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Mein Zeichen: CU
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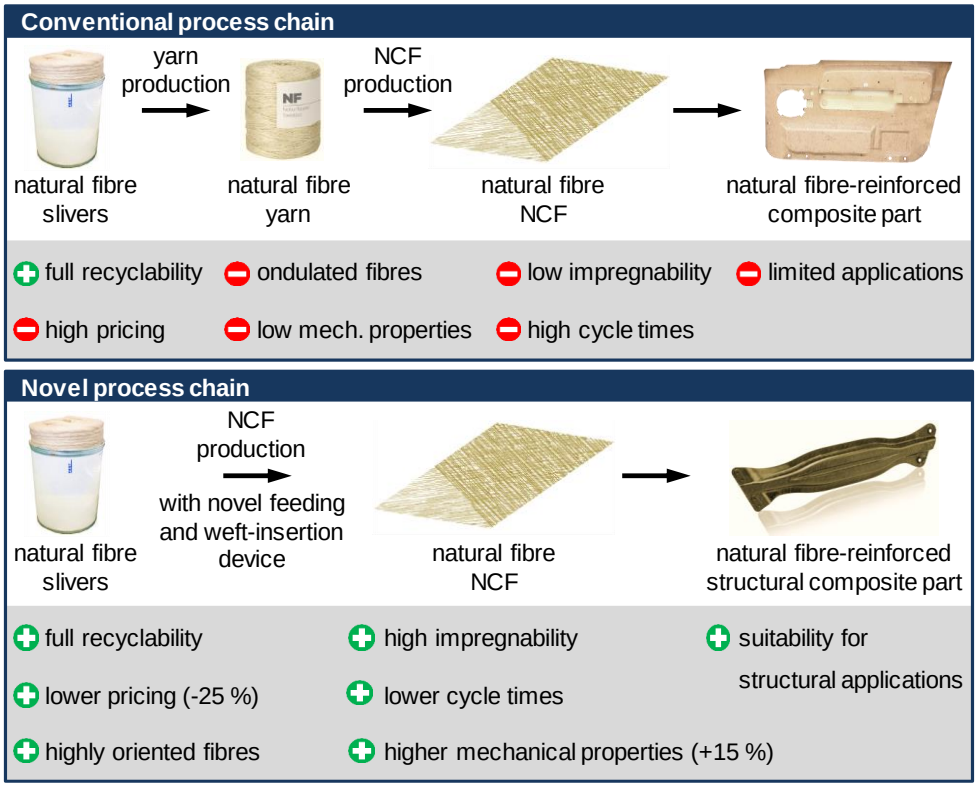
Project title:	Hyper-NFK: Development of a high-performance natural fibre reinforced composite material for structural parts
Partner:	Institut für Textiltechnik (ITA) of RWTH Aachen University Institut für Polymerwerkstoffe und Kunststofftechnik (PuK) of TU Clausthal
Laufzeit:	03/2017 - 02/2020
Förderträger:	Federal Ministry for Economic Affairs and Energy (BMWi)

Mission Statement

Non-crimp fabrics (NCF) are often used as reinforcement structures for mechanically highly stressed fibre reinforced composites. NCF are manufactured from continuous filament rovings, like e.g. glass, carbon or aramid. The use of these materials, however, requires a high energy input during fiber production and thus leads to high CO2 emissions during the production of fibre reinforced composites. Compared to glass fibre reinforced composites, natural fibre reinforced composites (NFRC) emit about 30 % less CO2 and save about 40 % of energy during their production. NFRC are already being used for non-structural components with low mechanical properties. Due to the additional process step of yarn production, however, natural fibre fabrics are very expensive. In addition, the maximum achievable mechanical properties are reduced by fibre ondulation when using staple fibre yarns.

The aim of this project is to reduce the manufacturing costs for fabrics based on natural fibres by 25 % and at the same time to increase the mechanical properties of the composite structures produced using them by at least 15 %.

The solution approach is based on the development of a new process for the processing of twist-free natural fibre slivers on warp-knitting machines and the additional saving of the cost-intensive spinning process for natural fibre yarns, see figure 1. At ITA, consolidation and transport mechanisms for the processing of flax fibre slivers are investigated and a novel feeding device for staple fibre slivers is developed. Biaxial NCF (+/-45°) are produced using the new technology. These fabrics are qualified by PuK with regard to their drapability and permeability. The NCF are impregnated with a duromer matrix and the resulting mechanical properties are determined. Using the novel semi-finished product, an automotive demonstrator is produced and its economic efficiency is evaluated.



Project results

Within the scope of the project, the technical feasibility of the false-twist technology for the efficient conveying of staple fibre slivers in the production of semi-finished products for composite components has been demonstrated. In addition, the improved performance of NFRC made of twist-free slivers compared to fabrics made of conventional yarns has been shown. The mechanical properties of the composite components produced from this material could be increased by up to 100 %. At the same time, the manufacturing costs for NCF produced using natural fibres could be reduced by up to 21,5 % compared to yarn-based semi-finished products. The interaction of both effects makes the use of NFRC in load-bearing structures possible. This is particularly important for applications with high mechanical requirements.

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