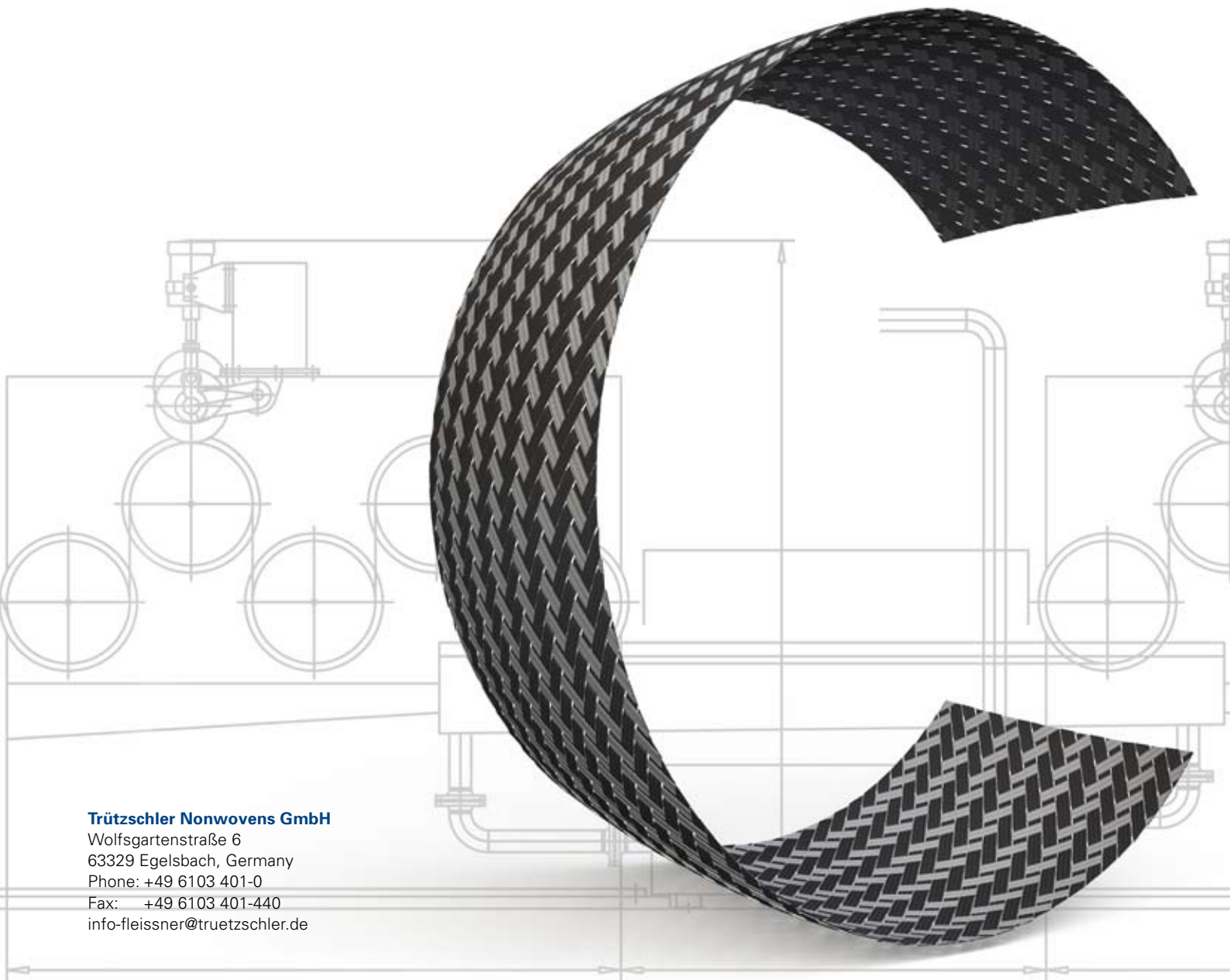


# ***Precursor and Carbon Fiber Lines***

**TRÜTZSCHLER**  
NONWOVENS

**Trützschler Nonwovens GmbH**

Wolfsgartenstraße 6  
63329 Egelsbach, Germany  
Phone: +49 6103 401-0  
Fax: +49 6103 401-440  
info-fleissner@truetzschler.de

