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

Max Schwab
Sebastian Oppitz
Researchers

Ref.: MS/OP
16.04.2019

Project title:	**TFPInsert** - Development of a preforming process using TFP embroidery technology for direct integration of inserts
Partner:	Rheinstick GmbH
Duration:	03/2019 – 02/2021
Funding Agency:	Central Innovation Programme for SMEs (ZIM) of the Federal Ministry for Economic Affairs and Energy

Mission Statement

Complex components made of fibre reinforced plastics (FRP) are currently produced in small to medium sizes (< 1 m²) by multi-stage processes on the basis of dry, textile preforms or pre-impregnated semi-finished products (prepregs). In addition to a high amount of manual production, the current production of these parts is characterized by a high degree of waste (currently 30-50 %). Due to the high costs of expensive textile semi-finished products, they can account for up to 50% of the component manufacturing costs. The quantity of waste has a significant influence on an efficient cost structure in the production of FRP components.
This is why a new low-cut preforming process is increasingly being used: Tailored Fibre Placement (TFP). The TFP is a special embroidery process that provides a near-net-shape, efficient fibre placement in line with the load path. The process not only offers the possibility of producing reinforcing textiles for high-performance components, but also offers the potential for additional functionalization, e.g. for the integration of fasteners for multi-material designs.
Due to the increasing demand for multi-material designs, especially in the automotive industry, detachable fasteners (on- or inserts) are required as joints in the composite material. At present, however, such fasteners are either bonded to the consolidated component at great expense or additional holes have to be drilled to integrate them into the already rigid component. Bonded inserts are limited by the adhesive surface. The bonding of fasteners into drilled holes leads to high tool wear. In addition, reinforcing fibres are cut so that the TFP process is suitable for the material compared to subsequent drilling.
The introduction of the fasteners into the dry textile preform and common infiltration and curing would eliminate process steps. Adhesive application or drilling of the rigid FRP components is then no longer necessary.

Approach:

The aim of the project is the automated application of new, material- and process-specific joint elements (fasteners) within the preforming process by Tailored Fibre Placement.
Inserts are fixed on the substrate or on the embroidered preform by the embroidery thread. The insert is not only integrated under the roving layers,

but is also fixed by additional loops. This is intended to significantly increase the mechanical strength. New inserts adapted to the material and process are being developed which enable embroidery with higher process stability. An automated feeding system for fasteners is developed, implemented and integrated into the existing embroidery machine. The central picture of the TFPInsert project is shown in Figure 1.

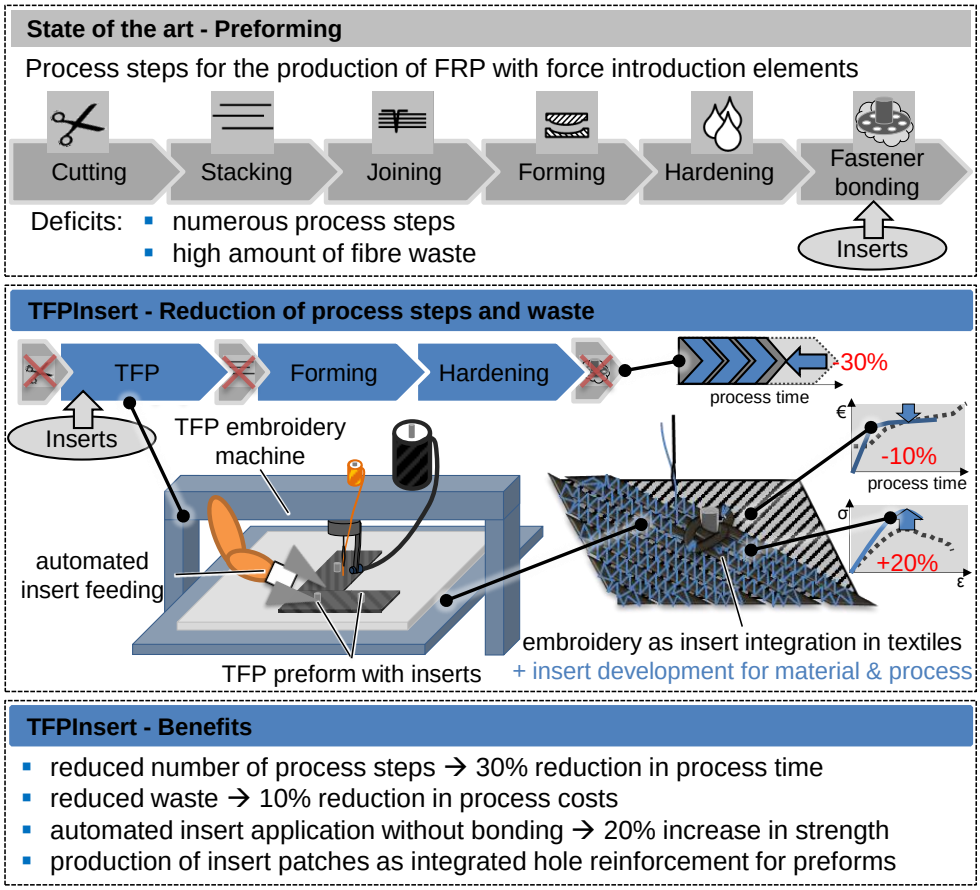

Figure 1: Central picture of the approach for the TFPInsert project

Acknowledgement

We would like to thank the Federal Ministry of Economic Affairs and Energy (BMWi) for the financial support of the research project "OptiTFP" within the framework of the Central Innovation Programme for SMEs (ZIM).

Contact

Max Schwab, M.Sc.
Email: max.schwab@ita.rwth-aachen.de
Fon.: +49 (0) 241 / 80 234 73

Sebastian Oppitz, M.Sc.
E-Mail: sebastian.oppitz@ita.rwth-aachen.de
Fon.: +49 (0) 241 / 80 220 96