



# Schunk Materials – Advanced Technologies for the World's Markets

# Schunk Materials – Global Player

## The Schunk Group – A Group of International Technology Companies

Schunk Materials is part of the Schunk Group, a group of global technology companies with a remarkably wide spectrum of products both in materials and systems engineering.

The Schunk Group is composed of diverse individual companies which operate independently in the world's markets. This guarantees a high degree of flexibility and allows proximity and close cooperation with the customers.

The combination of these individual companies with similar technologies and markets under a streamlined corporate management and organizational structure, allows direct communication and rapid decision making, as well as the efficient use of common resources and synergy potential, all to the benefit of the customer.

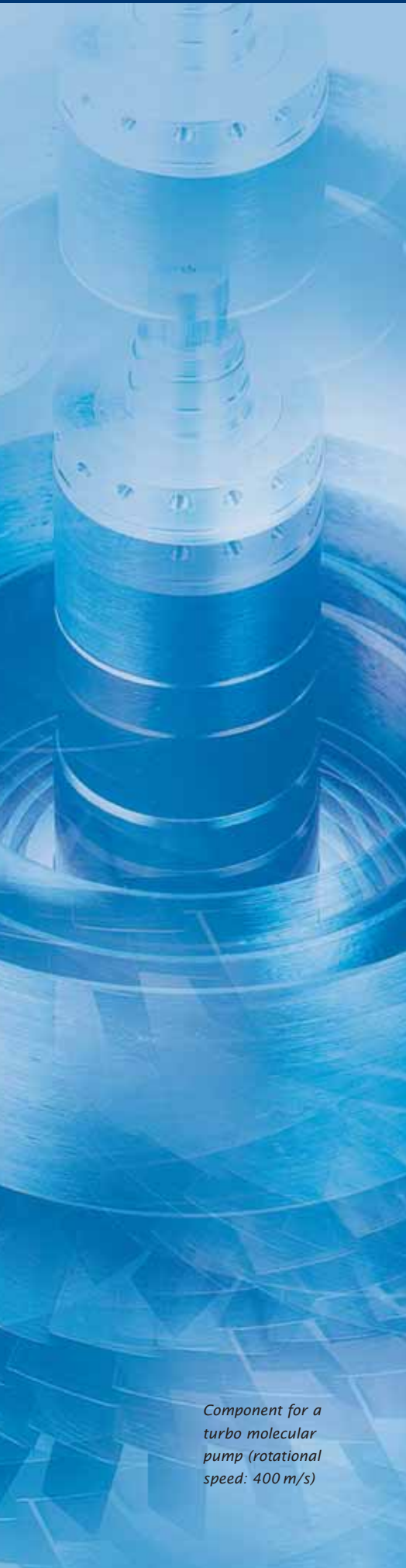
## Global Player – Present in 28 Countries on 5 Continents

As a global player, the Schunk Group is represented by 60 subsidiaries in 28 countries in North and South America, in Europe, Asia and Australia and the South Pacific. In addition, there is a network of strategic alliances and cooperations as well as connections with the world's leading research institutes.


The Schunk Group employs approximately 8,200 people worldwide, some 1,500 of which are located in Heuchelheim near Giessen, Germany. The consolidated annual turnover amounted to 880 million Euro in 2010.

*“Progress lives from the  
exchange of knowledge”*

Albert Einstein



*Component for a  
turbo molecular  
pump (rotational  
speed: 400 m/s)*



*Space mirror with a highly  
structured SiC coating by  
Schunk Materials*

### **Top Quality and Cooperation with Our Partners**

The products and services of the companies belonging to the Schunk Group can be found in many different industries and on many markets.

The group is divided into the following divisions:

- Schunk Materials
- Weiss Group
- Schunk Sinter Metals
- Schunk Sonosystems

Through constant innovation, development and diversification into future oriented technology fields, the Schunk Group has been able to experience remarkable expansion in recent years.