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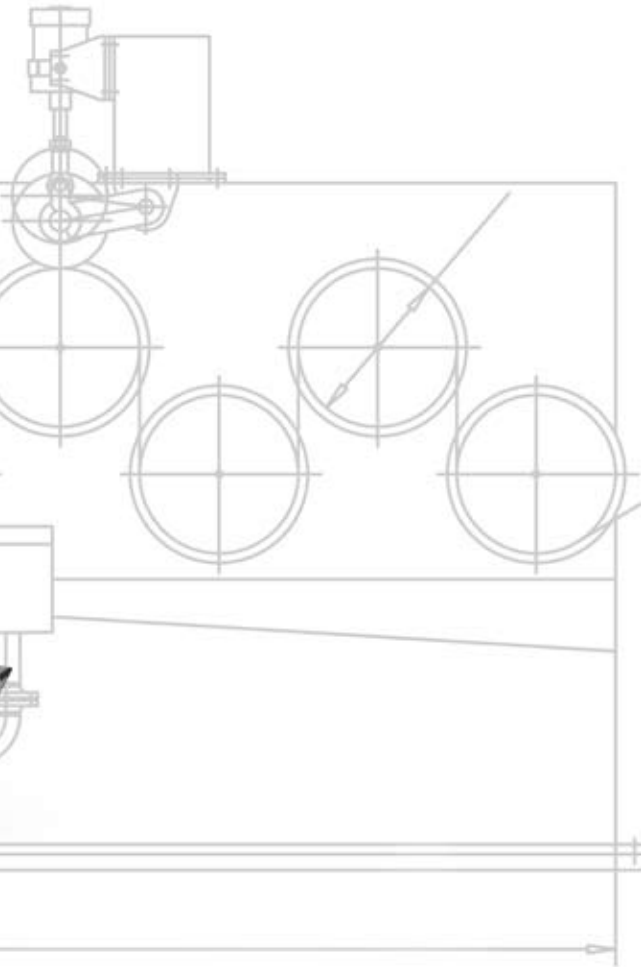
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## We are ahead, SINCE A STRONG TEAM STANDS BEHIND US

The Trützschler Group is a specialist in fiber preparation for the yarn spinning and nonwovens industries. Trützschler produces excellent machinery at eight locations in five countries worldwide.

TRÜTZSCHLER NONWOVENS has been formed by the merger of the long-established companies Erko and Fleissner under the umbrella of Trützschler and offers knowledge and competence in all matters relating to the production of nonwovens products and man-made fibers. Two specialised technical centres in Egelsbach and Dülmen are available for tests and developments.

**A brand with tradition: Fleissner**  
Fleissner was a well established competent manufacturer for machinery and systems for the chemical fiber industry. The equipment is known for highest reliability continuously improved in the last 50 years, since Fleissner grew up together with the man-made fiber market. Since the 70ies, Fleissner has been one of the leading suppliers of wet-spinning lines for the production of Polyacrylic fibers. 35 lines worldwide have been running with Fleissner equipment. Already in the 80ies the production of precursors on Fleissner lines has been started.

Today TRÜTZSCHLER NONWOVENS supplies complete systems for fiber production including state-of-the-art spinning systems under the Machine Brandname of Fleissner. Our

company is successful in the field of nonwovens too – offering leading edge products for web bonding, drying and finishing. We are the only manufacturer that offers four different entanglement methods. One of them, the Fleissner AquaJet, is the leading solution for hydroentanglement.

### **Erko products**

TRÜTZSCHLER NONWOVENS develops, produces and markets machines and installations for bale opening, fiber blending and fiber opening under the name of Erko. The expertise also covers web formation with roller card or airlay, crosslapper, web drafter and web bonding. As successor of Hergeth, the continuously improved knowledge is based on many years of experience.

### **Trützschler Card Clothing (TCC)**

TCC, which emerged from the former JDH companies, has long been known for its high production clothing for roller cards and cards for spinning as well as nonwovens, and has a worldwide presence. With TCC, Trützschler Nonwovens is the only company in the industry that has its own clothing manufacturer, which is a clear advantage: Clothings that are perfectly matched to all machine types, ensuring firstclass results.

### **Trützschler Spinning**

Since its founding in 1888, Trützschler has been building machines for spinning preparation. For more than 120 years Trützschler has brought out the best in fibers and is the technology market leader for openers, mixers, high production

cards and draw frames. Whether cotton or man-made fibers – Trützschler stands for innovation, quality and efficiency. In addition to the headquarters in Mönchengladbach, Germany, production facilities exist in China, India, Brazil and USA.

