Project title:	SingleStepSandwich
Partner:	Germa Composite GmbH, Kurtz GmbH, T. Michel Formenbau GmbH & Co. KG, Institut für Textiltechnik der RWTH Aachen University, Fraunhofer-Institut für Chemische Technologie ICT, Associated partners: Hennecke GmbH, BMW Group, AIRCONCEPT GmbH, Magna Exteriors GmbH, proseat GmbH
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Univ.-Prof.
Prof. h.c. (Moscow State Univ.)
Dr.-Ing. Dipl.-Wirt. Ing.
Thomas Gries
Director

First Boris Manin

Ref.: man
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<u>Mission Statement</u>

In the current environmental and public discussion in the context of climate protection, weight savings through lightweight construction are of decisive importance. Through a component-integrated combination of material and structural lightweight construction, sandwich structures enable an unrivalled lightweight potential with weight savings of up to 80 %. The use of fibre-reinforced plastic (FRP) face sheets and cores made of plastic foams is particularly advantageous from the point of view of lightweight construction and process technology. The FRP sandwich construction method has therefore been widely used in the transport sector (aviation, trucks, trains, motor vehicles) for years. A central demand of the industry is the reduction of process steps or process time to increase the output rate. In addition, the continuing trend towards ever greater functional integration and integral design is leading to complex three-dimensional (3D) component geometries. Due to their simple shaping, sandwich components with FRP facings and foam cores represent an ideal material combination for mapping 3D geometries. However, current manufacturing methods cause high amounts of waste, lengthy processes and a high CO2 footprint. This counteracts the basic principles of lightweight construction applications. Overall, there is a need for a cost-, time-, material- and emission-efficient process for the mass production of 3D FRP foam sandwich components.

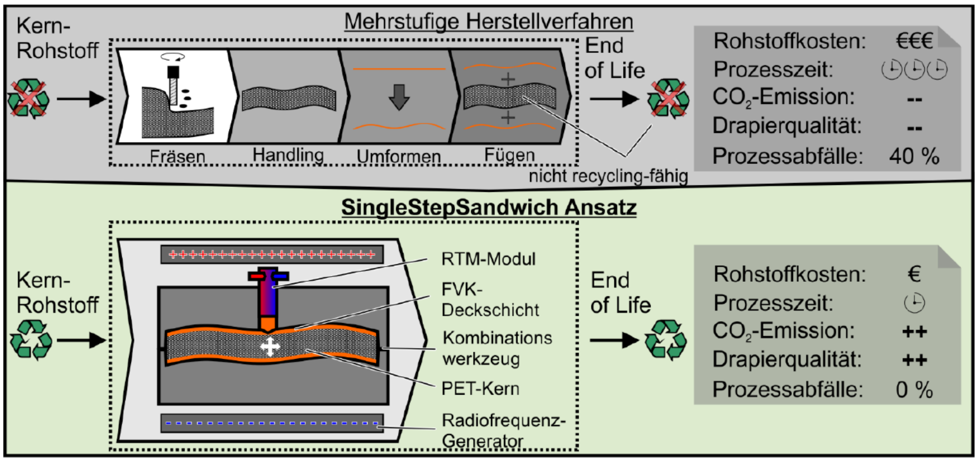

Figure 1: SingleStepSandwich Approach

The aim of this research project is the cross-sectoral reduction of the CO2 footprint of moving 3D components. The core of the development is the combination of a radio frequency foam moulding process (RF) with a resin transfer moulding (RTM) impregnation process. This combination offers for the first time the possibility to map the forming, foaming and impregnation process in one procedure without material cutting, whereby considerable waste, emission, cost and time savings are realised. The novel process also enables the use of recyclable foam plastic as a lightweight material for high-performance applications.

The project will transfer the individual technologies of the project partners into a new type of overall process. In the process, actors and technologies from the lightweight construction sector will be linked with actors who were previously active outside the lightweight construction sector. The implementation is based on the example of complex, multi-axially loaded components in the automotive sector (battery casing of electric cars), which can also be found in a similar form in other technical applications in other sectors, e.g. as multi-curved rotor blades of wind power plants. Overall, the CO2 footprint of 3D sandwich components is significantly reduced and an increased application in mass markets is achieved.

Approach

The aim of this project is to develop an overall process for the integrated production of 3D sandwich panels with a core made of recycled PET foam and FRP face sheets. For this purpose, a multi-stage development is necessary and two sub-processes will be developed. The development of the sub-processes leads to the development of the overall process. The sub-process production of the core-textile-preform and the sub-process cover layer impregnation and core bonding are examined. The sub-process development is again divided into tool and process development. First, the necessary forming tools are developed. Then, the tools are used on the RF or RTM systems to develop the process control.

The development starts with a two-dimensional sandwich mould. For this, the corresponding foaming and impregnation tools are developed. The knowledge gained during the development of the 2D component provides the necessary basis for the development of the 3D component. The production of the 3D components requires an additional forming (drape forming) of the reinforcement textiles through the (expanding) PET foam. For this purpose, the foaming tool is extended by corresponding draping functions. The basic principles of foam draping are developed on a separate draping test rig. The validation and transferability of the project development is made possible by the development of process- and material-specific testing and simulation methods.

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Contact

Boris Manin
Wissenschaftlicher Mitarbeiter
Automated Composite Production
ITA – Institut für Textiltechnik der
RWTH Aachen University
Otto-Blumenthal-Str. 1
52074 Aachen
Boris.manin@ita.rwth-aachen.de

Hannah Dammers
Bereichsleiterin
Automated Composite Production
ITA – Institut für Textiltechnik der
RWTH Aachen University
Otto-Blumenthal-Str. 1
52074 Aachen
hannah.dammers@ita.rwth-aachen.de