### **Success and Reliability**

The basis of Schunk's success has always been and is the high level of quality, close cooperation with customers, excellent reliability, comprehensive know-how and the self-responsibility of the individual Schunk companies for their products and markets.



# Schunk Materials – Innovations for the Future



## Material Properties at the Cutting Edge of Technology

When technical developments encounter limits, these limits are usually set by the materials used. In order to make possible the machines and products for tomorrow's markets, materials must be ever lighter and stronger as well as more and more temperature and wear resistant.

It is our objective at Schunk Materials to develop materials for electronic, mechanical and apparatus engineering which push and expand these limits.

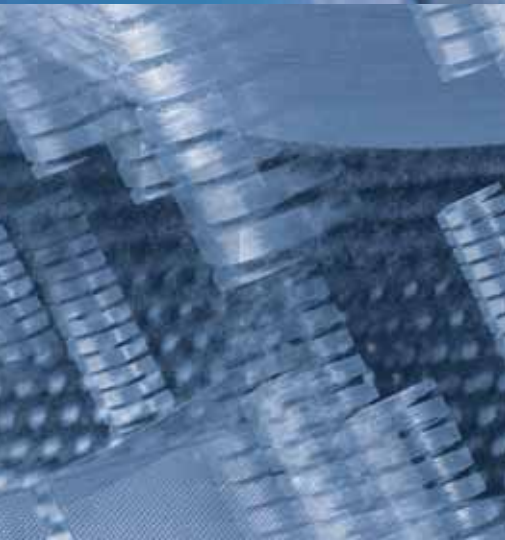
Our materials of carbon graphite, carbon composites, silicon carbide, aluminum oxide, and quartz allow the manufacture of innovative products which overcome many of the limits that conventional materials are subject to. Among the optimized properties are:

- electrical conductivity
- abrasion resistance
- surface hardness
- temperature resistance
- purity
- self-lubricating properties
- mechanical strength
- weight

## Continual Development of Production Processes

In addition to the optimization of material properties, Schunk Materials continually improves the manufacturing processes. In doing so we achieve:

- a high degree of process reliability
- easy machinability and shaping
- environmental compatibility of wear debris



*Purity test by atomic absorption spectroscopy (AAS)*

### **Mass Production and Individual Parts**

Schunk Materials companies produce several million parts annually, among others for the:

- automotive industry
- electrical motor industry
- railway industry
- medical technology
- semiconductor industry
- pump industry
- glass industry
- analysis and measuring technology
- fiber optics industry

Upon request, we also manufacture small series and single parts. Some examples of such products are carbon brushes for the Mars-Rover, coatings for Ariane combustion chambers or graphite crucibles for the semiconductor industry which we manufactured for leading international companies.

### **Applications of Innovative Products**

A new Schunk Materials development is for example the carbon piston for internal combustion engines. It is lighter than aluminum, more temperature resistant than steel and self-lubricating.

Newly developed molding technologies for bipolar plates used in fuel cells allow large volume production. The bipolar plates are characterized by their excellent homogeneous electrical conductivity and possess a high chemical resistance as well as an exceptional long-term stability.

For mechatronics, we design and produce minimum size parts of graphite with a high degree of miniaturization which are self-lubricating and highly wear resistant.

*“As soon as we have decided that we can and should do something, we will find a way to do it.”*

Abraham Lincoln

# Schunk Materials – Business Activities

## **Tribology**

In the Business Unit Tribology, Schunk Materials develops and produces bearings and seals out of carbon graphite and silicon carbide materials for the use in pumps, seals and plants of the chemical and petrochemical industries, for the automotive technology and power plants as well as for the food and pharmaceutical industries.

Carbon and graphite materials are applied for vanes, housing parts, end plates, and rotors for rotary compressors and pumps.

## **Automotive Technology – A Systems Approach**

The Business Unit Automotive Technology is custom tailored to the special requirements of automotive suppliers.

Schunk Materials supplies about 1 billion carbon brushes worldwide each year, and frequently also the corresponding carbon brush holders as well as complete ready-to-install assemblies for all electric motors for automobiles.