Due to the extensive experience gathered in processing of staple fibers in the spinning sector, Trützschler Mönchengladbach not only is at home in the field of yarn production but for decades in nonwovens as well, from fiber preparation to width controlled roller card feeding.



Controlled fiber processing is our strength



## True partnership

### TRANSCENDS BOUNDARIES

Worldwide present in the global textile markets our profound competence in consulting and support is linked to our knowledge of local characteristics and international wealth of experience. To ensure fast and competent service, subsidiaries, service and spare parts centres are available around the world.

Our continued business success is based on a clear focus on the market, the end-products and the customers – across the entire globe.

Excellent Service includes professional maintenance, first-class clothing service, smooth spare parts supply and quick on-site service.

Our worldwide team of competent and experienced technicians makes this level of performance standard for our customers.

Servicepoints round the world enable us to match your requirements from any place in world at the earliest.



Maintenance



On-site quality control



Process optimisation



# Mastering new challenges

## WITH TREND-SETTING TECHNOLOGIES

### Precursor

Only precise tow-guiding, defined draw-ratios and an accurate speed control ensure the required high tow uniformity in the production of precursors. This is the prerequisite for constantly producing high product qualities at highly economical production costs.

Therefore TRÜTZSCHLER NONWOVENS offers a system using all the experience and state of the art technology. The systems consist of all required process steps, including the Fleissner spinning system, the de-solventing, low friction drives and draw stands, the dryer and heatsetting system and finally our intelligent process control. Our visualization always allows quick and easy access to all relevant machine and process parameters. Systems with up to 96 tows allowing capacities of up to 5,000 t/a (depending on tow size).

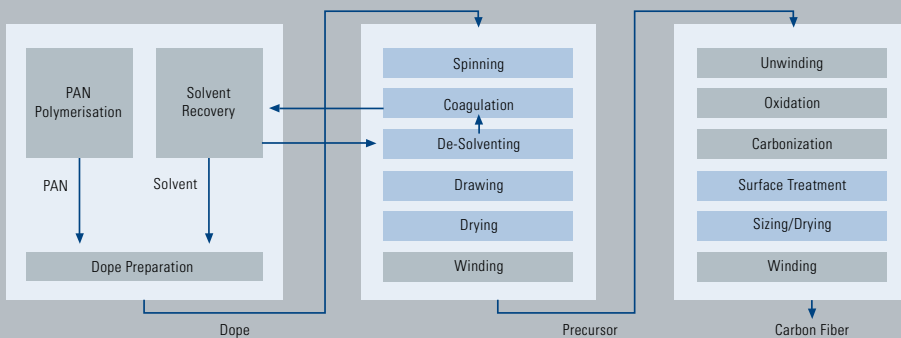
### Carbon Fiber

For the subsequent carbonization process TRÜTZSCHLER NONWOVENS offers full-process Fiber-Logistics which consist of a sophisticated fiber conveying system with tension stands and deflection rollers as well as surface treatment and sizing with corresponding can and contactless dryers.

As in the Precursor Lines the overall process control is completely visualized for quick and easy access to all relevant machine and process parameters.

Since high qualities and efficiencies depend much on defined tensions at each point of the line, this conveying system plays a key role in the process beside the oxidation

and carbonization technology. The capacities range from pilot scale up to more than 2,000 t/a of heavy tows on industrial lines of up to 4 m width. Complete Carbon Fiber Lines can be supplied in alliance with our Partners.



**Trützschler Nonwovens**
 **Partner**

**Precursor Lines**

- Spinning
- Coagulation
- De-Solventing
- Drawing
- Drying/Heatsetting
- Winding

