

# New Course of Studies in Composite Technology

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## Abstract

Future markets for CFRP structures are characterised by high potential for growth in main industrial sectors such as aviation, automotive as well as machine and plant construction. One success criterion for the realisation of innovative CFRP structures is the availability of highly qualified composite engineers and skilled workers with knowledge in composite processing. In close co-operation with leading representatives of the industry and with the private university of applied sciences "Private Fachhochschule Göttingen, PFH", the network of competence CFK-Valley Stade generates the two novel study courses Bachelor of Engineering and Master of Science with the main focus on composite design and processing contents. The contents of teaching will be based on the requirements of leading companies in the market of composite technology. Due to this practical education, the diploma holders of the Composite Campus in Stade are ideally prepared for a straight career in future orientated CFRP markets.

### CFRP – a tailor-made material having great potential for lightweight construction

The use of CFRP lightweight structures in future markets is characterised by an annual growth rate of more than 10% (illustration 1). A considerable potential of the fibrous composite materials is based on their lightweight potential as well as on their anisotropic material behaviour [1]. By purposeful combination, arrangement and design of the individual components – fibre and matrix – directionality of the material characteristics can be constructed and used in a way which is suitable for the respective application.

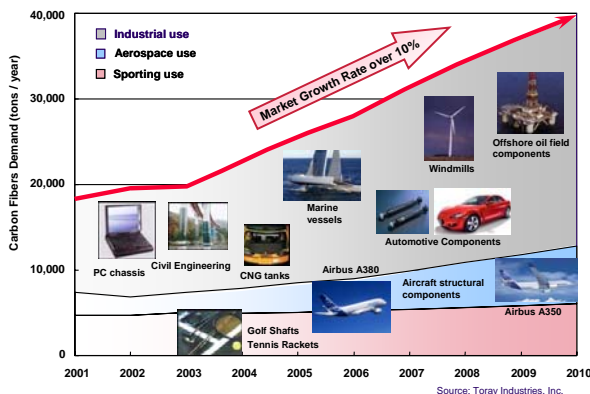


Illustration 1: Future markets of CFRP

Furthermore, the state-of-the-art lightweight material CFRP is characterized by high specific damping and by a high specific energy absorption capacity. These additional "degrees of freedom" lead to a completely new development potential, but also require a more complex and

new type of design philosophy as well as interdisciplinary knowledge ranging from the design to the production of fibre composite structures.

### New Study courses concerning composite technology

One considerable criterion of success with regard to the realisation of innovative CFRP structures is the availability of highly qualified composite engineers and skilled workers with knowledge in composite processing. Leading representatives from the industries

- automobile construction,
- aircraft manufacturing,
- rail vehicle building,
- shipbuilding and
- wind power station construction

unanimously state that a great demand for highly qualified engineers with practically orientated expertises in the area of composite technology becomes apparent even today.

Against this background, the Private University of Applied Sciences "Private Fachhochschule Göttingen, PFH" in close cooperation with the network of competence CFK-Valley Stade and relevant industries, developed two completely novel courses of studies which passed the accreditation [2] in 2008 successfully.

A dual course of studies with the main focus on production and engineering was thus generated which is being completed with the Bachelor of

Engineering. An important feature of this course of studies is the parallel training as composite engineer and as skilled worker in the area of composite processing with a degree awarded by the chamber of commerce (IHK).

It is thus ensured that the students of engineering are provided with practically relevant training thanks to which the graduates will ideally be prepared for a straight career in future-orientated employment markets. The Master of Science course of studies which is offered parallel to the Bachelor studies is aimed at experienced engineers who want to undergo job-related further training with the main focus on design and automated production technologies in the target area of fibrous composite materials [3].

The training of the students and the skilled workers will take place at the university location Stade in the Composite Campus specifically intended for this purpose which is just being built right next to the Centre of Technology and to the partners of CFK-Valley Stade (illustration 2). Furthermore, process engineers for rubber and plastics engineering will be trained in this building, with the job outline having been adjusted to the training requirements of the fibre composite industries in close cooperation with the Chamber of Commerce of Lüneburg Stade.



*Illustration 2: Composite Campus Stade (completed in September 2007)*

## Bachelor of Engineering

The dual course of studies for the “Bachelor of Engineering (Verbundwerkstoffe / Composites)” is a study concept which was tailored to the future market requirements. The formal precondition for being admitted to the Bachelor studies is a university entrance qualification which is usually complied with by acquiring the general academic standard required for university entrance or entrance to a university of applied sciences.

Against the background of the demand of leading industrial companies, the course of studies for the “Bachelor of Engineering (Verbundwerkstoffe / Composites)” was designed as a dual course, so that the student parallel to the engineering training passes a specialist training as “Verfahrensmechaniker Kautschuk und Kunststofftechnik” (process engineer in rubber and plastics engineering).

As a result, the period of studies covers a total of eight semesters, with the training as skilled worker taking place in the 3<sup>rd</sup> and 6<sup>th</sup> semester (illustration 3). In the remaining 6 semesters, both the fundamental principles of engineering relevant to the target area of composite technology and the practice-relevant expert knowledge in the two main groups of subjects construction and calculation as well as production of fibrous composite structures will be imparted.