## **Current Transfer for Industrial Motors and Mass Transit Technology**

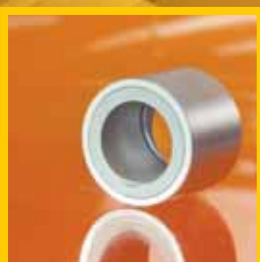
In the fields of industrial engineering and transport, Schunk Materials develops and produces components and assemblies for the safe current transfer – from measuring current to high current – such as pantographs, current collectors, carbon brushes, carbon brush holders, and rocker rings as well as grounding contacts and switches.

Schunk Materials produces flexible current connectors as well as holder systems for the manufacturers of switchgears, industrial furnaces, welding robots, transformers and electrical locomotives.

## **Small Motor Technology – Globally present**

Schunk Materials supplies carbon brushes used in household appliances and toys as well as for motors in power tools for professionals and DIY.

For motor manufacturers Schunk Materials produces carbon brush holders which are assembled with brushes. In addition, complete brush cards as well as forward/backward movable brush cards which include interference suppressors, heat monitors and switches are manufactured.



**Tribology**



**Automotive Technology**



**Current Transfer and Railway Technology**



**Small Motor Technology**

Schunk Materials' customers benefit from our highly innovative R&D departments, the chemical and physical laboratories, the station for radio interference suppression as well as from the test rigs of our department of Application Engineering.

**Engineering Ceramics –  
A Multitude of Excellent Properties**

In the field of engineering ceramics, Schunk Materials produces a large variety of components for thermal process technology and furnace construction. As an example, kiln furniture are often used for the production of porcelain and/or sanitary ware due to their temperature resistance and the optimum use of furnace volume.

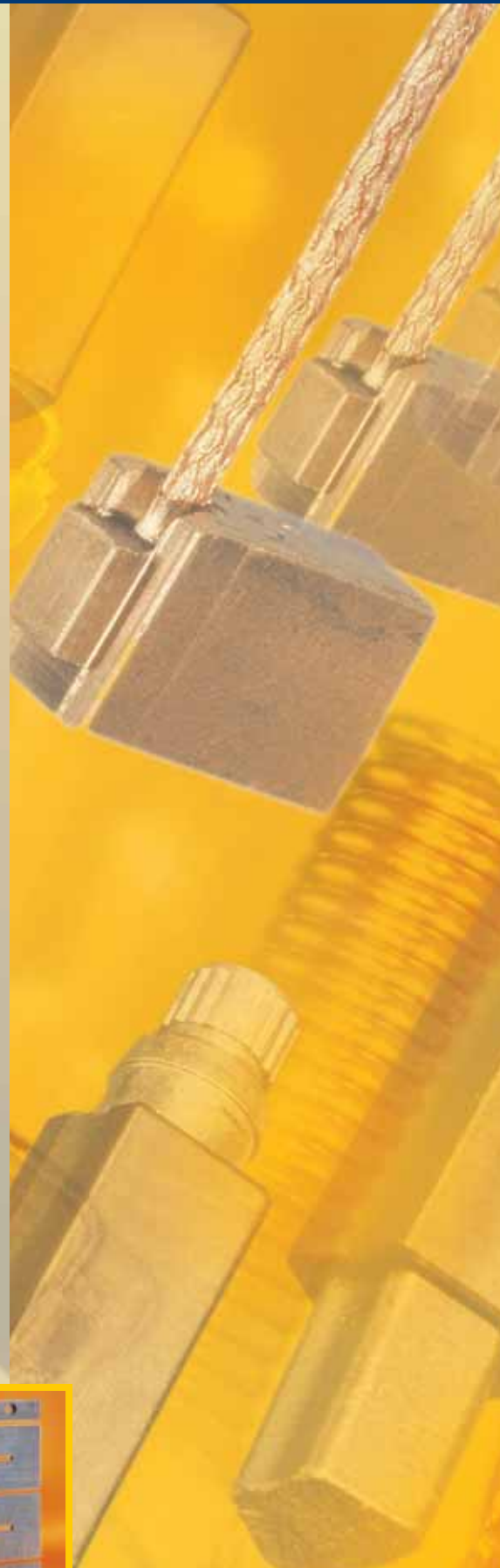
Flame tubes and burners guarantee a high degree of operational reliability and optimum efficiency during heat treatment processes.

