Faserinstitut Bremen e.V. (FIBRE) is a scientific institute situated on the campus of the University of Bremen with more than 60 years experience in the fields of characterisation, development and processing of technical fibres and fibre based composites.

Today 55 scientists and technicians with a background of material science, mechanical engineering, aviation and chemistry cooperate with a huge number of industrial partners and research institutes to improve polymers, fibres and textiles and to implement high-end composites into innovative products. In addition the institute is active in education and training of engineer-students and technology transfer.

The activities of four teams of competence is supported by modern laboratories for fibres, plastics and composites, which enables the characterisation of materials and process developments in-house and for customers. Pilot-plants for fibre spinning and several composite processes are available in the technical center for own trials and those of partners.

Due to the permanent application and participation of challenging research projects FIBRE is well experienced in project work and -management.

We like to offer You to benefit from our competences and to participate from our network.

Christoph Hoffmeister, Prof. Dr. Axel S. Herrmann, Axel Drieling (from left)
The development of new processes, increased material efficiency, reduction of cycle times and testing of new lightweight construction concepts are part of the research activities in the department of Composite Design and Manufacturing Technologies.

**Composite Design**

Material design and stress-resistant layout has to be taken into account in the development of lightweight composite applications. The design of the outer shape and the inner fibre architecture has to be adapted to the respective local component requirements.

Research in this field includes:
- Design of load-optimised fibre composite structures
- Development of efficient load introduction elements and reinforcements
- Solution concepts for material-hybrid construction

**Manufacturing Technologies**

The optimisation of established and the development of new manufacturing processes are being driven forward for thermoset and thermoplastic fibre composites. Processing of material combinations and the linking of different processes plays an increasing role in the department’s activities.

Research in this field includes:
- Tailored fibre placement
- Hybrid laminates
- Thermoforming and Overmoulding
- 3D-printing of continuous fibre reinforced thermoplastics
- Continuous preforming and pultrusion

**Contact**

Dipl.-Ing. Patrick Schiebel  
phone +49 (0)421 218-56667  
mail schiebel@faserinstitut.de
Modelling and Simulation

The Modelling and Simulation department focuses on modelling composite materials for structural analysis and process simulation. Many topics are closely related to the specialist area of the composite design and manufacturing technologies department. The cooperation facilitates research during the development of new production processes. The work in this department is divided into two core areas.

Virtual Manufacturing

The properties of composite materials largely depend on the manufacturing process. That’s why we aim for a deeper understanding of the process-dependent material properties. This is achieved by numerical modelling and process optimisation. In practical industrial applications, the development of manufacturing processes is often based on personal experience, empirical relations obtained from previous processes or manufacturers specifications.

Using process simulation enables us to minimize costly production trials and transform the development of the production process from an experience-based to a knowledge-based process.

Our research in this field includes:
- Draping and forming simulation for dry textiles and organo sheets
- Liquid composite moulding (LCM) process simulation
- Thermoplastic injection moulding and overmoulding process simulation
- Cure prediction and distortion analysis for LCM and prepreg components
- Computational fluid dynamics for autoclaves

Innovative Lightweight Design

The aim is to fully exploit the structural advantages of fibre-reinforced plastics. To achieve this, the special properties of several composite and hybrid materials are characterised and modelled, among others, those of sandwich materials. These structures offer great performance regarding crash and impact tolerance. Different approaches, such as topology optimisation or analysis and design methods, give the possibility to influence the structural properties in the desired way.

Our research in this field includes:
- Improving impact tolerance for sandwich structures
- Developing crash concepts for small aircrafts
- Predicting mechanical behaviour of injection moulded and overmoulding parts

Contact
Arne Breede, Dipl.-Math.techn.
phone +49 (0)421 218-58695
mail breede@faserinstitut.de

Arne Breede, Dipl.-Math.techn.
phone +49 (0)421 218-58695
mail breede@faserinstitut.de

Fig. 2: Virtual crash test of a Flight Design C4
Measurement Systems and Monitoring

The Measurement Systems and Monitoring department is engaged in the development of measurement systems for assuring the product quality from fibre production via semi-finished fabrics to the final fibre reinforced product. Additionally, specifically developed methods assist in understanding the behaviour of the material. With these objectives, Measurement Systems and Monitoring is an interface to material related as well as process related departments of FIBRE.

Measurement Systems

Our measurement systems range from camera-based solutions and laser triangulation for 2D-/3D surface inspection up to computer tomography (µ-CT) to examine the inner structure and operate non-destructive and contactless. For each application, the measurement strategy and the image/data analysis is developed and adapted individually.

Monitoring

A further focus is upon the integration of actuators and sensors and on the analysis of the acquired data to monitor processes, structures and components. „Smart“ particles, optical fibres, ultrasonic converters and miniaturised dielectric sensors are applied as wafer system components. Data transmission is performed by wired as well as wireless techniques.

