



Advanced Solutions

Creating Future. With Carbon and Ceramics.

PAVE

Quality
Management

Energy
Efficiency

Customization

Production
Excellence

Industry
Operations

Analytics

Schunk Group – A worldwide success.
Always at your side.

Advanced Solutions
Accelerating Your Way to Innovation.

Schunk focuses on the development, manufacturing and application of both carbon and ceramic solutions. It combines an innovative spirit and technological expertise with an exceptional customer service to provide a range of products and solutions unique in the market. With Schunk, you have a partner who can offer all the technological possibilities of an international company and implement custom-tailored ideas to your needs, both for high-volume industrial markets as well as for highly specialized niche applications.

The Schunk Group

Empowering, idea-driven, collaborative - this is how the Schunk Group has made a name for itself as a globally-active technology group since 1913. Empowering, because we build bridges for our customers to help them develop better products and conquer new markets with innovative technologies. Idea-driven, because innovations are a significant aspect of our company culture. Collaborative, because every employee of the Schunk Group is focused on the customer.

The Schunk Group is a globally operating technology company. The company is a leading supplier of products made of high-tech materials - such as carbon, technical ceramics and sintered metal - as well as machines and systems - from environmental simulation and air conditioning to ultrasonic welding and optical machines. The Schunk Group has around 9,600 employees in 26 countries and achieved sales of €1.6 billion in 2023.

To enable cutting-edge developments with our customers we established "Advanced Solutions" - a business unit that covers all the technological know-how of the Schunk company and offers solutions with an added value.

"Follow your vision because what is impossible today may be the norm tomorrow."

— J.A. Barker

Keeping this in mind, Advanced Solutions enables you to discover the revolutionary and develop the customized products. Advanced Solutions can be considered as Schunk's business incubator for new approaches, materials and technologies encompassing carbon, ceramics and quartz. We grow products from ideas thus paving the way for industrial trends and providing the technological solutions for your applications. Advanced Solutions opens new markets and enables growth opportunities. Through technological cooperation with our partners, we ensure the success of our customers.

