)

Abstract:

The aim of SmartWeld is to develop a technology platform which integrates thermoplastic composites into medical applications. This platform will address material as well as process development. The consortium consists of all relevant links: from material suppliers to product manufacturers, along with academic expertise and motivation to innovate. It is expected that the project will impact the sustainability of the medical manufacturing industry, but also support automotive and aerospace sectors. The project will focus on the development of ultrasonic and induction welding technology with data collection for AI analysis, and pair this with efficient processing of a novel material (KyronTEX).

Countries involved

Application sectors
Aerospace, Automotive, Consumer goods, Medical applications

Research and innovation domains
Advanced manufacturing processes, Smart & adaptative manufacturing systems, Sustainable manufacturing, Customer-based manufacturing

Total cost in M€ (millions)
692 K€

Starting date
01/09/2024

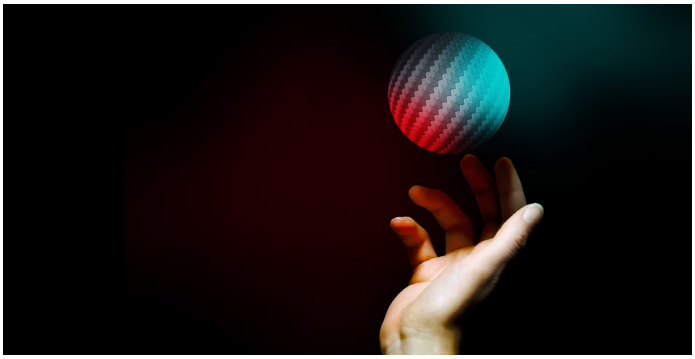
Duration (in months)
24 months

Project leader
Konstantinos Giannadakis
konstantinos.giannadakis@orfit.com
Orfit Industries NV [BE]

Project participans
Vrije Universiteit Brussel (VUB) [BE], Linköping University (LiU) [SE], Mitsubishi Chemicals Group (MCG) [DE]

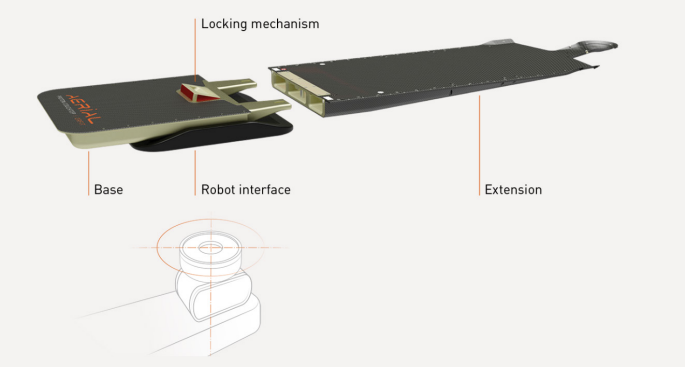
RATIONALE OF THE PROJECT

The aim of the project is to develop a technical process which implements thermoplastic composite materials into medical applications. Fast thermal cycling of lightweight moulds to produce thermoplastic composite parts with a low energy consumption and high surface quality will serve as the first step in the manufacturing. Novel ultrasonic welding as well as induction welding will be directly applied to join the parts in the production of the aforementioned medical applications, in both cases with certain optimisations to meet the requirements of the carbon fibre thermoplastics. The development of this technology includes material handling and a new material technology that can be directly implemented to medical applications. As CFRP composites are complex materials, where the material properties are set during processing, the project collects the market value chain; the medical supplier Orfit, the material provider MCG, and technology solutions on heating and welding provided by significant players in the market. Combining these with academic partners (VUB and LiU), the technical value chain is completed, as the combination will ensure objectivity and the access to state-of-the-art knowledge and testing facilities. To make sure the results are accepted by clinics, the project will also include a study on how the new material is received and how it can be positioned to ensure acceptance.



TECHNOLOGICAL INNOVATION, ACHIEVEMENTS AND RESULTS

On a material development level, KyronTEX® aims to replace the thermoset material that has been traditionally used in medical applications. What makes KyronTEX® interesting, is that it is not a singular material, rather than a flexible material platform. The textile material skips an energy-intensive process step and ensures the cost-effective usage of advanced composite materials for a high-volume market. Orfit as an end-user of KyronTEX®, aims to take advantage of the previously mentioned traits of this material and gradually integrate it in its production line, with the use of fast thermally cycled tooling solutions. Advanced research both on ultrasonic and induction welding technologies will be also performed for the considered thermoplastic materials. The main focus will be given on ultrasonic welding technology. Optimisation of the parameters, considering both the specifications of the considered materials, as well as the needs of the medical market, will be undertaken. Apart from optimisation of the welding processes with respect to modification of parameters and adaptation to the existing material requirements and market needs, a great target of the project will be the implementation of machine learning and AI for the automation of the processes. Mechanical testing with advanced NDT will be also performed for characterisation and validation of the aforementioned processes.



MARKET POTENTIAL

The fibre composite area has been growing for many years due to the requirements of lighter products, more sophisticated geometries, electromagnetic transparency behaviour and other properties not met by metals or other materials. Despite its existence on the market for many years, the design, production, and applications of the materials are generally not very mature, and a lot of development is needed to become a competitive alternative to other materials. Cost, cycle time and recyclability are important topics which need to be improved. If the project is successfully implemented, a greater material and processing awareness and understanding will be generated in the market. The results will also benefit different applications such as aerospace and automotive as well as sporting goods and other medical products. A successful project would open up a lot of new opportunities for Orfit and MCG with hundreds of millions of EUR in turn-over within reach in relatively short amount of time.

IMPACT POTENTIAL

SmartWeld will contribute to reinforce European manufacturing capabilities in the medical devices sector. The consortia are international, as the value chains in these industries (composite and medicine) are seldom contained in one country, especially if specific areas and/or competences are sought after. In SmartWeld the skillsets of recycled materials (MCG), thermoplastic organosheets (MCG), ultrasonic and induction welding (VUB), material testing (VUB, LiU), composite automation solutions (LiU and Orfit) and advanced medical positioning devices (Orfit) are combined to solve the addressed problem.