Project title:	Development of an economical concrete moulding system for the production of structural components made out of fibre-reinforced composites
Partner:	Germa Composite GmbH, Pulheim KMB Keramischer Modell- und Formenbau GmbH, Wesel Institut für Textiltechnik der RWTH Aachen University
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Mission Statement

Mould making plays a central and important role within the process chain for the production of components made of fibre-reinforced plastics (FRP). At 5.8 thousand metric tons, the "Molding & Compound" segment accounts for a significant 11% of the total market volume of the carbon fiber market. Mould making ensures both component quality and process stability in the manufacture of fiber-reinforced plastic components.

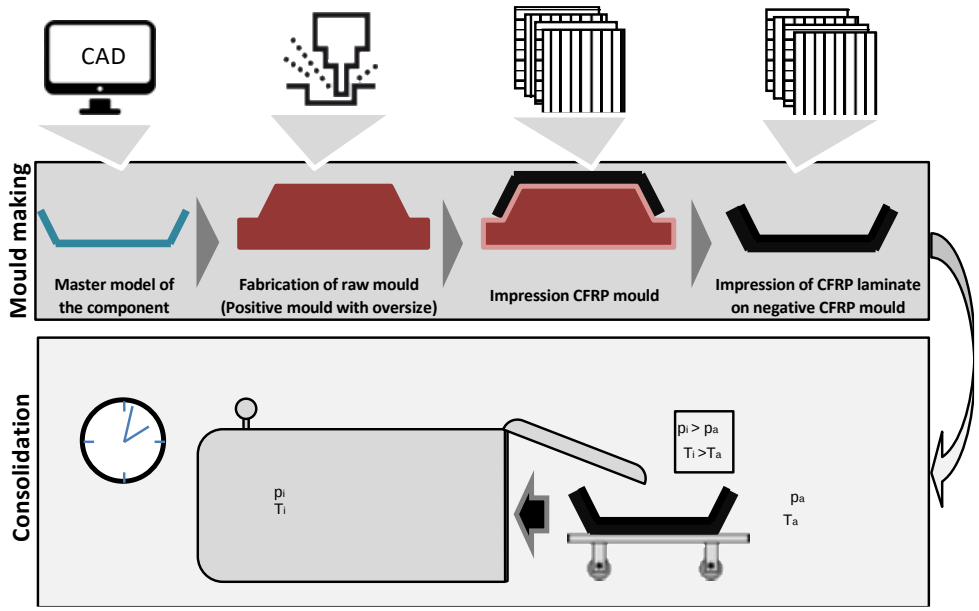

Figure 1: Process chain of mould making in the FRP component production

The high demand of approx. 11 % of the total market volume of carbon fibres can be explained by a special feature in fibre composite construction in handling moulds: In order to compensate the thermal expansion of the materials

during the autoclave process (curing of the composite component under high pressure and temperature) during the curing process, the moulds are made of the same material as the component to be manufactured. In most cases this is carbon fibre reinforced plastic (CFRP).
CFRP moulds are associated with high manufacturing costs and low durability. The limited durability results both from manufacturing defects and from very strict specifications regarding the accuracy of the component dimensions.
Due to the growth of carbon fibre demand, the demand for tools for the production of fibre-reinforced plastics will also increase. According to the German Engineering Federation (VDMA), the tool industry is dominated by SMEs. Due to the high costs, there is a high need for innovation in tool manufacturing.

Approach

The aim of the joint project is the development of a raw mould system based on a cost-effective and recyclable material as an alternative to PU, aluminium and CFRP, with which even small batch sizes of components can be produced economically. This project is based on the production of raw moulds from fibre-reinforced concrete. The advantage of concrete components lies in the low costs of concrete (0.40 €/kg) compared to aluminium (approx. 4 €/kg) and PU (approx. 6.50 €/kg), a high temperature resistance (fire resistant) combined with a low coefficient of thermal expansion, increased service life, high compressive strength and the possibility of recycling the concrete components. Concrete moulds allow cost savings of 40% to 83% compared to PU or aluminium moulds. To check the approach, a multi-dimensionally curved, complex component, in this case a Longboard, is selected.

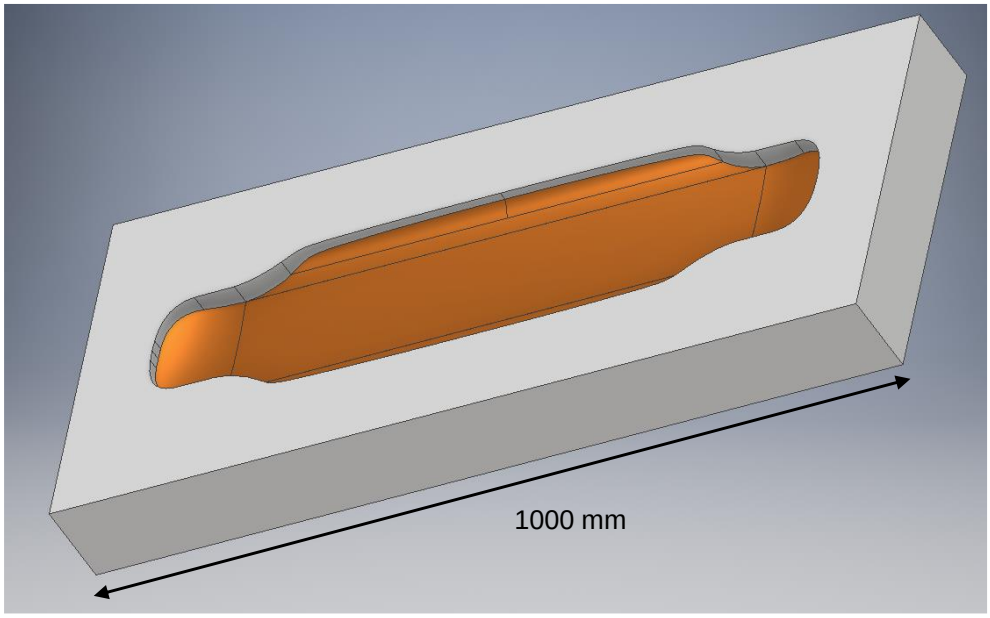

Figure 2: CAD model of the raw concrete mould as a negative mould

The concrete moulds produced are tested for their suitability according to different criteria using a factorial test plan.

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