BIOTECHNOLOGY

AEROSPACE

CARBON
CERAMICS
QUARTZ

MATERIAL
PROPERTY
ENGINEERING

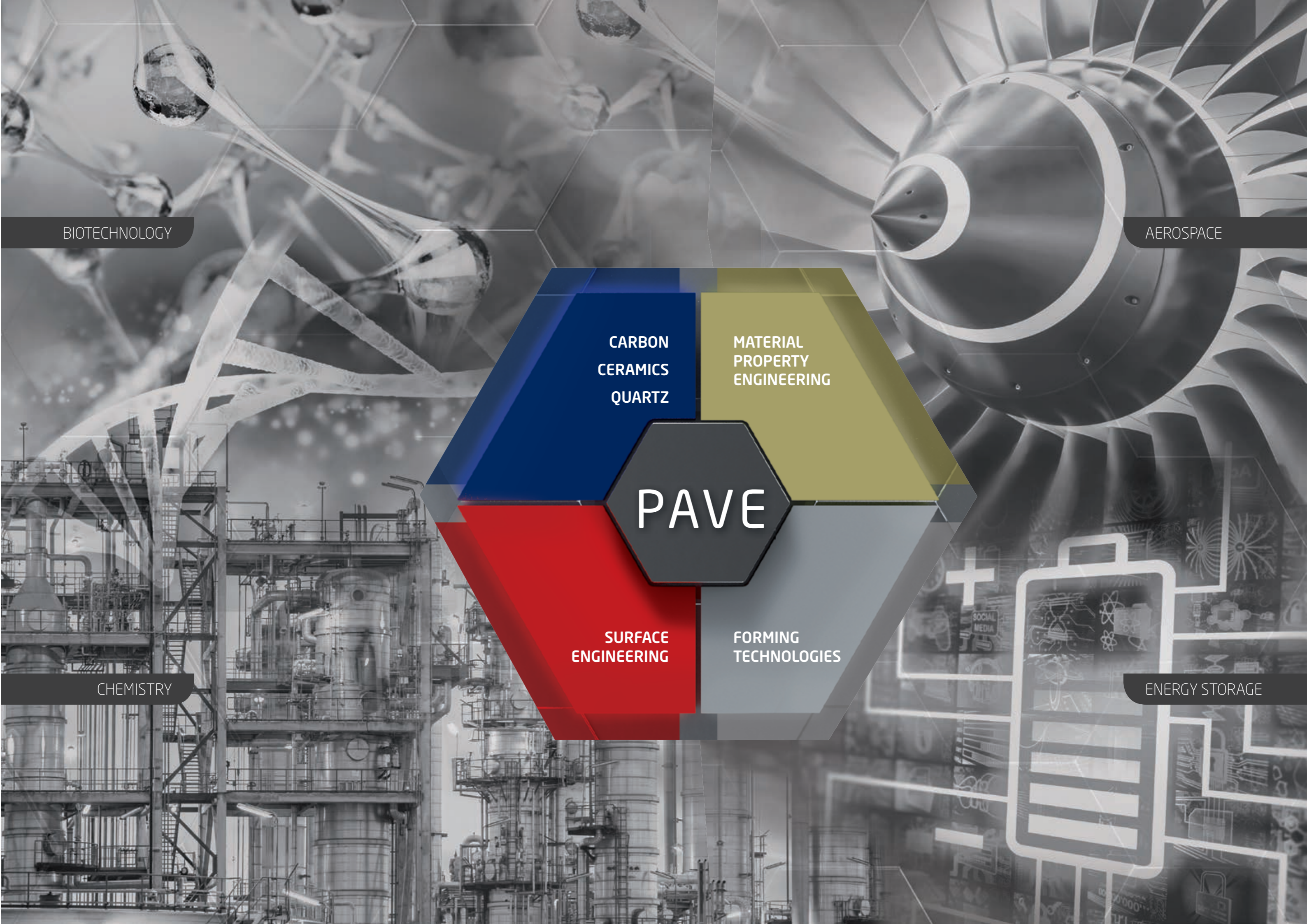
PAVE

SURFACE
ENGINEERING

FORMING
TECHNOLOGIES

CHEMISTRY

ENERGY STORAGE



Schunk PAVEs – Process Added Value Engineering of Innovations.

Process Added Value Engineering (PAVE) is our unique method to develop new products that precisely meet our customers' requirements. You will profit from our innovative spirit, customer-oriented practices and an efficient realization of serial production.

Advanced Solutions has access to our entire company like to a toolbox. Our four core areas of expertise include a comprehensive material know-how in carbon, ceramics and quartz; precise customizing of the intrinsic material properties to specific applications, state-of-the-art forming technologies for efficient production lines and tailor-made high quality surface treatment of the final products. By combining and advancing our production techniques, we meet your specific requirements. We call it PAVE - Process Added Value Engineering.

Thanks to our PAVE philosophy, we always start with the solid foundation based on years of expertise but keep our minds open for new ideas. Our customers benefit from the analytical skills of our experts and the practical approach for industrial solutions. Schunk's global production capacities and hands-on mentality of a mid-sized company guarantee rapid and successful development cycles and market introduction.

It always starts with the right material.

- Carbon Graphites
- Graphites
- Tailor-made Graphite compositions
- Resin bonded Carbon
- Expanded Graphite
- Carbon Foams
- Special Processed Carbon powders
- Al₂O₃ – Aluminum Oxide ceramics
- RBSiC ceramics (reaction-bonded Si infiltrated Silicon Carbide)
- RBB₄C ceramics (reaction-bonded Boron Carbide)
- NSiC – Silicon Nitride bonded SiC
- Freestanding CVD SiC or Pyrolytic Carbon
- P-SiC – porous Si
- Quartz (opaque & fused)
- High purity synthetic quartz, black quartz
- Carbon Felt
- Carbon Fleece
- Carbon Fibers
- Carbon Braids
- Composites:
 - C(G)FRP – Carbon (Glass) Fiber Reinforced Polymers
 - C-SMC – Carbon Sheet Molding Compounds
 - C/C – Carbon Fiber Carbon
 - C/C-SiC – C/C with Silicon Carbide
 - C/C-SiSiC – Silicon infiltrated C/C-SiC
- CMC – Ceramic Matrix Composites (Ox/Ox, SiC/SiC, SiC/SiCN)
- C-SiC – Silicon infiltrated Carbon felt
- Metal Graphites
- SiC3O
- Graphite-Polymer composites

CARBON
CERAMICS
QUARTZ

Property engineering turns materials into unique solutions.

- Density
- Porosity (volume, shape)
- Permeability
- Conductivity (thermal & electrical)
- Temperature performance
- Heat capacity
- Radiation property (black body or less)
- Thermal expansion
- Thermal shock resistance
- Hardness
- Stiffness
- Elasticity
- Crystallinity
- Purity (up to semi-conductor grade)
- Anisotropic property engineering
- Corrosion resistance
- Coefficient of friction
- Wear resistance
- Transmissivity/absorptivity (from X-Ray to IR)
- Reduced noise emission
- Wettability
- Biocompatibility
- Techniques:
 - Infiltration (metals, organic resins, wax, oil, salt, carbon, graphite slurries)
 - Reactive Infiltration with Si
 - CVI – Chemical Vapor Infiltration
 - Purification processing (up to semiconductor grade)

MATERIAL
PROPERTY
ENGINEERING

PAVE

Layer upon layer to the high-end performance.

