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Technical mesh for green energy

Woven metal mesh and filter solutions

Competence

Mesh solutions from the technological leader

GKD: Made-to-measure innovations

GKD is the global technological leader for ultra-modern industrial mesh and filtration solutions made of metal and synthetic wires and technical fibers – for all industrial applications. With innovative weaving technologies and the latest simulation methods, we create efficient technical weaves, semi-finished products, components, and filter equipment – optimally matched to the most diverse mechanical process engineering requirements. For the production and use of green hydrogen, GKD produces technical mesh solutions to cater to different use specifications. GKD supports the sustainable transformation of industry with its expertise. Our customers benefit from tailor-made solutions, intensive consulting, and worldwide service partners.

GKD is continuously developing new fields of application through manufacturing technology and process expertise. We use GKD mesh to create efficient systems, equipment, and components that are perfectly integrated into our customers' processes across all industrial sectors.

Thanks to ISO certifications, our customers can rely on certified quality worldwide.



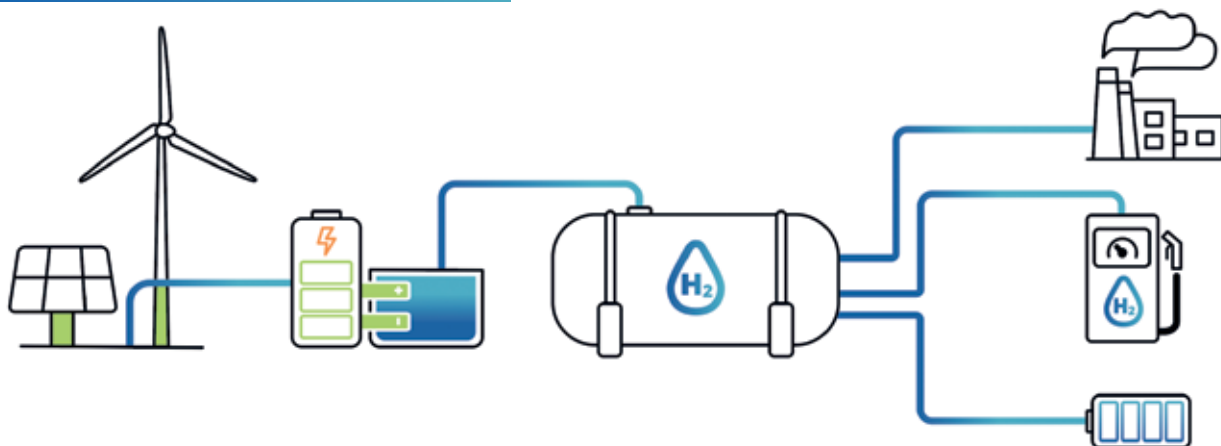
Green energy: For a climate-neutral transformation

Green hydrogen is considered the energy source of the future. With this technology, industry aims to meet global climate protection objectives. As an alternative to fossil fuels, it supports the independence of industry and politics from geopolitical change.

Hydrogen in general is generated through electrolysis. To produce green hydrogen, only energy from renewable sources is used. As a sustainable energy source, green hydrogen has enormous future potential and enables industry to be climate-friendly or

climate-neutral. Suitable fields of application include refineries, iron and steel production, and the chemical industry. Green hydrogen can also be used as a fuel for goods and passenger traffic, and as energy storage in the smart grid. As the global market leader for solutions made of metal, hybrid, and synthetic mesh as well as spirals, GKD supports the efficient use of green hydrogen in industrial applications, as technical weave is used in generating green hydrogen and converting it to energy. Its quality and properties are fundamental to the efficient use of green hydrogen.

Hydrogen generation



The background of the page features a close-up, artistic photograph of several circular metal components, likely part of an electrolyzer. These components have a fine, woven mesh pattern and are arranged in a slightly overlapping, circular pattern. A large, semi-transparent blue triangle is superimposed over the center of the image, pointing towards the bottom right. Inside this triangle, the text is displayed in white.

Hydrogen generation

Technical weave for **electrolysis**



Hydrogen and oxygen reaction Increasing efficiency

Technical weave from GKD is used as electrode material, spacers, and a current distributor in electrolysis. The electrochemical, structural, and mechanical properties of the materials are optimized for alkaline water electrolysis, but they are also used in other electrolyzers. They increase the efficiency of the hydrogen generation reaction (HGR) and the oxygen generation reaction (OGR) and are optimized for each customer.

GKD has developed special mesh solutions for the optimal performance of the anode and cathode in all essential aspects of electrolysis. The structures of the technical weave are homogeneous. Compared to non-woven media, our solutions exhibit a large surface area, optimal current distribution, and a good connection to the membrane. Furthermore, the mesh ensures optimum gas diffusion and withstands considerable bending without losing contact with the active materials. In addition to the solutions for alkaline electrolysis, GKD also offers solutions for the solid oxide electrolyzer cell (SOEC). The meshes are used on the cathode side in this process (H₂ electrode) as a current distributor and contact agent.

