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## High-Performance Fibre-Reinforced Composites – The New Dimension for your Developments

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Schunk Kohlenstofftechnik



# Your Partner for Processing Fibre-Reinforced Composites

## Fibre-Reinforced Composites and their Special Characteristics

The success story of fibre-reinforced composites began in the early sixties when the processing of such materials opened completely new dimensions in performance for the aircraft and space industry. Today, the extraordinary characteristics of these materials allow for ever-expanding possibilities and innovation.

The special performance of fibre-reinforced composites is based on the principle of combining the most-favorable characteristics of at least two individual and different components into one new composite.

Fibre-reinforced materials meeting high-performance requirements are obtained by embedding fibres into a matrix.

Fibre-reinforced composites excel though their broad spectrum of desirable characteristics:

- high degree of strength and stiffness
- low density
- suitable for applications at temperatures from -270 °C up to 2700 °C (-450 °F up to 4900 °F)

Extremely high corrosion resistance is achieved through special matrix systems. The coefficient of thermal expansion can be adjusted to a certain level.

Fibre-reinforced composites show excellent damping properties and allow for a multitude of possible shapes and designs.

## Your Partner for Successful R&D

Schunk Kohlenstofftechnik is a company within the internationally operating Schunk Group. As part of this innovative group of technology companies we have been a successful business partner in the field of hi-performance fibre-reinforced composites for more than 18 years.

Our core specialities are the analysis and selection of material components such as fibre and resin systems, consulting, calculation of components, development of appropriate fibre-reinforced designs as well as the selection of the optimum manufacturing process. Based on this know-how, we offer you a solution to nearly any of your application challenges.

*Schunk manufacturing of composites: Filament winding with ring feeder for high-precision, economical series production; feeding the fibres via an external guiding system*

## 3. High Stiffness

Solutions with composites can achieve a very high stiffness (up to four times compared to that of steel constructions). Example: Robot arm with flanged aluminium components. Length: 1.70 m.



*Robot arm for the packaging industry*

## 4. Low Weight

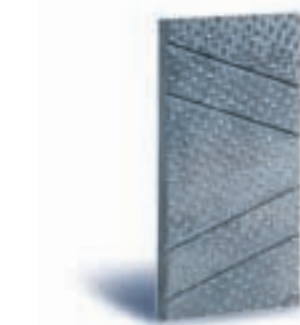
You want to or have to lower the weight of your component? In this case, you should consider a construction using our fibre-reinforced composites.



*Drive shaft for pumps, mixers, and other large rotating equipment*

## 5. Aggressive Media

Our fibre-reinforced composites are especially suited for direct use with aggressive media (fuel, hydrofluoric acid, etc.). Example: Vanes (CF/PEEK) as elements in a rotating vane pump.



*Rotating vane for high-performance pumps*

## 6. Coatings

Your application puts high demands on the component's surface? Profit from our special know-how in the coating technology – i.e. for applications in the semiconductor or aerospace industries.



*Nose cap with Schunk coating for the space glider CRV. This coating allows for 120 re-entries into the earth's atmosphere.*

## 7. High Lifetime

Your component should achieve a very high lifetime? Schunk fibre-reinforced composites offer you exactly such possibilities!



*Development of brake discs for sports cars and luxury limousines*

## We are looking forward to your inquiry!

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# Innovative Concepts from a Single Model to Industrial Production

## Seven Reasons for using Fibre-Reinforced Composites in your Processes

You know for yourself: Every challenge is different. Each application has its own specific requirements. Combining the special characteristics of different materials often makes for the success of a component. Use the advantages of our fibre-reinforced composites to achieve the special demands required in the following seven fields:

### 1. High Strength

Fibre-reinforced composites are especially suited for components requiring extremely high material strength. Example: Pump rotor with three CFRP bushings and CFRP retaining ring for the permanent magnets.



Component for a turbo molecular pump (rotating speed up to: 350 m/s)

### 2. High Temperatures

If you need components for applications at extreme temperatures (up to 2700 °C (4890 °F), under vacuum or protective gas), Schunk offers you a safe solution using C/C materials.



Heating element for vacuum furnaces

## Schunk – Industrial Production for Highest Requirements

Components made of fibre-reinforced composites are being used in an ever-increasing number of industrial applications. Schunk Kohlenstofftechnik develops and produces such components for a multitude of different applications.

For bearing and seal technology we manufacture vanes and rotors for different pumps, especially for the conveyance of aggressive media. In addition, we manufacture components for furnace construction and mechanical engineering.