For the process technology, Schunk Materials offers a wide range of wear resistant coatings and linings as well as machined parts.

**Semiconductor Technology –  
Our Standard is Fulfilling the  
Highest Requirements**

The products of the Semiconductor Business Unit are used in all essential process phases of semiconductor production.

Among our many products are graphite crucibles for crystal growing, CVD coated ceramic susceptors and quartz wafer boats for wafer processing. All products are characterized by their extremely high degree of purity and their excellent temperature and corrosion resistance.



*“All knowledge derives  
from experience.”*

Immanuel Kant



**Engineering Ceramics**

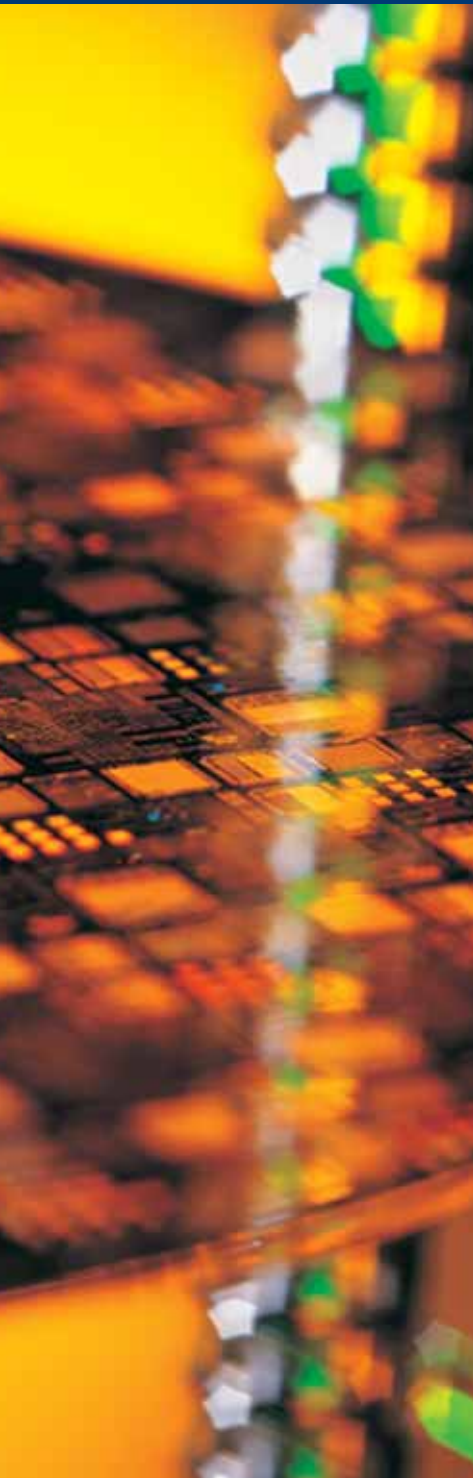


**Semiconductor  
Technology**



**High-Temperature  
Applications**

# Materials for Advanced Technology



## **Carbon Fiber-Reinforced Carbon (CFRC; C/C)**

Compared with conventional high-temperature materials, C/C materials are distinguished by their high stiffness and mechanical strength, even at extremely high temperatures.

C/C enables solutions in the area of high-temperature applications that would not be possible with conventional materials.

## **Graphite – Applicable up to 2,500 °C with Inert Gas**

Graphite can be applied as a refractory material up to 400 °C in air and up to 2,500 °C under protection gases. It displays good non-wetting properties against fused iron and other fused metals.