<b>1<sup>st</sup> Semester</b>	<b>Module 1G</b> Engineering principles 1
	<b>Module 2G</b> Interdisciplinary principles
	<b>Module 3G</b> Fundamental principles of natural sciences
	<b>Module 4G</b> Material characteristics
<b>2<sup>nd</sup> Semester</b>	<b>Module 5G</b> Engineering principles 2
	<b>Module 6G</b> Interdisciplinary applications
	<b>Module 7G</b> Applications of business administration
	<b>Module 8G</b> Mathematics of simulation technology
<b>3<sup>rd</sup> Semester</b>	<b>TRAINING AS SKILLED WORKER</b>
<b>4<sup>th</sup> Semester</b>	<b>Module 9G</b> Engineering principles 3
	<b>Module 10G</b> Construction principles
	<b>Module 11G</b> Principles of manufacturing technology
	<b>Module 12G</b> Design principles of composite structures
<b>5<sup>th</sup> Semester</b>	<b>Module 13G</b> Principles of composite structure manufacturing
	<b>Module 14P</b> Semi-finished products / Textile precursors
	<b>Module 15P</b> Production technologies
<b>6<sup>th</sup> Semester</b>	<b>TRAINING AS SKILLED WORKER</b>
<b>7<sup>th</sup> Semester</b>	<b>Module 16P</b> Industrial serial production
	<b>Module 17D</b> Design of composite structures
	<b>Module 18D</b> Composite design suitable for production
<b>8<sup>th</sup> Semester</b>	<b>Main practical training</b>
	<b>BACHELOR THESIS including DISPUTATION</b>

*Illustration 3: Modules of Bachelor course*

The theoretically acquired knowledge will be extended by practical laboratory exercises and homework. In the 4<sup>th</sup> year of studies, the Bachelor Thesis (BA) will be prepared following the main period of practical training in the 8<sup>th</sup> semester, resulting in a workload of altogether 180 ECTS for the studies as “Bachelor of Engineering (Verbundwerkstoffe / Composites)“.

The tuition fees amount to 500 Euro per month. Consultations with regard to individual financial

assistance such as scholarship programmes or subsidized credits through the Private Fachhochschule Göttingen (PFH) are possible, however.

### Master of Science

The job-relevant advanced training within the framework of the course of studies "Master of Science (Verbundwerkstoffe / Composites)" contains three semesters over a period of 18 months. The entrance qualification for this course of studies is a completed university education in engineering of at least four years, no matter which subject area, or a mathematical-scientific degree as well as work experience of at least one year.

The course of studies for the "Master of Science (Verbundwerkstoffe / Composites)" altogether includes six modules, with the main emphases being put on the areas business administration, construction and calculation as well as production (illustration 4). The contents of these modules are tailored to the current and future job requirements for the engineers of leading companies in the target area composites (e.g. CFRP) thanks to which the graduates will ideally be prepared for a straight career in future-orientated employment markets.

Tuition fees for the Master course of studies amount to 990 Euro per month. Consultations with regard to individual financial assistance such as scholarship programmes or subsidized credits through the Private Fachhochschule Göttingen (PFH) are possible, however.

1st Semester	Module 1	Business Administration
	Module 2	Consolidation of math.-engineering science principles
	Module 3	Structural design of composites
	Module 4	Partial automatic and automatic manufacturing processes
2nd Semester	Module 5	Design of multi-functional composite structures
	Module 6	Sustained process optimization
3rd Semester	MASTERTHESIS and Disputation	

Illustration 4: Modules of Master course

### Characteristics of PFH

The Private University of Applied Sciences "Private Fachhochschule Göttingen, PFH" was founded in 1994. Since March 2006 PFH is listed within the Top-Ten of the FAZ-Academy-Ranking for privately financed Universities in the German-speaking region (Germany, Austria and Switzerland).

Based on a privately financed and organised enterprise, the state-approved and accredited PFH is focussing on the education of high qualified management personnel. Beyond this area of expertise the engineering department was established in 2006 including core competences in the categories composite technology as well as adaptronics.

The study courses

- Bachelor and Master Study in General Management / Business Information System,
- Bachelor and Master study courses focusing on composite technology (in accreditation phase, started since October 2006),
- M. Sc. in Adaptronics (1.5 years duration) and
- Diploma in Business Administration Distance learning courses (3 years duration)

are exceedingly practise orientated. Against this background, a job guarantee was established for the excellent coached students of PFH.

### Network of Competence CFK-Valley Stade e.V.

The network of competence CFK-Valley Stade e.V. focuses on future-orientated construction methods and automated manufacturing processes in the growth market CFRP. Due to the interdisciplinary core competences of the experts of CFK-Valley Stade e.V., the total of the value-added chain is being covered, beginning with the conception up to the disposal of a CFRP structure after operational use [4].

In the network of competence CFK-Valley Stade, there are more than 82 renowned companies and research institutions working together in the area of CFRP lightweight technology. The concentration of expert knowledge emerging from this develops an immense innovation power for the favour of all those involved. Technological innovations are being developed, thus causing advantages in the competition for customers and market shares.

## Contact

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## Further literature

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