- (High Purity/Very High Purity) Coatings:
 - Si coating
 - SiC coating
 - TaC coating
 - PyC – Pyrolytic Carbon coating
 - Diamond coatings (conductive and non-conductive)
 - AlN – Aluminum Nitride coating
 - Siliconizing of Carbon fabrics
 - Plating (electro-, electroless)
 - Thermal spray coating
 - Plasma spray coating
 - CVD – Chemical Vapor Deposition
 - Barrier coatings
 - Surface passivation
 - Surface activation
 - Multilayer coating
- Surface Cleaning:
 - Wet cleaning
 - XClean crack removal etching
 - HT HCl cleaning & etching
 - Chemical polishing of Si
 - CMP – Chemical Mechanical Polishing of Si
 - No particle release surface
- Surface Treatment:
 - GDC – Graphite derived Carbide Surface
 - Mechanical Quartz polishing
 - Robot Flame Quartz polishing
 - CNC machining of Si and SiC after coating
- CNC texturing and micro-texturing of graphite
- Grinding, lapping, polishing, blasting
- Plasma treatment
- Laser surface processing
- Services: refurbishment, repair, cleaning

SURFACE
ENGINEERING

We bring precision into form.

- Press to Size:
 - High precision press to size
 - Multi material press to size
 - Compression-/injection molding
 - Extrusion
 - Carbon SMC – Sheet Molding
 - Soldering, sintering ceramics
 - Laser welding (SHADOW)
 - Automated flame polishing and fusion of quartz parts
 - Quartz molding
 - Stabilizing nonwoven 3D forms and fibers via CVI process
- Forming Technologies:
 - Composites prepreg stacking
 - Filament winding
 - Textile preforming
 - TFP – Tailored Fiber Placement (Unigridd™)
 - Needled and toughened preforms
 - RTM – Resin Transfer Molding
 - Autoclave techniques
 - Systems: assembly and engineering
- Mechanical machining techniques for graphite, Si, ceramics, quartz
- Temperature controlled graphite CNC machining
- 3D printing & additive manufacturing technique
- Slip Casting (with/without pressure)
- Various joining techniques
- Expand to Shape
- Isostatic pressing

FORMING
TECHNOLOGIES

Make PAVE Your Winning Composition.

Process Added Value Engineering is based on our four core areas of expertise for creating customized solutions from carbon, ceramics and quartz. Schunk is your ideal single-source partner, from raw materials to finished products.

CARBON | CERAMICS | QUARTZ

The properties and specifications of each finished product are based on the selection of the right raw materials based on carbon, ceramics or quartz. Schunk has over a century's worth of experience in developing and processing of our high-end materials.

MATERIAL PROPERTY ENGINEERING

For each application, the material will be selectively processed to maintain its desired electrical, chemical and physical properties. Schunk masters all the necessary techniques for perfect results.

FORMING TECHNOLOGIES

We manufacture customized products in specified shapes using the technologies that guarantee the highest possible quality at attractive prices. For complex modules and systems, our assembly and engineering expertise is also at your service.

SURFACE ENGINEERING

To withstand aggressive media and extreme temperatures, or add additional functions to put you ahead of the competition, our materials are properly coated or surface modified. Schunk will surely impress you with the large dimensions and the realizable form complexities.

All this know-how contributes to Schunk's **INDUSTRIAL OPERATIONAL EXCELLENCE**, which ensures customer-focused development of innovative products for an efficient serial production.

New Thinking Leads to Innovative Solutions.

The broad diversity of the activities of Advanced Solutions can be illustrated by the four examples below. These products represent perfect innovations originating from unique ideas important for future trends.

Latent Heat Carbon

The newly developed composite comprises an expanded graphite that has been infiltrated with a phase-change material utilizing the high thermal conductivity of expanded graphite with significantly improved heat accumulation properties. The manufacturing method is new too - the foaming nature of the graphite enables flexible geometries, optimal thermal contact and one-step forming.

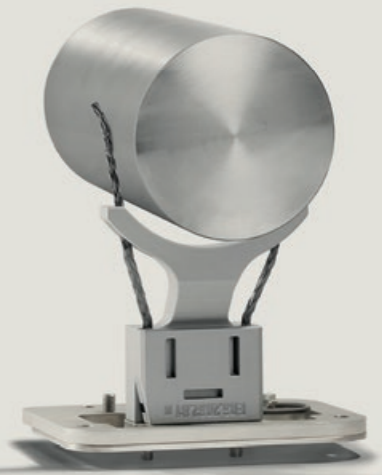
This product was developed upon the request of a customer to prevent the overheating of fuel after switching off an engine. Latent Heat Carbon can also be used to cool electronic components in e-mobility applications.