**Carbon Fiber Lines**

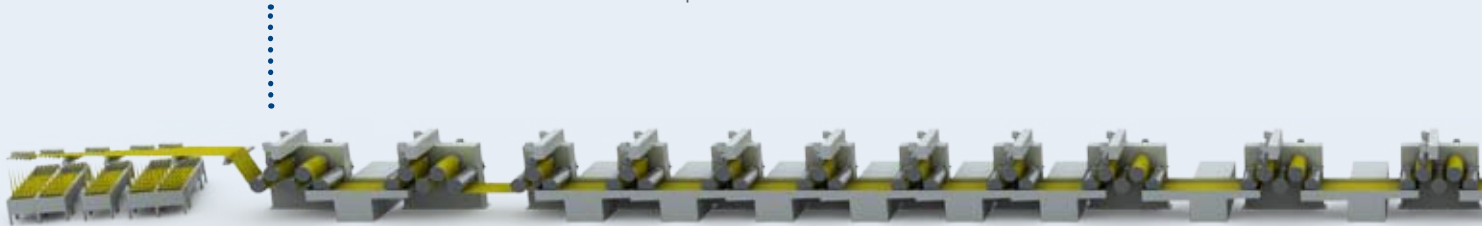
- Unwinding
- Oxidation
- Carbonization
- Surface Treatment
- Sizing/Drying
- Winding

## The complete process chain from one supplier

### Precursor Line



Dope, consisting of PAN and solvent, is leaving a nozzle, stabilizes by coagulation, becoming strong enough for further treatment steps.

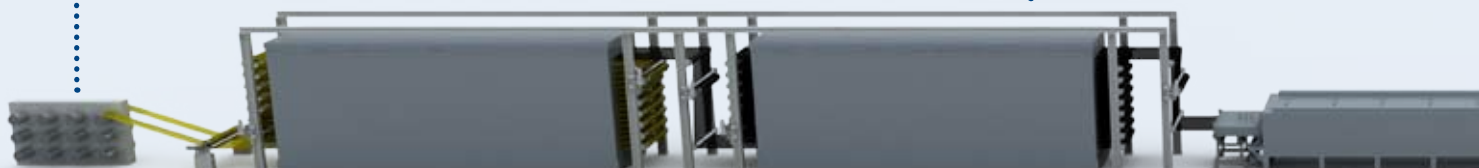
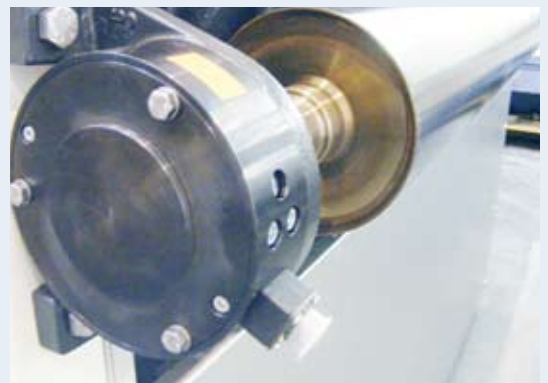


### Carbon Fiber Line

Precursor tows are guided under controlled tension through oxidation ovens.

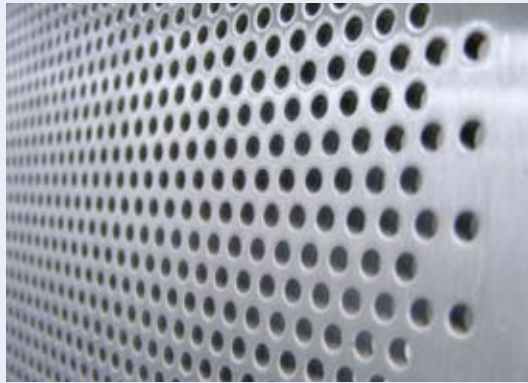
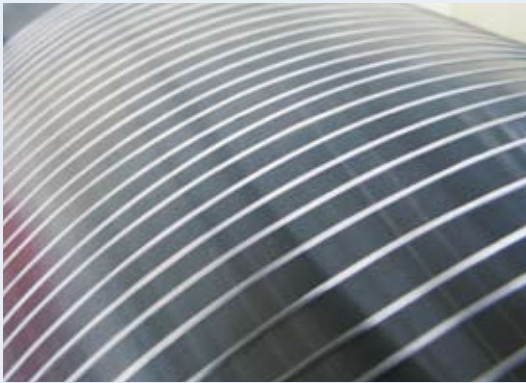


Full control of the tow due to modular tensioning-units.



Draw stands with nip rollers continuously guide the fibers through the de-solventing removing all the solvent. Defined drawing reduces the fiber fineness and increases the fiber strength.

Dryers in combination with high-pressure steamers ensure uniform drying and heatsetting of each individual tow.

