Center for Textile Lightweight Engineering


ShapeTex

Key Technology Lightweight Engineering

Textile lightweight engineering has become one of the main research areas with all its facets at STFI in recent years. This includes the entire value chain, starting with the development of semi-finished textiles, going to formation of new, partly hybrid materials and ending with recycling and reuse.
Carbon fibre reinforced plastics used for many applications like transportation and automotive sector or mechanical engineering take a large share of the research work. Other reinforcement materials, such as glass, basalt, aramid and natural fibres are also considered in various matrix systems. Topics reach from classic thermoset and thermoplastic systems to elastomers and mineral matrices. In addition to research into novel materials and processes, the parallel development of suitable test methods and complex evaluation criteria is a focal point of the work carried out with the support of the in-house testing and certification body.

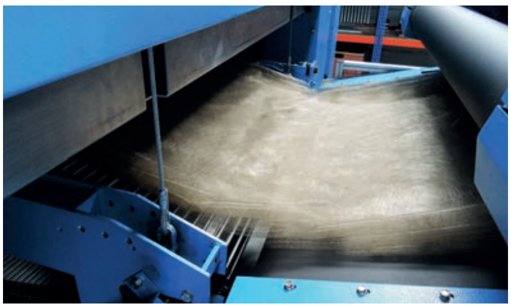
The Center for Textile Lightweight Engineering including its technology lines and existing know-how is available for one-time customer orders, bilateral research projects and small batch series as well as joint research activities within consortia and clusters.

Christopher Albe, M. Sc.
Head of Group Center for Textile Lightweight Engineering

Nonwoven Production Line

- Cutting and tearing machine to convert different kinds of textile waste material (consisting of high performance fibres) into processable staple fibres
- Fibre opening and blending, fibre sizing
- Web forming by use of monocharges or blends with synthetic and/or natural fibres based on the carding process or airlay process
- Inline mechanical bonding methods: needle-punching and/or stitch-bonding
- Online quality monitoring systems
  - Determination of fibre orientation by using NOS 200
  - Determination of basis weight and thickness by using Qualiscan QMS-12

- Processable materials: carbon fibres, glass-, basalt- or natural fibres and blends with PP, PA, PES, PEI, PPS, PEEK
- Processable fibre length: 30 – 120 mm
- Working width: 500 – 1,000 mm
- Working speed: max. 5 m/min
- Possible area weight: 40 – 1,500 g/m²

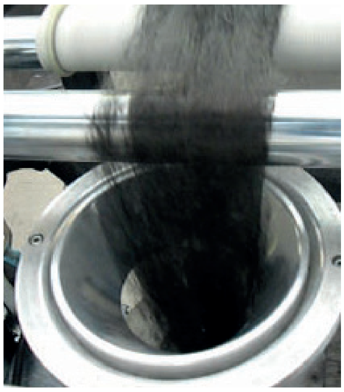


Production of rCF-Slivers

- Consisting of staple fibres (100 % carbon fibres or fibre blends)
- Inline bonding method to obtain a strand-like product

AK INNOVATION AWARD

DEUTSCHER ROHSTOFF Effizienz Preis



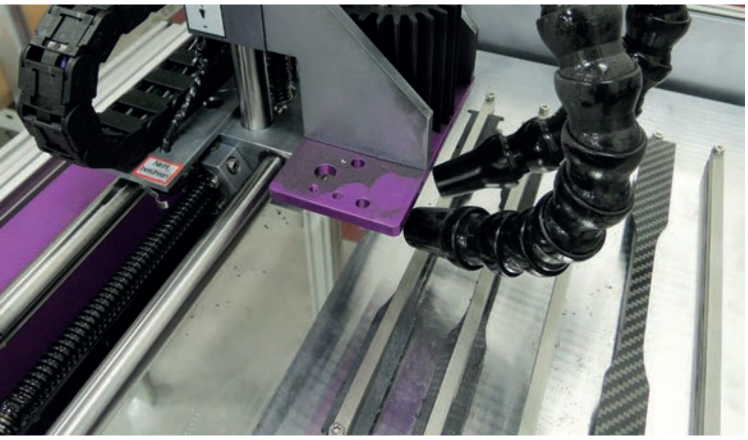
- Production of cylindrical tubes resp. flanged bobbins
  - Processable fibre length: 60 – 100 mm
  - Working speed: 4 – 10 m/min
  - Diameter: 8/12/16 mm (Hotmelt)
- Cetex Lab-Spinning-Machine (LSE-C)
  - Processable material: slivers or roves
  - Spinning process: ringspinning process (Siro/Core)
  - Number of spinning stations: 6
- Carding, stretching and tape production by using fibre blends (Carbon or natural fibres with thermoplastic fibres)
  - Processable fibre length: 60 – 100 mm
  - Tape area weight: 100 – 600 g/m²
  - Tape width: ¼ – 12 Zoll
  - Working speed: 4 – 20 m/min