For high-temperature technology we produce materials and components for hot pressing as well as for glass and medical technology applications. We are specialized in developing materials which are characterized by high dimensional stability and resistance to extreme thermal cycling.

For the semiconductor industry we produce C/C components for furnaces used for high-volume production of semiconductor materials.

## We will advise you – From your Initial Idea up to Full Industrial Production

We will accompany our customers during their entire planning and development phase. Many application and customer-specific problems are thus already solved beforehand through computer simulation.

Profit from our in-depth know-how by using us as your partner through the entire process!

We will support you both in layout and dimensioning of your component and when selecting the most economical form of production.

## We will be there for you

If you are interested in the possibility of using fibre-reinforced materials – please give us a call.

Even if you only have a vague idea about a new product component – we will help you get started. We would like to be your partner through the development process and will be happy to advise you – you're most welcome!

C/C heating elements with defined and pre-adjusted heat resistance. For application in installations for the production of high-purity silicon. Manufactured in prepreg technique. Developed, designed and dimensioned in cooperation with our customer.

C/C crucibles for the manufacture of silicon monocrystals. Diameter: 32 inches. Suitable for temperatures of up to 1400 °C (2550 °F). Clearly visible: the highly complex filament winding structure

# Customer-Specific Solutions for Highest Requirements

## Composites will offer you Possibilities you never dreamed of

A large number of possible fibre matrix combinations and manufacturing processes allow for fibre-reinforced composites to be used in a multitude of applications. Schunk is regarded as a worldwide specialist in using this potential.

Make use of our experience to "customize" selected materials out of the multitude of possibilities according to your very own specifications.

Demanding specifications and highest requirements are a welcome challenge for us!

## Maximum Stiffness at Minimum Weight

We will support you with our high-performance Finite-Element-Analysis when designing your component.

Based on its analysis, we will design stiffness, strength and minimum weight for your component to be optimally suited for its practical use in your application.

## Construction and Design with Fibre-Reinforced Composites

Making optimum use of the special advantages of fibre-reinforced composites requires you to consider the unique characteristics of this class of materials from the very beginning of the design process.

Special emphasis should be placed on the distinct anisotropic mechanical and physical characteristics of fibre-reinforced composites as well as on the chemical and thermal limits of application for the matrix systems used. Please call on us!

Knowing the exact stress profile, we will be happy to assist you when developing your component.

By selecting the specific fibre type, fibre content, reinforcement pattern and a component design suitable for this individual composite, we will meet the mechanical and physical stress requirements for your component.

In order to meet chemical and thermal application requirements, we will present specific recommendations for selecting the appropriate matrix system.

For economic reasons we recommend near-net-shape processing without first manufacturing semi-finished products. Both near-net-shaped components and semi-finished products may be machined with highest precision.