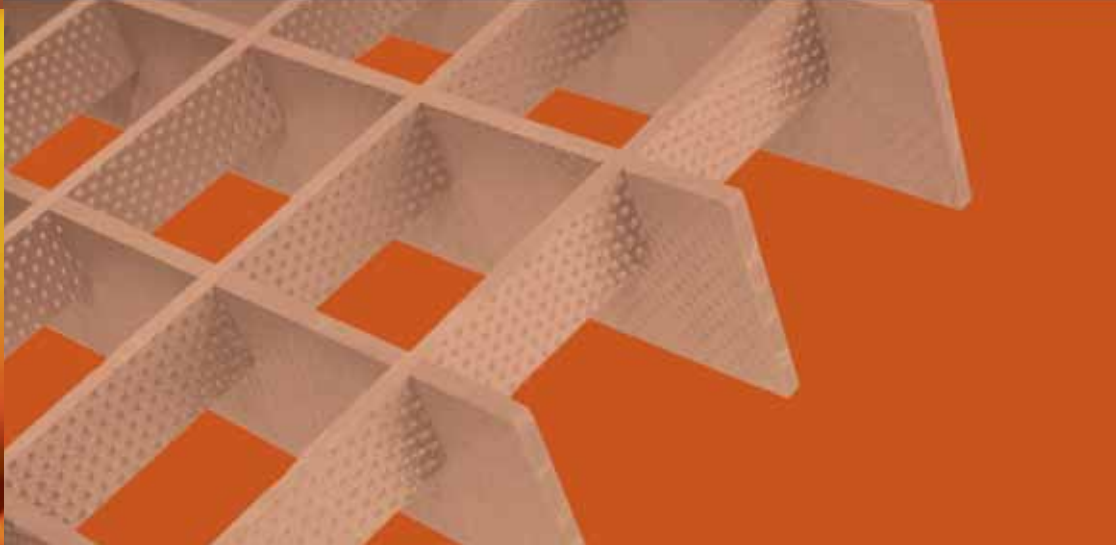
Its crystal structure possesses a layered composition, so that it can also be used as a solid lubricant.

## **Pyrocarbon and SiC Coatings**

In devices for the production of polycrystalline silicon and silicon single crystals, many of the components used are made of graphite and carbon fiber-reinforced carbon.

Schunk Materials offers all graphite and C/C parts for the manufacture of silicon wafers.

In addition to electrodes, slicing beams, crucibles, heaters and tubes, Schunk Materials also manufactures special parts out of highly purified graphite, which can be coated with pyrolytic carbon or SiC.



### Silicon Carbide Coatings used in Space

Schunk Materials with silicon carbide coatings are becoming more and more important for the production of mirrors for space applications. This especially applies to ultra-light optomechanical systems.

Designed for use in extremely demanding environments (e. g. in space), these products are characterized by an extremely low brittleness as well as a shrinkage that can be exactly defined during the manufacturing process.