Contact

Dr.-Ing. Andrea Miene
phone +49 (0)421 218-58654
mail miene@faserinstitut.de
The development of new technical fibres and materials represents an important field of research. These research activities are bundled in the competence field Fibre and Material Development. The institute is based on profound experience in the field of fibre and material characterisation, state-of-the-art equipment for the production of melt-spun fibres as well as numerous partnerships with material and fibre manufacturers.

Current main activities are the development of functional fibres, the characterisation and application of recycled carbon fibres, the development of a precursor for lignin based carbon fibres, modification of fibres and synthetics for the application in fibre composites as well as the usage of bast fibres and cotton in technical textiles and fibre-reinforced plastics.

A bicomponent melt spinning machine on a pilot scale is available for the development of new technical fibres:

- For a temperature range up to 400 °C with twin-screw extruder, high-temperature draw field up to 350 °C and a throughput up to 15 kg/h
- Different nozzle geometries for core/sheath, hollow and solid fibres
- Spinning tester for a first material screening
- Direct access to the modern plastics and fibre laboratory

Contact
Johanne Hesselbach, M.Sc.
phone +49 (0)421 218-58681
mail hesselbach@faserinstitut.de
The laboratory offers a comprehensive range of test methods for the determination of properties of plastics, fibres, textile products and fibre composite materials. The know-how and the competence are based on many years of experience of the highly skilled staff, the outstanding equipment and interaction of research, development and test method development.

Since 2002, the accreditation of the laboratory according to EN ISO/IEC 17015 ensures a consistent quality of the tests. Our conditioned laboratories ensure compliance with the climate requirements according to EN ISO 139 and EN ISO 219, so that the test procedures can be carried out according to the prescribed ambient conditions. On the one hand the analysis supports research projects and on the other hand, the various requirements of external customers in the field of aviation, automotive, textile, wind energy, plastics, etc. are served.

For the exact analysis of the samples, the extensive laboratory equipment can be used:

**Imaging methods**
- Preparation of microsection (Struers, Knuth-Rotor 2)
- Light microscopy (Zeiss, Axioplan, Axioskop 2 plus, Makroskop)
- Scanning electron microscopy (CamScan, CS 24)
- µ-computer tomography (Phoenix x-ray v|tome|x m (research edition))

**Thermal analysis**
- Differential scanning calorimetry (TA Waters, Q 1000)
- Thermomechanical analysis (TA Waters, Q 400)
- Dynamic-mechanical analysis (TA Waters, Q 800)
- Rheometer (TA Waters, AR2000ex)
- Thermogravimetical analysis (ELTRA, Thermostep)
- Laser flash analysis (Netzsch, LFA 457 MicroFlash)
- Thermal conductivity (Taurus Instruments, TLP 500P)
- Combustion chamber (Atlas, HMV)

**Thermal analysis**
- Thermomechanical analysis (TA Waters, Q 400)
- Dynamic-mechanical analysis (TA Waters, Q 800)
- Rheometer (TA Waters, AR2000ex)
- Thermogravimetical analysis (ELTRA, Thermostep)
- Laser flash analysis (Netzsch, LFA 457 MicroFlash)
- Thermal conductivity (Taurus Instruments, TLP 500P)
- Combustion chamber (Atlas, HMV)

**Mechanical test methods**
- Universal testing machine inclusive temperature chamber (Zwick, Z2500)
- Universal testing machine (Instron)
- Determination of strength on single fibre (Dia-Stron, Favimat+, Textechno)
- Fibre-MatrixPull-out (Fimatest and Fimabond, Textechno)
- Impact testing machine (Roell/Amsler, RKP 50)
- Determination of creep behaviour
- Drapetest
- Determination of density

**Chemical test methods**
- Residual grease content of wool (Soxhlet extraction)
- Fibre volume content (Soxhlet extraction)
- Calcination

**Fibre testing on cotton**
- Uster HVI 1000
- AFIS Pro2
- Premier ART2
- Premier ART2 G-Gtrash
- Stickiness Tester
- Cottonscope

**Fibre testing on wool**
- Fibre fineness (Airflow; OFDA 2000)
- Fibre length (Almeter AL 100)
- Cleanliness (Silver tester)

**General fibre analysis**
- Strength collective test (Universal testing machine and Stelometer)
- Strength and fineness of single fibre (Dia-Stron)
- Fibre fineness (Airflow; OFDA 2000)
- Fibre length (Almeter AL 100)
- Fibre length and fineness (FibreShape)
- Trash content (Premier G-Gtrash)
- Animal fibre analysis with REM
- Animal fibre analysis with DNA in cooperation with Impetus Bioscience GmbH
- Regain Tester

**Contact**
Dr.-Ing. Ernő Sándor Németh
phone +49 (0)421 218-58692
mail nemeth@faserinstitut.de
Technical Service and Pilot Plants

The facility of the Faserinstitut Bremen (FIBRE) has 300 square meters of comprehensive technical production ground on the campus of the University of Bremen. As of 2019 this will be further enhanced through a technical center of another 400 square meters in the EcoMaT at Bremen Airport. In both of these areas the latest technologies are used for the technical production and implementation of projects. The basic equipment includes many modern and high-quality machines and systems.