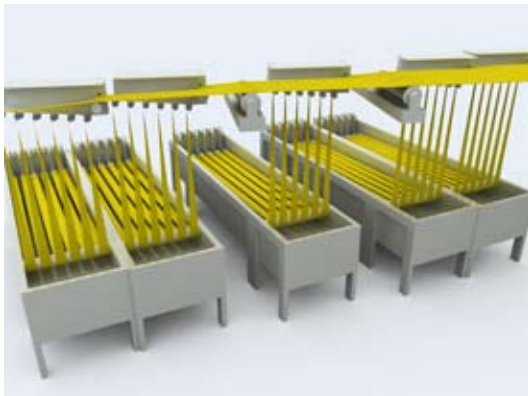


Continuous treatment in an electrolytic bath roughens the fiber surface and enhances the adhesion of the sizing, which is applied after an intermediate drying step.

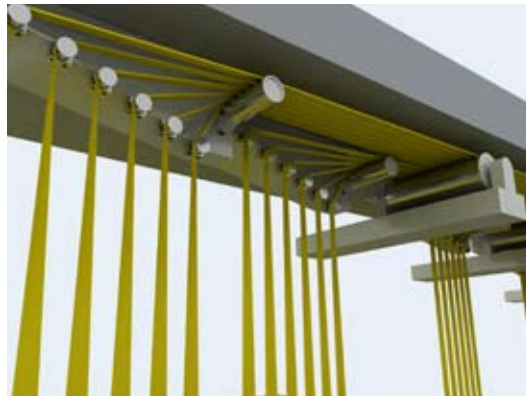
After a final drying step the carbon fiber tows are wound individually on handy bobbins.



## Precursor – High tow uniformity at its best



Spinning and Coagulation



Tow - Guiding

### Spinning and Coagulation

The spinning is the most important step within the production of fibers, since all fiber characteristics are based on this part of the entire process.

Already the dope distribution, including the microfiltration, is important to generate even filaments.

The environment in the coagulation bath should have absolutely uniform conditions. The circulation system guarantees most equal temperatures and even concentration of the liquor to keep the fiber quality constant.

### Further features

- Constant dope feeding by high precision pumps driven by exact controlled motors
- Easy handling by hinged rounder arms with rupture discs
- Uniform coagulation in standardized spin baths
- Rollers equipped with maintenance free bearings with extremely low friction
- Quick and exact adjustment of tow spacing for perfect subsequent de-solventing and drawing
- Easy and safe handling by ergonomic optimized dimensions
- Normal wet spinning, but also air-gap spinning are available



## Our technology partner

### EPC Group

EPC is our partner for

- PAN polymerization plants  
Polymerization, Dope Preparation, Solvent Recovery
- Carbon fiber factory design  
Infrastructure, Utilities, Civil Engineering

### Competitive Advantages

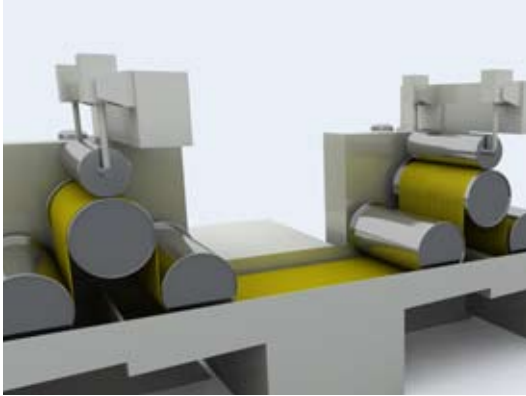
- Long - term experience in polymerization & polycondensation plants
- German engineering & equipment
- Tailormade solutions for carbon fiber industry

- Short realization time
- R & D capacities and pilot plants available

### Applications of Carbon Fiber

PAN is the base polymer suitable for fiber with high tenacity and high module for best performance:

- Wind turbines & blades
- Aircraft modules
- Composite material for high performance cars
- High - tech bicycles and tennis rackets
- civil constructions



De-Solventing and Drawing



Drying and Heatsetting

### De-Solventing and Drawing

- Standardized rollers for an easy adaption to individual process requirements
- Minimized maintenance by single driven draw rolls
- Easy and safe handling by ergonomic optimized dimensions
- High de-solventing performance by efficient and uniform water flow
- Intelligent water management for minimized recovery costs