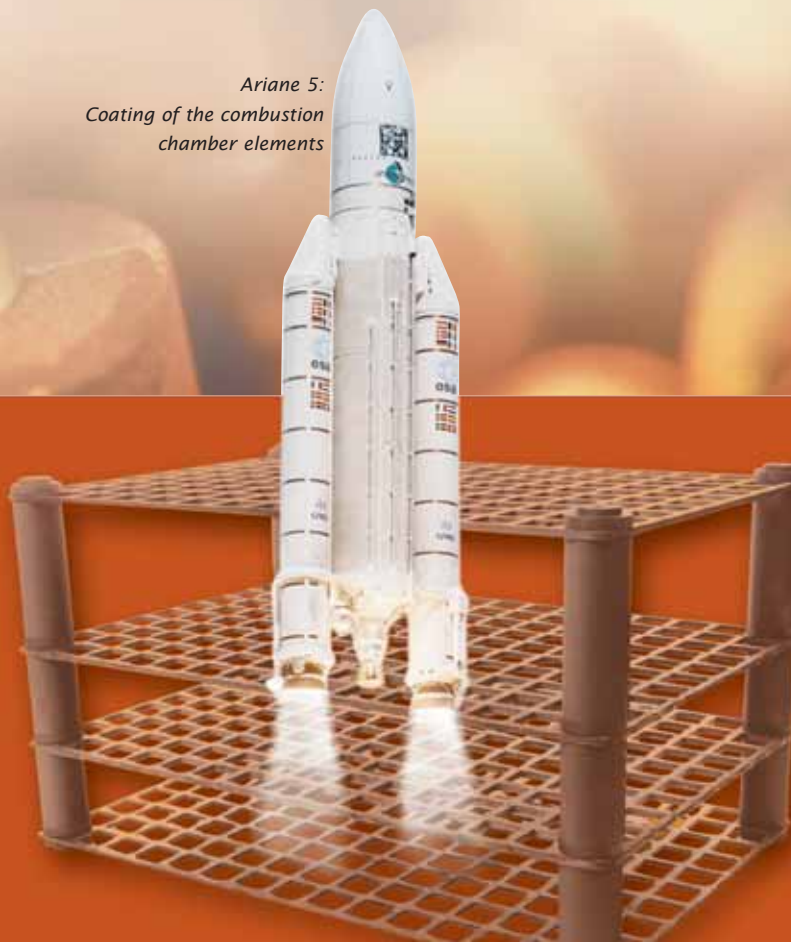
### Other Materials and Developments

In addition to the developments mentioned in the areas of C/C, C/C-SiC, pyrolytic carbon and SiC, the Schunk engineers and scientists are intensively working on such materials as CFRP (Carbon Fiber-Reinforced Plastics), oxide ceramics, silicon nitride ceramics, felt based materials and many more.

*“Coming together is a beginning.  
Keeping together is progress.  
Working together is success.”*

Henry Ford I.

*Ariane 5:  
Coating of the combustion  
chamber elements*



# Schunk Materials – Global Production



## **Flexible Production**

Schunk Materials produces at a total of 33 locations worldwide and takes advantage of the particular benefits that each respective region offers. Schunk Materials can carry out fully automated, semi-automated and/or manual production at nearly every location.

## **Innovation in Production Processes**

Our innovation is not restricted to the research and development of materials and assemblies; we also strive to continually optimize our production processes. Schunk invests a lot of resources in developing new manufacturing methods and procedures to guarantee our customers not only the highest quality, but also the best possible efficiency.

*Press with 5 cavity mold*

### The Most Modern Equipment

Our fully automatic presses work with an accuracy of up to 0.001 mm. We have highly modern furnaces all over the globe, and with these we reach the highest attainable temperatures that current technology allows.

Schunk Materials' coating technology meets the requirements of space technology.

### Schunk Materials' Global Presence

The companies of Schunk Materials are located at the following sites:

- Germany/Heuchelheim (near Giessen), Wettenberg, Oberzenn and Willich
- Australia/Melbourne
- Brazil/Saõ Paulo
- China/Hong Kong, Guangzhou, Shanghai
- France/Nanterre Cedex

- Great Britain/Pudsey
- India/Bangalore
- Italy/Milan
- Mexico/Toluca
- Netherlands/Hapert, Helmond, Rotterdam
- Austria/Salzburg, Bad Goisern, Vienna
- Poland/Warsaw
- Portugal/Lisbon
- Rumania/Bucharest
- Sweden/Lenhovda
- Switzerland/Zurich
- Singapore
- Spain/Madrid
- South Korea/Ansan
- Thailand/Bangkok
- Czech Republic/Pilsen
- Turkey/Istanbul
- Hungary/Cesztreg, Bóly
- Russia/Krasnodar
- USA/Georgetown-TX, Menomonee Falls-WI



*Approximately 8,200 employees worldwide successfully work as a team at Schunk Materials.*