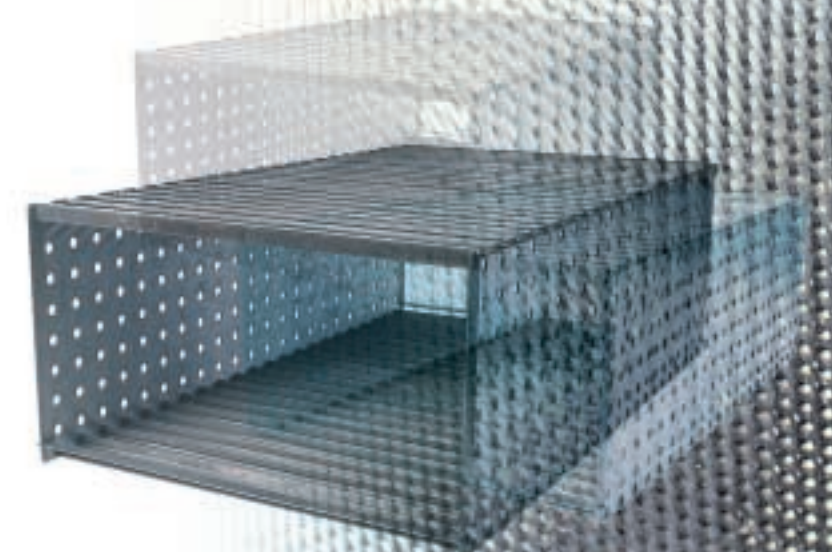
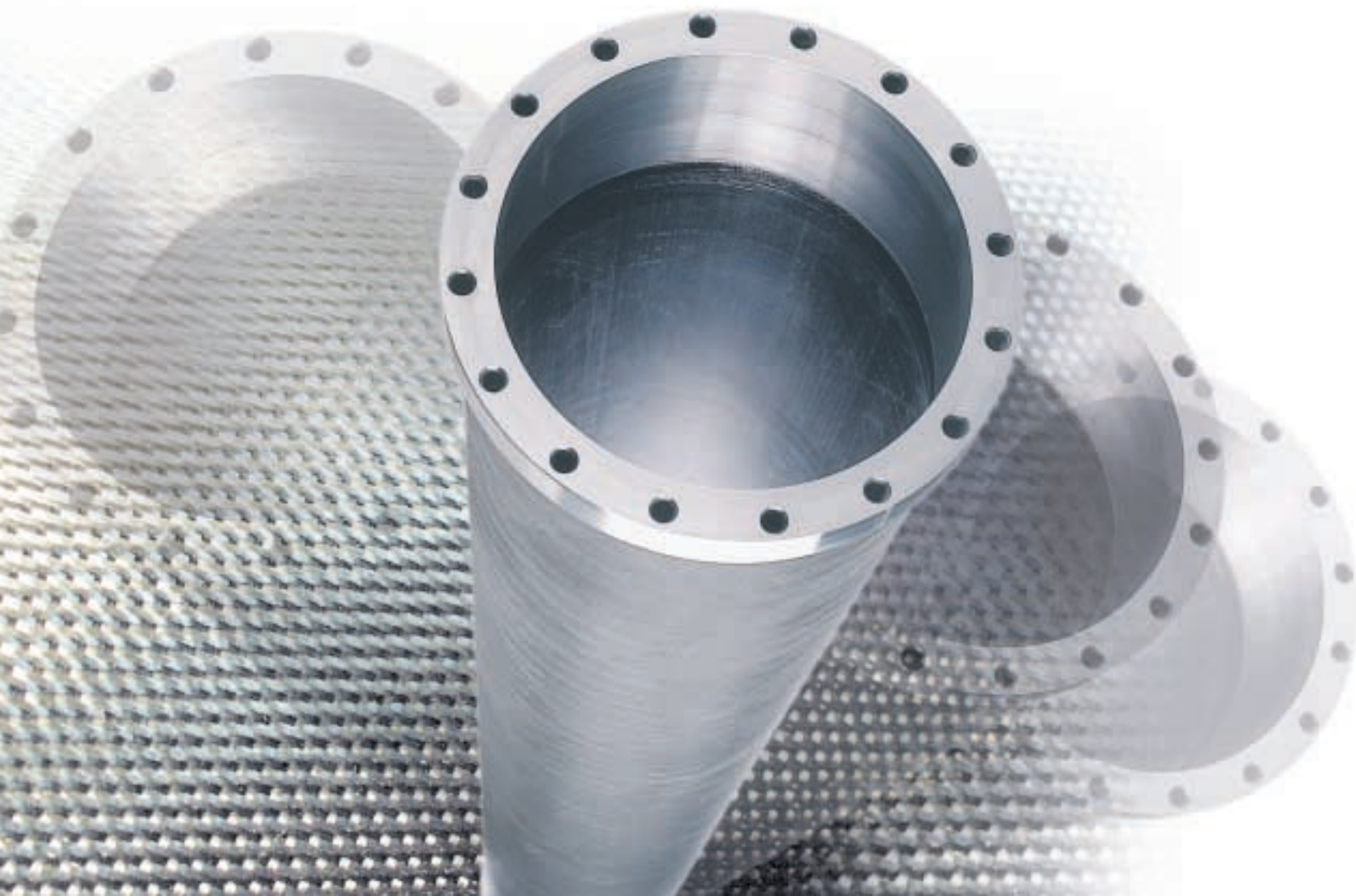
## Production Process, Purification and Coating

For the industrial manufacture of high-quality fibre-reinforced composites we use filament winding, autoclave pressing, plate pressing, resin transfer molding, as well as hand lay-up.

For the highest purity applications, such as those required by the semiconductor industry, we offer halogen purification of our composites.

Where protective coatings are desired to modify the surface of the composite, we offer a wide range of coatings based on our LP-CVD (Low-Pressure Chemical Vapour Deposition) technique.

*Carbon fibre-reinforced polymer drive shaft with joint steel flanges. Speed: 8000 rpm, torque: 8800 Nm for application in engine testing stands.*



*Soldering fixture for stainless steel heat exchanger used in a vacuum and protective gas environment. Dimensions: 2000 x 1200 x 650 mm. This is a specially customized development for suppliers in the automotive industry.*