Carbon Fiber Grounding

Schunk shaft grounding systems with carbon fibers protect bearings and transmission components from damage caused by stray electric currents. Their unique structure consisting of woven carbon fibers ensures ideal operation in the presence of small, but dangerous high-frequency shaft currents. It also exhibits greater wear resistance. Highly conductive and thoroughly coated fibers reliably transmit currents to defined earthing points and prevent the formation of micro-arcs, ensuring longer lifetime and better performance of the system.

If necessary, shaft grounding can also be adapted to mobile drive systems and stationary industrial systems. Thanks to their compact size, our carbon grounding can also be easily retrofitted. This means that the product quickly pays off, reducing repair and maintenance costs for our customers.



Carbon Fiber Reinforced Carbon Springs

This example demonstrates our expertise in developing even the most high-end solutions. The springs were developed for the aerospace industry and were part of a research device on the D-2 Spacelab mission to study crystal growth under microgravity conditions.

The carbon fiber-reinforced carbon springs were produced using a cost-efficient wet winding process. They are, thus, considerably more affordable than sapphire springs and beat any metal alternative in performance. These springs have a low weight, are electrically conductive, corrosion and creep resistant, and withstand temperatures up to 1800°C.

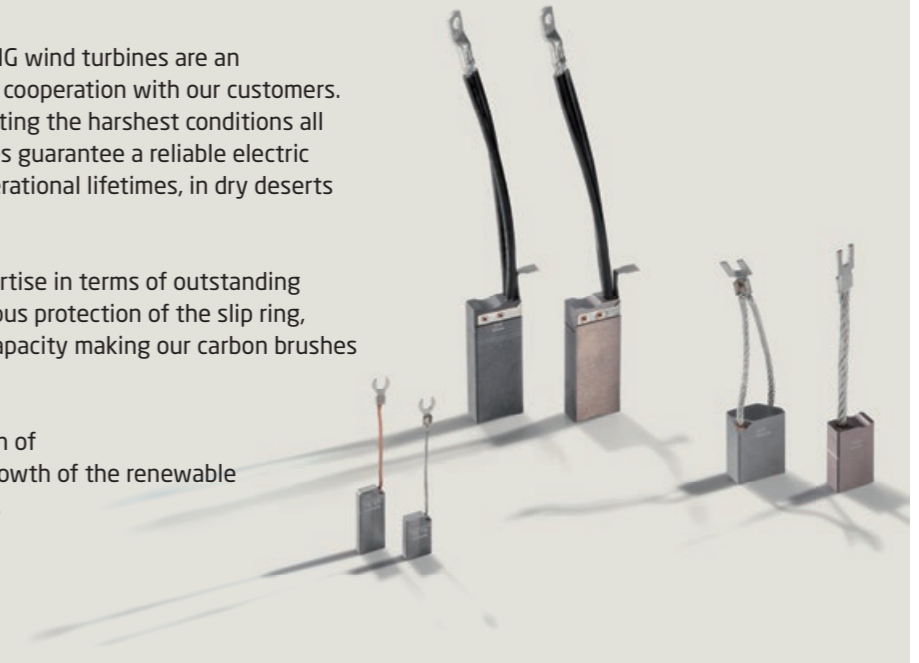


Carbon Power Brushes

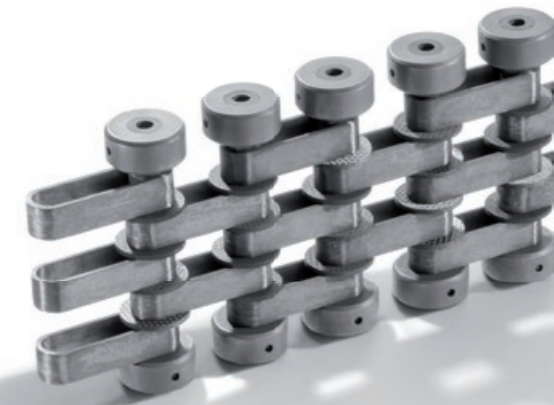
Our special carbon brushes for DFIG wind turbines are an excellent example of a successful cooperation with our customers. We have customized materials suiting the harshest conditions all over the globe. Our carbon brushes guarantee a reliable electric current transmission and long operational lifetimes, in dry deserts or in offshore sea water climate.

You can always count on our expertise in terms of outstanding wear performance and simultaneous protection of the slip ring, high thermal and electrical load capacity making our carbon brushes the best on the market.

Schunk enables efficient operation of wind plants contributing to the growth of the renewable energy sector for a greener world.



The Advanced Solutions team imagines, develops and cooperates closely with our customers just like the links of this high-end C/C chain – creating solutions where no other would succeed.



Schunk GmbH

Rodheimer Strasse 59

35452 Heuchelheim - Germany

Phone +49 (0) 641 6080

Fax +49 (0) 641 608 1223

E-Mail division-carbontechnology@schunk-group.com

schunk-carbontechnology.com

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