Univ.-Prof.
Prof. h.c. (MGU)
Dr.-Ing. Dipl.-Wirt. Ing.
Thomas Gries
Director

Andreas Bündgens, M.Sc.
Scientific researcher

Ref.: AB
04.05.2020

Project title:	**Freepreg - Innovative geometrically free reinforced fibre composites using prepreg-compatible Tailored Fiber Placement**
Partner:	Composyst GmbH Roth Composite Machinery TENOWO GmbH TFP Technology GmbH SGL Technologies GmbH ZSK Stickmaschinen GmbH Jakob Weiß & Söhne Maschinenfabrik GmbH Digel Sticktech GmbH u. Co.KG Carbon-Werke Weißgerber GmbH & Co.KG Institut für Textiltechnik (ITA) der RWTH Aachen University
Duration:	01/2020 – 12/2021
Funding Agency:	AiF / IGF vom Bundesministerium für Wirtschaft und Energie

Mission Statement

In Germany, more than 120 manufacturing SME use the Tailored Fiber Placement (TFP) technology as semi-finished product or component manufacturers. The TFP technology allows the fibres to be placed in the correct load path and ensures an improved flow of forces in the component. This results in optimum material utilization and thus a reduction in weight. A disadvantage is the high tool cost (RTM) for impregnating the textile. A combination of TFP structures e.g. a TFP hole reinforcement and a semi-finished textile product such as fabric is currently possible with dry textiles. For wet, i.e. impregnated, textiles (prepregs), the combination is not possible yet. Prepregs are used particularly in the area of high-performance components, since an exact fibre placement and optimal fibre-matrix ratios can be adjusted. This makes prepregs popular in the industry and, with a share of 45 % (41,200 t in 2015), they are the most widespread manufacturing process for carbon fibre composite materials.

Approach

In the "FreePreg" research project, a process chain is being developed, that enables the continuous production of high-performance FRP structures with load-bearing continuous filaments on a carbon fleece. By means of Tailored Fiber Placement (TFP), carbon fibre rovings are stitched along the load paths in the later component onto a carbon fleece. As a functional embroidery ground, the carbon fleece improves the impregnability and mechanical properties of the component to be produced. Several TFP structures are applied next to each other step by step, making optimum use of the web width. The embroidered nonwoven webs are then joined together to form a continuous roll of fabric and, in a continuous process, are deposited in a pre-produced resin film and pre-impregnated on one side. The products of this semi-finished product production are freely laid, already pre-impregnated preforms on a roll product, so-called FreePregs, which are optimally adapted to the load paths.

The free roving deposit allows an exact adaptation to the component requirements with optimal utilization of the fibre properties with minimum waste. The partial impregnation significantly reduces the flow path of the matrix, thus achieving short cycle times and even low pressures are sufficient for consolidation (out-of-autoclave). The continuous impregnation process guarantees a high throughput with low personnel effort. In addition, the semi-finished product can be processed with classic prepregs. A comparison of the existing and the new process chain is shown in figure 1.

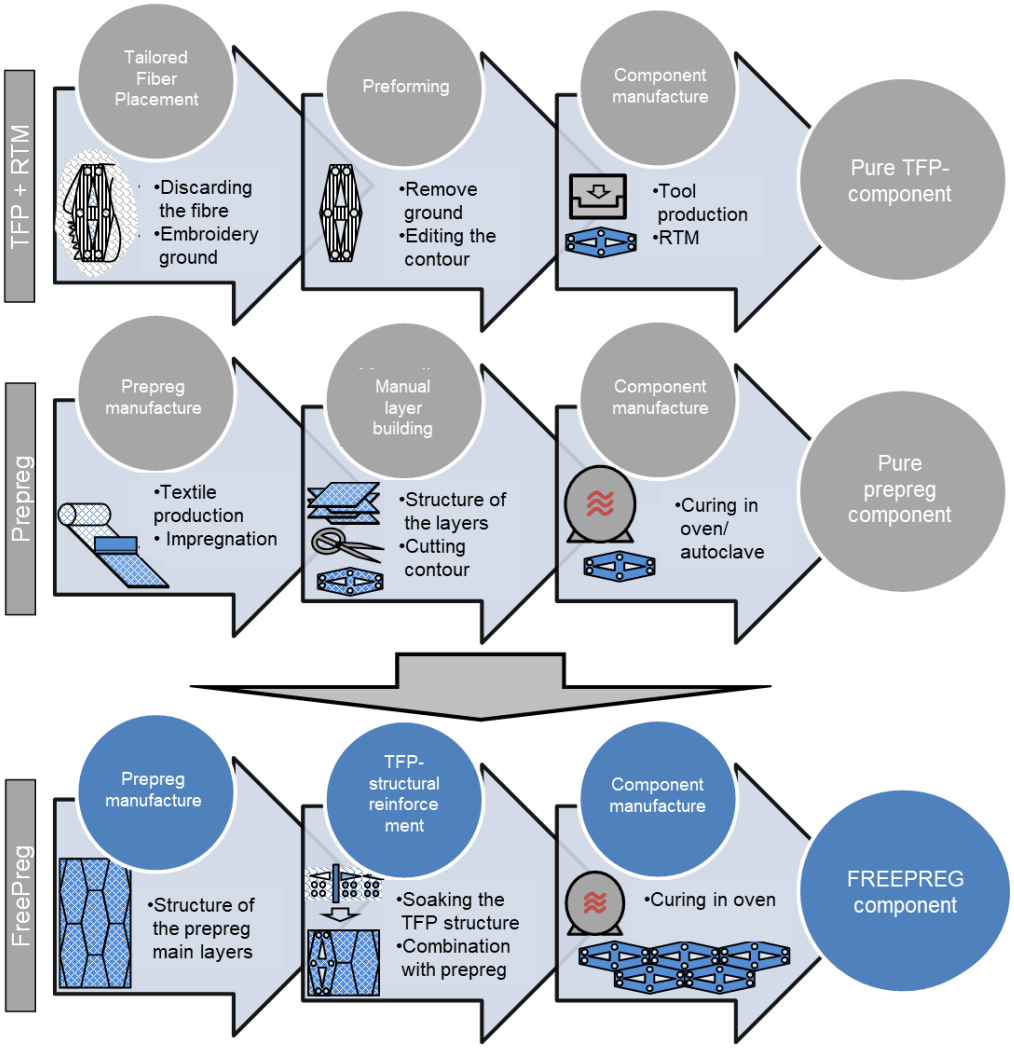

Figure.1: Comparison of the existing and the new process chain

The circle of users consists of manufacturers of TFP semi-finished products and coating companies as well as FVK component manufacturers. The technology addresses supplier markets for special applications for products for aviation and automotive sectors. These markets are predominantly occupied by specialized SME.

Acknowledgement

We would like to thank the Federal Ministry of Economics and Energy (BMWi) for funding the research project within the framework of the Industrial Joint Research (IGF) of the AiF Research Network for Small and Medium-Sized Enterprises.

Contacts

Lennart Jacobsen, lennart.jacobsen@ita.rwth-aachen.de, 0241 80 23282
Andreas Bündgens, andreas.buendgens@ita.rwth-aachen.de, 0241 80 23260
Waldemar Biche, waldemar.biche@ita.rwth-aachen.de, 0241 80 24711