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

Oliver Deußen
Research Associate – Reinforcing Fibers

E-Mail: oliver.deussen@ita.rwth-aachen.de
Tel. +49 (0) 241 80 23404

Project title:	Plasmahybrid - Development of a production plant for the manufacture of hybrid yarns on a single filament basis using plasma powder coating
Partner:	ecoCoat GmbH, Tigres GmbH, Faculty for Science and Technology der HAWK Göttingen
Duration:	April 2020 – September 2022
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Thermoplastic carbon fibre reinforced components (T-CFK) are regarded as the next important development step for the use of fibre reinforced plastics (FRP) in mass applications. Compared to thermoset components, thermoplastic systems are thermally formable. This allows considerably shorter cycle times to be achieved.

The current process chain for the production of T-CFRP is based on the use of so-called organic sheets (pre-impregnated flat textiles) and subsequent thermal pressing to produce T-CFRP components. So-called hybrid rovings are one possibility for the production of components made of T-CFK with high form complexities. These hybrid rovings consist of a reinforcing fibre (carbon fibre) and a thermoplastic fibre which are mixed together at filament level. The mixture of the reinforcing fibre and the thermoplastic fibre in a roving enables the use of conventional textile processes and machines (e.g. weaving, braiding, Tailored-Fibre-Placement (TFP)). The resulting preforms are consolidated into one component by using a heating press with shaping tool.

<u>Deficit</u>

In general, there are five main requirements for hybrid rovings:

1) Optimum adhesion between fibre and matrix
2) Optimum mixing of reinforcing fibre and thermoplastic (short flow paths)
3) Diverse draping possibilities (e.g. woven, braided, tape, etc.)
4) No fibre damage (no filament breaks)
5) High orientation

However, these requirements are not fully met by current manufacturing processes for hybrid rovings (commingling, stretch-breaking).

Objective and approach

The aim of the "Plasma Hybrid" project is to develop a new type of process for the production of carbon fibre hybrid rovings with endless filaments and a high thermoplastic mixing ratio.

For this purpose, the approach of a direct impregnation of the individual fibre films by means of a plasma coating with thermoplastic powder is being pursued. The process for manufacturing the novel hybrid roving is divided into five process steps:

1) Spreading of the carbon roving
2) Surface activation by plasma
3) Powder dispersion
4) Plasma coating of the single filaments with thermoplastic powder
5) Draping of the hybrid roving

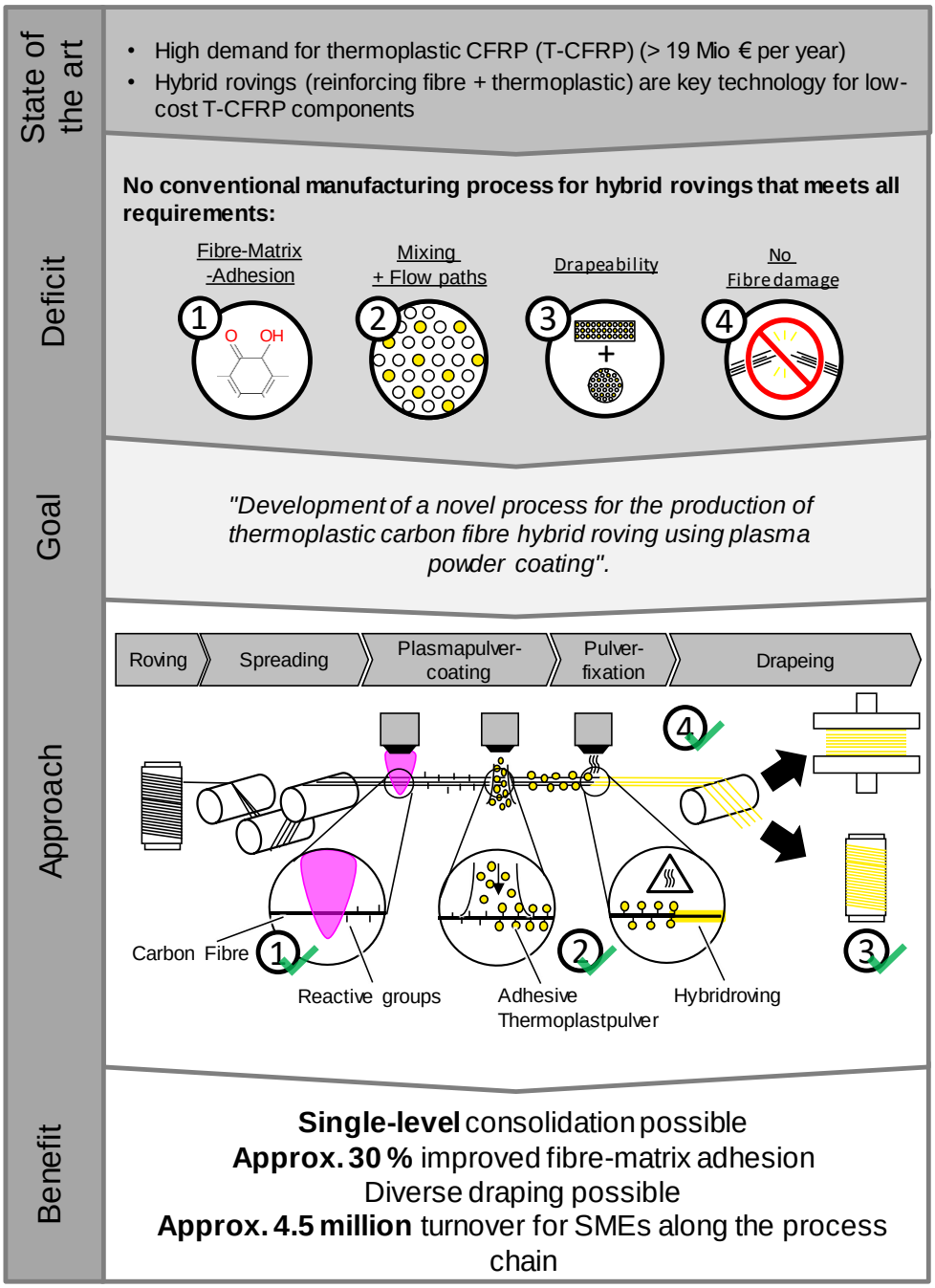
Solution

Together with HAWK Göttingen, ecoCOAT GmbH is developing a powder dispersion system for feeding the thermoplastic powder into the plasma nozzle. Tigres GmbH develops the plasma modules required for the process in cooperation with HAWK. The ITA is supported by the company STAHL-TEAM GmbH in the development of the fibre spreading module as well as the barrel processing.

Benefits

The use of hybrid rovings to manufacture T-CFK has the potential to achieve a market share of 2-5% as a starting material. This corresponds to a potential market volume in Europe of around €19m to €47m per year. The concrete areas of application include stabilisers in automobiles, stringers in aviation and needle bars in mechanical engineering. The derived number of units per year is approx. 200,000 units. With a conservatively estimated component weight of 2 kg and a hybrid roving price of €25/kg, the actual market volume is €10 million per year.

Mission Statement:



Contact:

Oliver Deußen, M.Sc.

Oliver.deussen@ita.rwth-aachen.de

0049(0)241 80-23404

Otto-Blumenthal-Str. 1

52074 Aachen

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