Mechanical Processing of Laminates

- High precision circular saw
- Band saw
- NC-milling machine
- Different grinding machines

CNC-Cutter

- Cut surface: 1,600 x 1,350 mm
- Cutting heads: draw blade, active or passive roll knife, oscillating knives

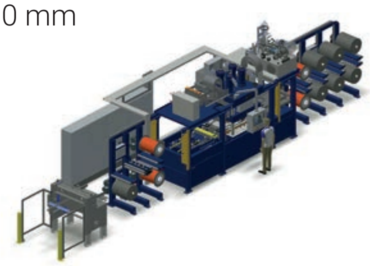


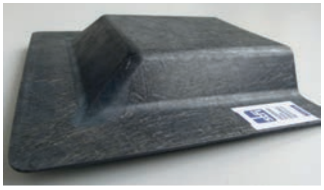
Hydraulic Downstroke Press

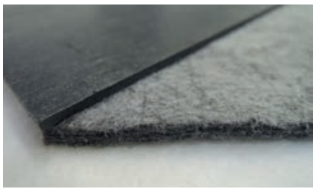
- Max. press capacity: up to 2,000 kN
- Press area: 900 x 600 mm
- Max. temperature: 420 °C
- Heating rate: up to 20 K/min
- Cooling rate: 20 K/min

Continuous Moulding System

- Continuous organic sheet production
- Position and pressure controlled or combined managment system
- Max. press capacity: 2,000 kN
- Temperature range up to: 450°C
- Working width: 610 mm
- 6 unwinder







Laboratory Press

- Press area: 320 x 320 mm
- Max. temperature: 400 °C

Injection Methods

- Vacuum injection system
- RTM technology (cold or warm curing)
- Vacuum infusion incl. VAP®-method

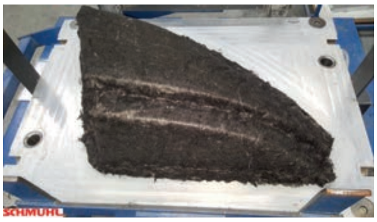
Heating Cabinet

- Up to 300 °C

Composites Production

At the composite centre thermoset and thermoplastic materials can be produced as part of the recycling strategy and for customized material developments. The following technologies are available:

- ► Hand lay-up
- ► Resin Transfer Molding (RTM)
- ► Vacuum infusion (incl. VAP®-License)
- ► Press technologies

Carbon Fibre Recycling

The following technologies for processing carbon fibre waste into isotropic or anisotropic nonwoven structures are available:

- ► Fibre preparation by using modified cutting and tearing technologies
- ► Web forming technologies
- ► Inline bonding methods
- ► Inline quality monitoring systems

Oriented Strand-like Structures From Recycled Carbon fibres

Based on the research results of the STFI regarding the reuse of recycled carbon fibres in different nonwoven structures, further investigations were carried out on better fibre orientation in MD direction:

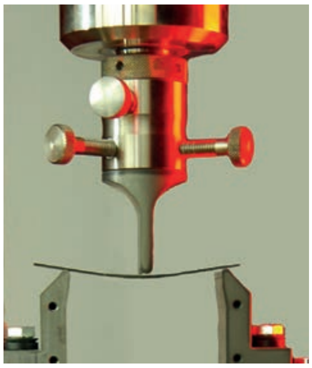
- ► Development and production of slivers
- ► Subsequent inline consolidation to form secondary rovings
- ► Development and production of doubled and stretched staple fibre webs
- ► Subsequent thermal bonding to form tape structures

