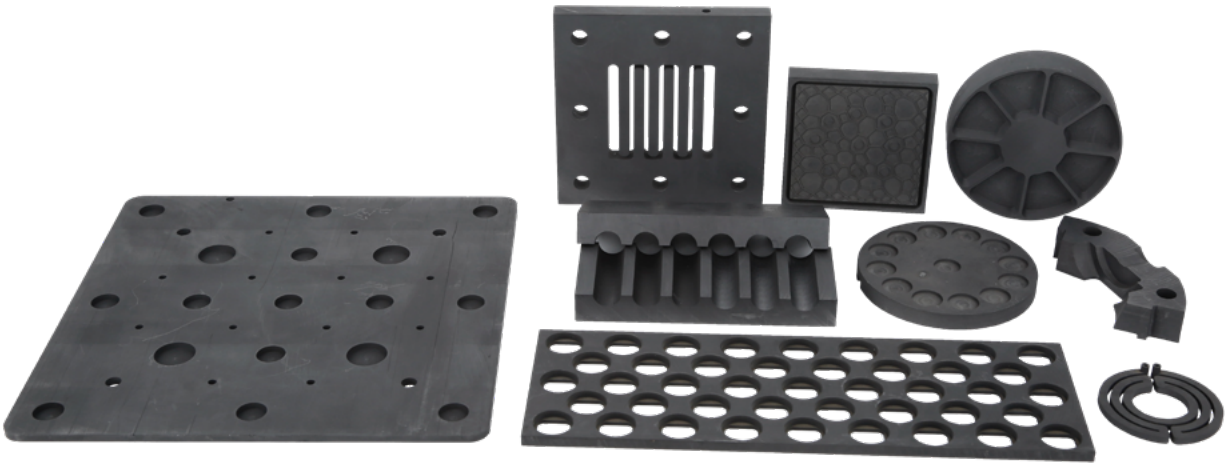
XURAN NEW MATERIALS LIMITED

Graphite Special-Shaped Parts Catalog

2023



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Welcome to

Xuran New Materials Limited is a production–based trading company specializing in the production and sales of graphite materials and products. Located in Hebei Province, China, this company was established in 2010 and has been focused on the production and development of high quality graphite products to meet the needs of chemical, mechanical, semiconductor, new energy, metallurgy and other fields for inorganic nonmetallic materials.

Currently, our main products include special graphite, mechanical carbon graphite parts, carbon–carbon composites, graphite felts, graphite crucibles, graphite dies & molds, vacuum furnace graphite parts for heat treatment, photovoltaic thermal field graphite parts, etc. We are committed to providing our customers with effective, comprehensive solutions as well as technical consulting and product customization services.