### Drying and Heatsetting

- Easy and safe handling by ergonomic optimized dimensions
- String-up also possible in hot condition
- All drums with single drives suitable for further drawing and the compensation of shrinkage
- Perfect temperature distribution on double-jacket rollers
- Insulated covers and doors for minimum temperature loss and a maximum of operator safety



## Carbon fibers – Complete lines for highest quality



Guiding and Tensioning



Guiding and Tensioning

### Guiding

- Parallel yarn path by individual dimensioning of roller diameters for a minimum of roller deflection
- Versions with grooved or smooth surface
- Minimized wear by high quality surface coatings
- Precise steel structures for accurate roller arrangement
- Double-sided bearings for minimized run-out
- Can and unwinding creels can be integrated

### Tensioning

- Intelligent roller arrangement
- Integrated tension control and monitoring
- Innovative drive systems systems with guides for easy removal of fiber wraps



**EISENMANN**



## Our technology partners

### Ruhstrat

Ruhstrat, an affiliated company of Eisenmann, is our partner for high temperature treatment of carbon fibers.

Ruhstrat manufactures industrial carbonization furnaces for carbon fiber production. Whereas the LT furnaces work with hot gas fans, HT furnaces work with a circular heating around the muffles.

The furnaces are provided with high quality insulation materials and sealing box systems.

The resulting advantages are manifold:

- up to 50% less installed power than the competition
- high temperature constancy over the width of the fiber
- low energy losses
- low consumption of protection gas
- low shutdown time and maintenance costs

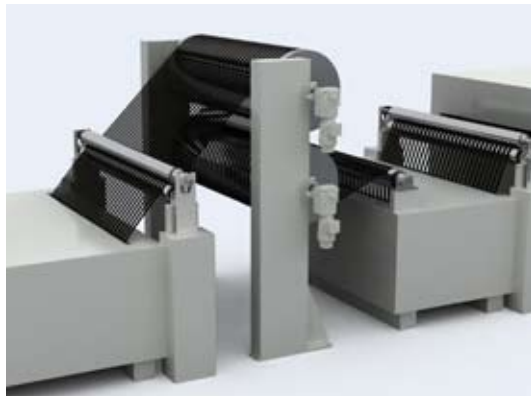
### Eisenmann

Eisenmann builds customized modular oven sys-

tems as well as exhaust air purification systems for the production of carbon fiber. Their product line encompasses oven systems for the oxidation and drying process as well as Regenerative Thermal Oxidation (RTO) systems and Combustion chambers (CC) to treat the contaminated exhaust air from the oxidation and carbonization process. Also from Eisenmann: control technology and integrated, individually designed energy recovery systems.

In the process chain of carbon fiber, the oxidation process is considered to be one of the most important steps. Exceptionally favourable air flow patterns are required to uniformly remove the heat generated in the fiber band during the oxidation process.

Eisenmann took on the challenge and developed oxidation ovens which stand out for their consistent airflow and temperature uniformity.



Surface Treatment and Sizing



Operating desks

### Surface Treatment and Sizing

- Bath modules with deflection rollers hanging in lifting frames
- Displacement bodies, also integrated in these frames, ensure a proper circulation and therefore a uniform concentration over the complete working width
- Each bath module covered completely by a suction hood to avoid any ammoniac emission
- Driven anode rollers with graphite liners
- Circulation system including refill tank with instrumentation for automatic control of electrical conductivity
- Multi-step washing bathes equipped with soft rubber nip rollers
- For tow drying, air circulation, infrared or can dryers can be selected

### Integration of winders

in a complete structure with:

- All necessary support and guiding rollers
- Precision winding, easily adaptable to each carbon fiber type
- Manual or automatic bobbin change
- High yarn tension uniformity central adaptable by a central CPU
- Adaptable bailing pressure

### Electrical Control

The installation is provided with all the required equipment including control system, frequency converters, regulating systems and monitoring devices, which are incorporated in control panels. Control is effected by a PLC with connected operating desks. The number of control desks and the control capacity varies according the process requirements.

#### Features

- Reliable ramping by proven and tested running modes
- Quick trouble shooting by mature alarm system
- Worldwide service support by remote maintenance even into the inverters
- Recipe management
- Logging of changes in values and operator activities
- Indication and recording of all faults and alarms
- Representation of process data in trend form
- Preparation of report charts with set points and actual values
- Prepared for remote internet service



## Man-Made Fibers in perfection



This is our promise for better machines producing fibers with added value.