A well-trained, competent and dedicated team of technicians is available to operate the equipment, support research projects and industrial assignments. This makes it possible to reproduce a complete and extremely flexible product development process, from the individual fibre production, through the form-fitting and efficient placement of rovings to textile semi-finished products, pressing, infusing or injecting. The technical production team works closely with the testing laboratory and actively supports thesis work.

**Machinery**

- 1,000kN thermoforming press (Rucks, up to 400 °C)
- 900kN thermoforming press (Rucks, up to 320 °C)
- 6-axes industrial robots (KUKA, KR 30, KR6)
- Bi-component meltspinning plant for technical filaments (Fourné)
- 2-head stitching machine (ZSK, JGW 0200-500 (700))
- Pultrusion system (Thomas Technik & Innovation, 8to pulling force)
- Hot oil tempering plants for RTM (GWK, 220 °C and 350 °C)
- Hot performance oil cooler (Lauda, 400 °C, 10kW)
- Injection molding plant (Engel, Victory 260lo)

**Contract work for technical production**

- Production of fibre composite panels and components, profiles, sandwich panels, test plates and test specimens
- Thermal forming of organic sheets
- High-speed curing of complex epoxy resin components (fast RTM)
- Preform production
- Fibre-reinforced 3-D printing

**Contact**

Peter Rödig
phone +49 (0)421 218-58674
mail roedig@faserinstitut.de
Cotton and Wool

In 1955, Cotton and wool testing formed the starting point of the activities of the Faserinstitut Bremen (FIBRE). Today, cotton testing is included in the cooperation with ICA Bremen, with our laboratory being the final appeal laboratory for the majority of cotton contracts worldwide.

An important focus of FIBRE’s work on cotton is the standardisation and harmonisation of testing. FIBRE is participating in and actively supporting the according international boards and organisations. Starting in 1956, FIBRE is carrying out regular worldwide Round Tests for comparing test results and hence for reducing the variation of test results between cotton testing laboratories. With the newly developed CSITC Round Trials and its evaluation of laboratories, a 30% reduction of the inter-laboratory variation was achieved from 2012 to 2017. FIBRE is providing its expertise to laboratories and national cotton quality management systems worldwide.

For wool, FIBRE is the active technical part of the International Association of Wool Testing Laboratories (INTERWOOLLABS), and is for this purpose conducting Round Tests for wool laboratory certification as well as preparing calibration standards for supplying all testing laboratories.

Research work includes:
- Development of fibre testing and monitoring methods
- Methods and systems for fibre tracing
- Development of cotton based technical products

Contact
Dipl.-Ing. Axel Drieling
phone +49 (0)421 218-58650
mair drieling@faserinstitut.de
The International Cotton Conference Bremen is held every two years, organised jointly by Faserinstitut Bremen e.V. and the Bremen Cotton Exchange. “Cotton Insights” is the motto for the upcoming 34th Conference, taking place from March 21 to 23, 2018, in Bremen.

The Conference provides a forum for scientifically founded and practically useful insights into key issues surrounding cotton from breeding and production via quality/testing and processing to innovative textile and technical cotton based products. More than 450 specialists from all parts of the cotton value added chain worldwide are expected for the Conference, taking place in the historic Town Hall of the Hanseatic City of Bremen.

ITHEC is the first and unique expert conference focusing on new topics in structural thermoplastic fibre-reinforced lightweight constructions. The two-day event covers the latest developments in high performance thermoplastic composite applications. The accompanying international exhibition presents new lightweight concepts, material trends, innovative manufacturing technologies and related inspection methods for thermoplastic composites.

ITHEC is guided by international experts from research and industry, dealing with thermoplastic composites. ITHEC’s contents are well chosen and reviewed by highly regarded members in an international Programme Committee.

The 2018 ITHEC conference and exhibition will be held for the 4th time and will take place at the Exhibition Center Bremen, Germany. An international audience of about 400 attendees is expected, gathering to discuss up-to-date topics and trends related to relevant industrial sectors (e.g. aviation, automotive, transport & engineering) in 6 oral sessions and one additional poster session.

ITHEC Conference focuses on:
- Thermoplastic Composite Lightweight Structures
- Raw Materials & Standardisation
- Simulation & Modelling
- Manufacturing & Process Technologies
- Process Automation & Production Machinery
- Process Monitoring / Material Quality & Testing
- Eco Balance & Recycling
Faserinstitut Bremen e.V.
Am Biologischen Garten 2
Building IW3
28359 Bremen
www.faserinstitut.de

Head of the Institute
Prof. Dr. Axel S. Herrmann
phone +49 (0)421 218-58700
mail sekretariat@faserinstitut.de

Laboratory
Dr.-Ing. Ernö Németh
phone +49 (0)421 218-58692
mail nemeth@faserinstitut.de

Cotton and Wool Laboratory
Bremer Baumwollbörse
Wachtstraße 17–24
28195 Bremen
phone +49 (0)421 339-7017
mail labor@faserinstitut.de