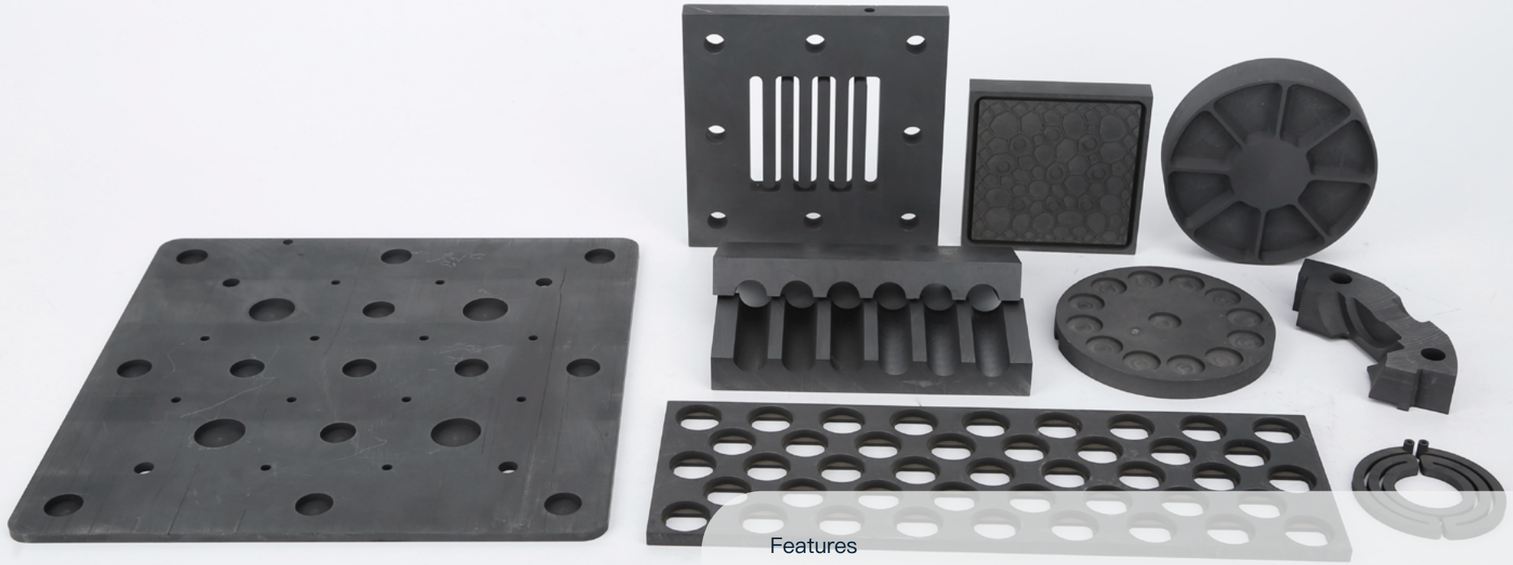
Professional service team, strict product factory inspection and timely tracking throughout the transportation process guarantee we can provide our customers with high quality, accurate, convenient and fast services. We aim to be the most trustworthy graphite solution provider for our customers and provide strong support for the development of our customers!

Chapter 5

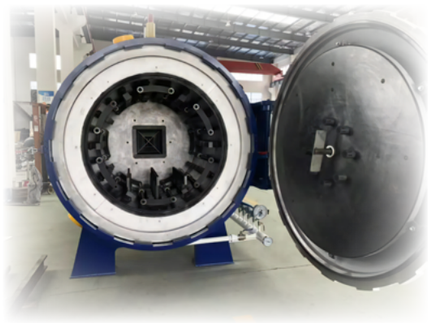
Graphite Special–Shaped Parts

When it comes to machining and processing in high temperature, vacuum, corrosive and other harsh environments, graphite special–shaped parts are an ideal choice of material. Due to their excellent high temperature resistance, electrical and thermal conductivity, graphite parts have been widely used in various industrial fields, especially in heat treatment, photovoltaic, and semiconductor industries. The shapes and structures of these graphite parts vary greatly depending on their working environments and equipment model.

We have a professional technical team and advanced machining equipment. We can provide tailor–made solutions according to customers' actual needs to ensure that our customers receive the best products and services available.



Vacuum Furnace Graphite Parts



Vacuum furnace graphite parts are parts made of special graphite used in the heat treatment process, such as heating elements, protective shields, hearth plates, insulation layers, etc. As an important equipment in modern material processing industry, vacuum heat treatment furnaces are widely used in metal, ceramic, powder metallurgy and other fields.

As the heating and insulation furnace liner of vacuum furnace for heat treatment needs to work under vacuum and high temperature conditions, while graphite has the special property that its strength increases as the temperature rises. Besides, it is easy to machine, has high precision and low coefficient of linear expansion and can maintain its dimensional stability at high temperatures, making it the preferred material as the internal components in the vacuum furnace for heat treatment.

If you need high quality vacuum furnace graphite part solutions, we will provide you with professional technical support and service.

XURAN

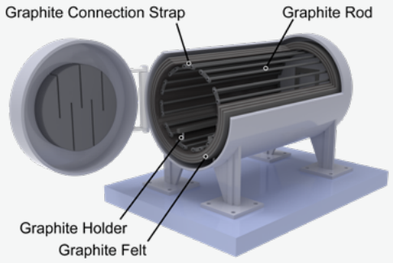
Features

- **Good high temperature stability:** Graphite has good high temperature resistance and can maintain stable performance under high temperature conditions without deformation or cracking.
- **High corrosion resistance:** Graphite has high corrosion resistance and can be used in harsh environments such as strong acids and bases without being corroded or oxidized.
- **Good thermal conductivity:** Graphite has good thermal conductivity and can transfer heat quickly , making the heat treatment process more uniform.
- **Excellent wear resistance:** Graphite has high wear resistance and can maintain stable performance under high temperature and high pressure environments for a long period without damage or wear.