TRÜTZSCHLER NONWOVENS is known as a competent manufacturer of machinery and systems for the chemical fiber industry named with the machine brand Fleissner.

Based on the vast experience of more than 350 supplied fiber lines, Fleissner fiber lines have

created a new standard for an improved operability and excellent fiber qualities at economical production costs. This is the prerequisite for constantly producing high product qualities at highly economical production costs.

**Our lines produce a wide range of fibers, such as**

- Cotton-type fibers
- Fibers for nonwovens
- Carpet fibers
- Filling fibers
- Dope-dyed fibers
- 2D/3D crimped fibers
- Hollow fibers
- Bicomponent fibers
- Precursor
- Carbon fibers



### Modular Melt Spinning System

- Professional design for extrusion and melt filtration
- Bottom loading spin packs
- Symmetrical melt distribution from centre inlet port to ring
- Unique spin pack sealing and fixation to beam
- Quick spin pack exchange
- Enclosed filament quenching system

### Solution Spinning System (PAN)

### Bicomponent Spinning System

### Tow Draw-off Systems

- Spinning walls with suction/cutting blocks and entangling jets for reduced down times and little waste
- Capstan units for fiber tow draw-off
- Sunflower reel plaiters
- Can traversing systems and cutting devices ensuring minimized waste
- Spin finish systems

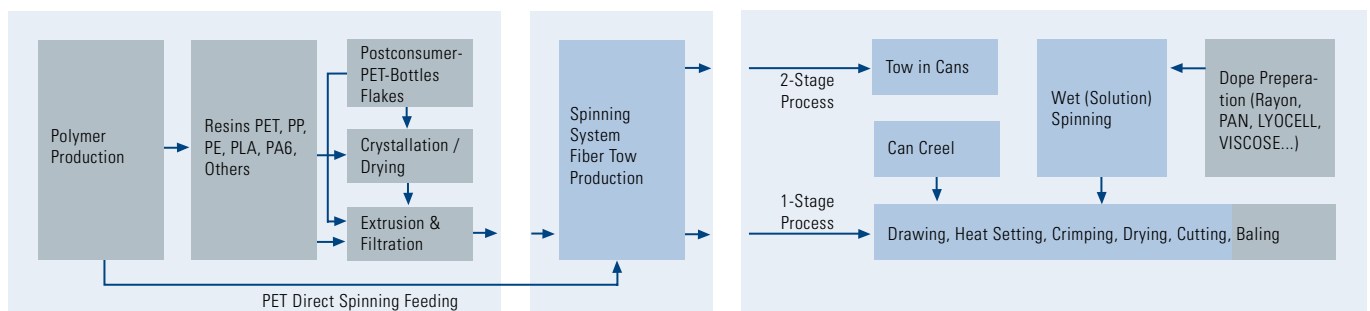
### Fiber Processing Lines

- Improved dip bath with gentle fiber treatment
- Efficient draw bath
- Drawstands of sturdy construction with and without heating or cooling of rollers; up to 2 m roller length
- New Draw Unit with direct driven rollers
- Thermosetting units with steam supply by steam cascade for minimization of energy costs
- Drawstands and thermosetting units with high-accuracy double-jacket rollers providing optimum temperature uniformity for heating or cooling



Fiber Line

- Cable tension control by wear-free load cell technology
- Stuffer box crimpers providing a highly uniform crimp without readjustment
- Optimum tow distribution on the plate belt dryers by oscillating chute or belt conveyor
- Reliable and maintenance-free plate belt and drum dryers with uniform hot air distribution and up to 3 m working width
- Fiber cutting machines operating to the proven rotary cutting principle, with optional rapid reel change system