Features and properties of the wire mesh

- ◆ High permeability of the gas diffusion layer
- ◆ High level of homogeneity
- ◆ Scalable surfaces of the electrode current collector
- ◆ Catalyst/electrolyte substrate with high electrocatalytic efficiency
- ◆ Long-term stability
- ◆ Customer-specific optimization

The background of the slide features a close-up, slightly angled view of several stacked metal plates. These plates are part of a fuel cell assembly, showing a fine, woven mesh pattern on their surfaces. The plates are silver-colored and have various circular holes and notches along their edges. A large, semi-transparent blue diamond shape is overlaid on the left side of the image, containing the text.

Hydrogen use

Technical weave for **fuel cells**



Power generation Components that make the difference

The technical weaves from GKD, which are employed as electrode material, are designed for the greatest possible efficiency in power generation. The special wire meshes are available for various types of fuel cells and for different manufacturers. Thanks to the material's porosity, conductivity, and shape, it opens up a broad range of applications within the fuel cell. For instance, it is used as current distributors on the anode side (H₂ electrode) and as a contact agent.

GKD mesh solutions improve the gas diffusion situation thanks to their highly homogeneous properties. What is more, they optimize the electrode current collectors and the catalyst/electrolyte substrate. The distinct and yet smooth surface structures of the technical weaves ensure optimal electrical contact for the membrane. In addition, the meshes withstand considerable bending without losing contact with the active materials. GKD offers solutions for fuel cells of different designs.

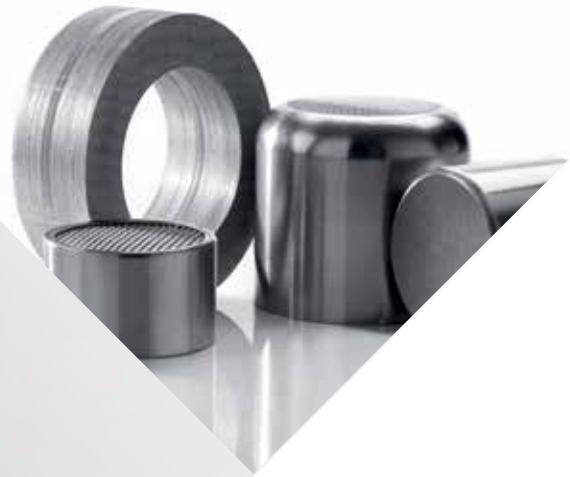
Types of fuel cell

- ◆ Alkaline fuel cells (AFC)
- ◆ Direct methanol (DMFC)
- ◆ Solid oxide (SOFC)
- ◆ Phosphoric acid (PAFC)
- ◆ Polymer electrolyte membrane (PEMFC)
- ◆ Molten carbonate (MCFC)



Combined heat and power

Technical weave for stirling technology



Heat and power generation

A decisive advantage with proven technologies

The efficiency of Stirling engines is primarily influenced by a regenerator, which consists of metal mesh. GKD produces regenerators for various units from different manufacturers with the design individually tailored to the machine. Along with the porosity of the mesh, the fabrication is also important. The technical weaves from GKD are suited for use up to a range of many kilowatts. GKD production

technology encompasses the entire vertical range of manufacturing, from mesh production, through application-oriented post-treatment, right through to the production of sintered regenerators and those with housing and mesh layers as ready-to-use assembly parts for series production.

Features and properties

- ◆ Regenerators and disc assemblies made of stainless steel and non-ferrous metals
 - ◆ Sintered regenerators, including for OEMs
 - ◆ Regenerators with housing
 - ◆ Reproducible series production
 - ◆ Special developments for high-temperature ranges in the regenerators
 - ◆ Special meshes for individually designed regenerators
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Technical weave

Specialized: Mesh types and materials



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- 1 Plain dutch weave
- 2 Volumetric weave
- 3 Gekuplate
- 4 Dutch twilled weave
- 5 5-heddle atlas weave
- 6 Oblong weave
- 7 Square weave

Individual: Wide range of solutions

The demands placed on technical weaves differ according to industry. That's why, at GKD, we match our products individually to the requirements of our customers. Using modern looms and production machines, we are able to produce a wide range of industrial mesh and structures. And when it comes to reproducible procedures, we look for the greatest and most reliable efficiency. That is how GKD achieves optimum product quality. Our technical weaves are produced in widths of up to four meters.