High Performance Fibres and Composites - Testing Laboratory

- ► Sample preparation
  - ▪ Production of sample plates
  - ▪ Sample cutting (rectangle, dumbbell-shaped)
  - ▪ Application of cap strips
  - ▪ Precision trimming (final sample)
  - ▪ Application of strain gauge
  - ▪ Roving impregnation

- ► Textile physical properties
  - ▪ Fibre length
  - ▪ Fibre fineness/density
  - ▪ Fibre tenacity and modulus
  - ▪ Fibre matrix bonding (pull-out test)
  - ▪ Roving fineness/tenacity (dry)

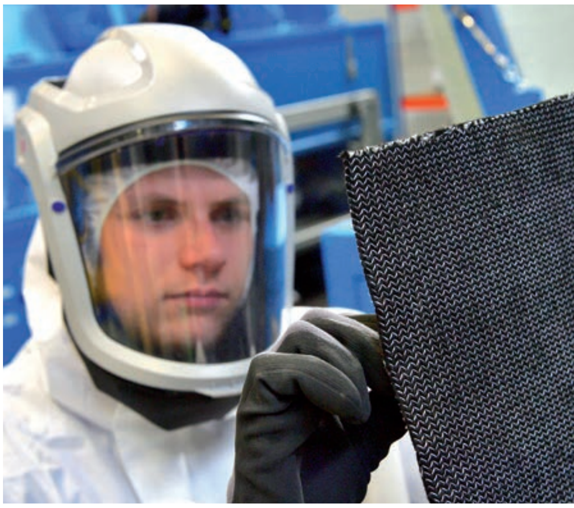
- ► Optical testing (microscopy)
  - ▪ Grinding and polishing
  - ▪ Cross-section image and surface image

- ► Composite testing
  - ▪ DIN EN ISO 10618 (tensile behavior of impregnated yarns)
  - ▪ Tensil test according: DIN EN ISO 527- Serie, DIN EN 2561, DIN EN ISO 14129 (shear stress)
  - ▪ Tending test according: DIN EN 2562, DIN EN ISO 14125, DIN EN 2746
  - ▪ Interlaminar shear strength (ILSS) according: DIN EN 2563, DIN EN ISO 14130
  - ▪ Compression test according: ASTMD 6641, DIN EN ISO 14126
  - ▪ Energy release rate GIc: ISO 15024
  - ▪ Fibre volume content via TGA: DIN 16459

Fibre Reinforced Plastics (FRP)

Focus of this research work is the development of new sustainable material and technology combinations for composites. Range of services of FRP laboratory includes the production of composites, preferably in static and continuous moulding processes, supplemented by infusion processes (including VAP®), injection processes as well as hand lay-up and various adhesive technologies. Woven structures, non-crimp fabrics and nonwovens serve as textile reinforcement structures.



Current Projects:
HIOS I VliesComp I VliesComp12 I Nonwoven pipe I InForm-VFK

Fibre Reinforced Concrete I Textile Concrete

Aim of an research work is the development and manufacturing of textile structures based on glass and carbon fibres to replace steel as reinforcing material in concrete. Main task of the textile reinforcement structure is to create form and/or material connection for load transfer to surrounding concrete matrix. In addition to the development of textile structures services will also include sample production in concrete laboratory as well as testing of specimen and components.

Current Projects:
WIRreFa I Bast bark fibre

Digitization I Industry 4.0 I Working Environment

The pilot installation equipment from fibre opening up to continuous production of organic sheets within the Center for Textile Lightweight Engineering is linked by using latest networking technology.
As research and testing area, these lines help to demonstrate self-optimizing manufacturing processes and intelligent maintenance. The systems engineering also allows to consider scenarios for human-machine interaction. Main focus is thereby on protecting people and machines, in particular when processing high-performance fibres.

Current Projects:
CarboBreak

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