# Nonwovens: From Fiber to Web – Turnkey Solutions for all Nonwovens Applications



Erko Random Card, e.g. for hygiene products

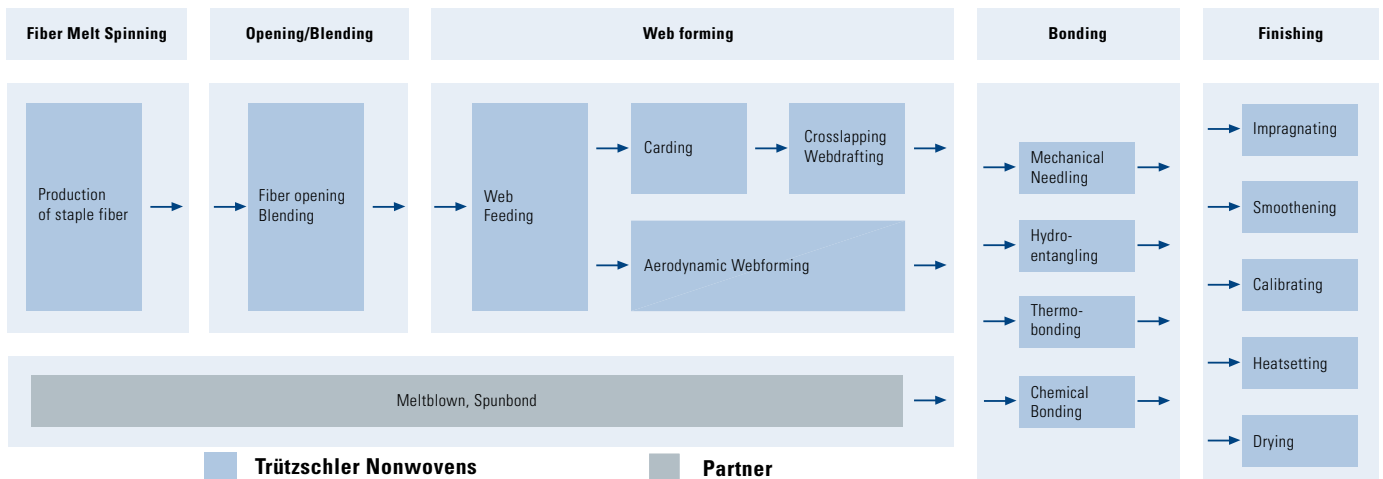
The product range of TRÜTZSCHLER NONWOVENS covers standard machines and special-purpose solutions, as well as complete systems that are tailor-made to customer specifications.

### Combined competencies

The product range of the machine brand ERKO includes the following: complete staple fiber preparation, opening and blending, web formation with roller cards or aerodynamic web formers, and needling. Cross lappers and web drafters enable the required web weights and widths to be produced.

The core competencies of the machine brand Fleissner include hydroentangling, thermal or chemical bonding, as well as drying and finishing equipment. Depending on the final product's economic as well as qualitative properties, we are able to choose and apply the perfect solution. A range of finishing technologies and equipment to produce hygiene articles round off the range of products.

This combination of machines from a single source is unique in the nonwovens world, and guarantees smooth and trouble-free operation after a short installation period.



### Two Technology Centres

The two TRÜTZSCHLER NONWOVENS Technical Centres in Dülmen and Egelsbach are especially equipped for the specific requirements of our customers: These have the option of testing all production methods on a large industrial scale, of course also using their own materials. On a total area of more than 5,000 m<sup>2</sup>, we are able to demonstrate all technologies, from fiber preparation and web formation, to web bonding and web finishing, for product development and customer trials. Furthermore, customers can also make use of our laboratory to obtain detailed material analyses, thus letting them know exactly what advantages the production methods of TRÜTZSCHLER NONWOVENS have to offer.



Erko high performance mixing system



Erko needling machine



Fleissner AquaJet

# TRÜTZSCHLER

## S P I N N I N G



Fiber Preparation  
- Bale Opening  
- Blending  
- Cleaning/Opening  
- Foreign Matter Separation  
- Dedusting  
- Tuft Blending  
- Waste Recycling  
Carding  
Drawing

## N O N W O V E N S



MAN-MADE FIBERS  
Staple Fiber  
Precursor Lines  
Carbon Fiber Lines  
  
NONWOVENS  
Opening/Blending  
Card feeding  
Cards/Crosslapping  
Web needling  
Hydro Entanglement  
Finishing  
Drying  
Heatsetting  
Chemical Bonding  
Thermobonding

## C A R D C L O T H I N G



Metallic Wires  
- Spinning  
- Nonwovens/Longstaple  
- Open End  
Flat Tops  
Fillets  
Carding Segments  
Service Machines  
Service 7/24