Mesh parameters

- ◆ Aperture
- ◆ Open mesh area
- ◆ Retention rate
- ◆ Flow values
- ◆ Porosity
- ◆ Bubble point
- ◆ Tensile strength
- ◆ Material

Materials

The choice of material as well as its quality and processing are very important for the properties of the wire mesh product. Certain requirements can only be fulfilled by certain materials. Knowing which material is best suited for which field of application and which processing and treatment it allows is particularly important. For green energy applications, nickel and nickel-base alloys are most commonly used, among them Crofer 22 H - UNS S44535 (DIN 1.4760), Ni 99.6% - S44535 (DIN 2.4060), and Duranickel. Other alloys (for example stainless steel, copper, aluminum, precious metals) as well as raw steel and titanium are possible depending on the specific chemical requirements.

Material	Description	AISI/UNS	Wire diameter
1.4301	X5 Cr Ni 18 10 (V2A)	304	> 0.016 mm
1.4306	X5 Cr Ni 18 11	304L	> 0.016 mm
1.4401	X5 Cr Ni Mo 17 12 2 (V4A)	316	> 0.015 mm
1.4404	X5 Cr Ni Mo 17 12 2	316L	> 0.015 mm
1.4841	X10 Cr Ni Si 25 20	314	> 0.030 mm
1.4539	X1 Cr Ni Mo Cu 25 20 5	904L	> 0.025 mm
1.4760	X1 Cr Ti La 22 (Crofer)	S 44535	> 0.120 mm
2.4602	Ni Cr 21 Mo 14 W (Hastelloy C-22)	N 06022	> 0.040 mm
2.4956	Ni Cr 22 Mo 9 Nb	N 06625	> 0.035 mm
2.4060	Ni 99.6	N 02200	> 0.036 mm
2.4066	Ni 99.2	N 02200	> 0.036 mm
2.4068	LC-Ni 99.2	N 02201	> 0.036 mm
2.0060	Copper	E-Cu 57	> 0.030 mm
3.3555	Aluminum	Al Mg 5	> 0.036 mm

Other alloys on request: industrialmesh@gkd-group.com



Production

Manufacturing: Highest standards

years of development excellence and process expertise as well as our consistent cost-benefit orientation are what make GKD a sought-after partner around the world.

What's more, products from GKD are produced to the highest standards – all the way up to production for clean room standards.

Manufacturing: From weaving to finishing

Weaving, cutting, cleaning, rolling, punching, finishing, and much more. With the latest looms and manufacturing machines, GKD produces the full range of industrial meshes and systems made of metal, synthetics, and technical fibers. Always leading with the individual requirements of customers in mind. Step by step, we analyze the demands on the material and the type of application, and we also optimize the processes and services. This eye for detail, many

Our services

- ◆ Process and requirements analyses with simulation tools (GeoDict/OpenFOAM)
 - ◆ Consultation on the choice of material
 - ◆ Application optimization and customized component design
 - ◆ Continuous analysis and further development
 - ◆ The latest manufacturing procedures and leading production standards
 - ◆ Certified know-how and decades of expertise
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Guaranteed: Certified quality

GKD doesn't just excel at production – we also have our own laboratory where we thoroughly inspect all of our meshes and associated components. It's vital that the quality products from GKD precisely meet the customer's desired specifications. That's why our physical and technical laboratory conducts tests in the following areas:

- ◆ Product development
- ◆ First sample inspection
- ◆ Inspection in the event of damage
- ◆ Inspection in the event of a complaint
- ◆ Customer-specific tests
- ◆ Production-related quality assurance

The benefit of the customer is at the heart of all testing scenarios. Our staff members possess the best material and testing expertise, work with the latest laboratory technology, and network constantly with professionals from the fields of inspection technology and science. The laboratory experts supervise the entire lifecycle of GKD products.

Inspection procedures (selection)

- ◆ Mechanical and physical testing
- ◆ Chemical testing
- ◆ Quality-assurance mesh testing



Service

GKD worldwide: Close to the customer

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International: Manufacturing and supply chains

With more than 900 employees worldwide, the GKD Group is a leading international technology and service company. With its headquarters in Düren, Germany, GKD also operates production sites in the USA, Chile, South Africa, India, and China. Locations in France, Spain, and Dubai as well as worldwide representatives ensure that we

are close to the customer all over the world. Our understanding of service includes developing individual solutions for individual customers. GKD produces around the world but relies locally on short distances. A broad network ensures delivery security so that we are always able to respond to customer requests quickly and with flexibility. Through



precise logistics, the use of recycled materials, and production processes that are gentle on resources, GKD promotes sustainable actions in keeping with our guiding principle: “for a healthier, cleaner and safer world”.

www.gkd-group.com

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- 03 **GKD Spain** Barcelona
- 04 **GKD USA** Cambridge (MD) & Star City (AR)
- 05 **GKD Latin America** Santiago de Chile
- 06 **GKD Africa** Johannesburg
- 07 **GKD India** Jaipur
- 08 **GKD China** Qufu

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