Schunk Kohlenstofftechnik GmbH Germany/Heuchelheim Telephone: +49 (641) 60 80	Schunk AG Switzerland/Adliswil Telephone: +41 (44) 7 16 46 46	Schunk Graphite Technology LLC USA/Menomonee Falls Telephone: +1 (262) 2 53 87 20
Schunk Bahn- und Industrietechnik GmbH Germany/Wettenberg Telephone: +49 (641) 80 30	Schunk Wien Gesellschaft m.b.H. Austria/Vienna Telephone: +43 (1) 61 66 80 70	Schunk Electro Carbón, S. A. de C.V Mexico/Ocoyoacac Telephone: +52 (728) 2 82 78 90
Schunk Bahn- und Industrietechnik GmbH Austria/Bergheim Telephone: +43 (662) 45 92 00	Hoffmann & Co. Elektrokohle AG Austria/Bad Goisern Telephone: +43 (6135) 40 00	Schunk (Aust) Pty. Ltd. Australia/Rowville Telephone: +61 (3) 97 53 35 88
Schunk Ingenieurkeramik GmbH Germany/Willich Telephone: +49 (2154) 49 70	Schunk Italia S.r.l. Italy/Magenta Telephone: +39 (02) 9 72 19 01	Schunk do Brasil Ltda. Brazil/São Paulo Telephone: +55 (11) 46 13 32 02
Gerhard Präzisionspresstechnik GmbH Germany/Oberzenn Telephone: +49 (9844) 9 71 10	Schunk Ibérica S. A. Spain/Pinto Telephone: +34 (91) 6 91 25 11	Schunk Metal & Carbon (I) Pvt.Ltd. India/Bangalore Telephone: +91 (80) 28 51 85 07
Schunk Nordiska AB Sweden/Lenhovda Telephone: +46 (474) 2 95 00	Schunk Portugal Lda. Portugal/Marinha Grande Telephone: +351 (244) 57 24 80	Pichit Industrial Works Co., Ltd. Thailand/Pichit Telephone: +66 (2) 3 79 52 62
Schunk UK Ltd. Great Britain/Pudsey Telephone: +44 (113) 2 56 72 38	SIRMA Elektrik Kömürleri SAN TIC AS Turkey/Istanbul Telephone: +90 (212) 2 78 99 70	Schunk General Carbon (Guangzhou) Co., Ltd. China/Panyu Telephone: +86 (20) 34 63 48 88
Schunk Benelux B.V. Netherlands/Rotterdam Telephone: +31 (10) 4 14 47 66	Schunk Praha s.r.o. Czech Republic/Plzen Telephone: +420 (377) 45 41 21	Schunk General Carbon Ltd. China/Hong Kong Telephone: +852 (2) 4 08 66 88
XYCARB Ceramics B.V. Netherlands/Helmond Telephone: +31 (492) 57 87 87	Schunk Carbon Technology SRL Rumania/Bucharest Telephone: +40 (21) 3 37 28 59	Jiangsu Seung Lim Electric Co. Ltd. China/Jiangsu Telephone: +86 (511) 8 42 08 97
Xycarb Ceramics Inc. USA/Georgetown Telephone: +1 (512) 8 63 00 33	Hoffmann Carbon Kft. Hungary/Csesztreg Telephone: +36 (92) 50 09 00	Seung Lim Carbon Metal Co., Ltd. South Korea/Ansan-City Telephone: +82 (31) 4 91 27 22
XYCARB Ceramics (Singapore) Pte. Ltd. Singapore/Singapore Telephone: +65 (636) 06 72	Schunk Bahntechnik Polska Sp.z.o.o. Poland/Warszawa Telephone: +48 (22) 8 24 04 11	
Schunk Electrographite S.A.S. France/Nanterre Cedex Telephone: +33 (141) 19 52 52	OOO NPP "Soyuzkarbon" Russia/Krasnodar Telephone: +7 (861) 2 00 62 36	

**Schunk Materials**  
Rodheimer Strasse 59  
35452 Heuchelheim  
Germany

Telephone: +49 (641) 608-0  
Telefax: +49 (641) 608-12 23

[www.schunk-group.com](http://www.schunk-group.com)  
[infobox@schunk-group.com](mailto:infobox@schunk-group.com)