Related Introduction: About Heat Treatment and Vacuum Furnace

Heat treatment is a process of changing the physical and chemical properties of materials through heating and cooling. A vacuum furnace is a device in which heating and treatment can be performed in an oxygen–free or low–oxygen environment. In the heat treatment process, using a vacuum furnace can effectively reduce oxidation reactions, avoid the influence of the oxide layer on the material surface on material properties, and also protect material surface from contamination.

In a vacuum furnace for heat treatment, the heating zone is the key part for heating and treatment. This zone is mainly composed of heating elements (graphite rods and connecting pieces), insulation layers (graphite felt), and the hearth bottom (graphite holder). In the vacuum furnace, graphite heating elements are heated to high temperature and then transfer heat energy to the heated object through radiation, convection and conduction methods, thus making it achieve the desired temperature. This heating method has advantages of high efficiency, uniformity, and energy–saving, and can effectively improve the physical and chemical properties of materials.



Thermal Field Graphite Parts

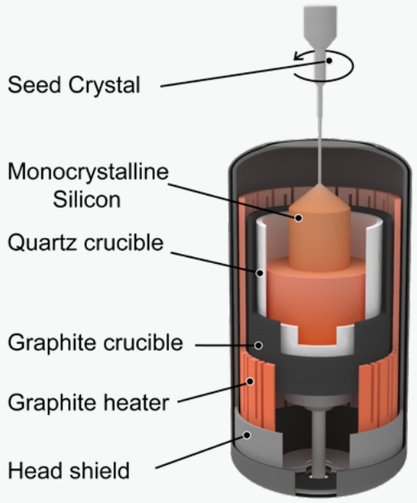
In the photovoltaic industry, thermal fields are indispensable consumables. While graphite materials have excellent high temperature resistance, good electrical & thermal conductivity, so they are widely used in the photovoltaic industry to produce thermal field graphite parts. In the czochralski single crystal furnace, commonly used thermal field graphite parts include crucibles, insulation barrels, and protective plates. In the polycrystalline casting furnace, commonly used thermal field graphite parts include casting dies & molds, casting trays, and insulation barrels. The function of these graphite parts is to support and protect monocrystalline or polycrystalline silicon, to ensure the stability and purity of the molten liquid during the preparation process. Meanwhile, these thermal field graphite parts have excellent corrosion resistance and mechanical strength, and can work stably in high temperature and harsh environments for a long time.

Features

- **High temperature stability:** Graphite has good high temperature resistance and can maintain stable performance under high temperature environments and is not easy to deform or crack.
- **Corrosion resistance:** Graphite has good corrosion resistance, and can be used in strong acids, strong bases and other harsh environments and will not be corroded or oxidized.
- **High purity:** As the purity of graphite material rises, its performance tends to more stable accordingly and can meet the requirements of the photovoltaic thermal field on material purity.
- **Thermal conductivity:** Graphite has good thermal conductivity and can transfer heat quickly, which makes the production process of solar cells in photovoltaic thermal fields more efficient.
- **Wear resistance:** Graphite has excellent wear resistance and can maintain stable performance under high temperature and high pressure for a long time, and is not easy to be damaged or worn.

Graphite Parts in Photovoltaic Thermal Fields

The thermal field system is a key device for preparing monocrystalline silicon and polycrystalline silicon. Photovoltaic thermal field graphite parts have important applications in czochralski single crystal furnaces and polycrystalline casting furnaces. For example, graphite crucibles can carry and protect quartz crucibles to ensure the stability and purity of the molten liquid during the preparation process. The insulation barrel can maintain the temperature of the molten liquid to ensure the stability of the temperature during the growth process of monocrystalline silicon or polycrystalline silicon. The protective tray can protect other parts of the thermal field system to ensure the stability and lifespan of the thermal field system.



Aluminum Degassing Graphite Rotor

Aluminum degassing graphite rotor is a part of aluminum alloy smelting equipment, which can help remove hydrogen and oxidation residues. Aluminum degassing is a process used in the manufacturing of aluminum alloy castings. During the aluminum and aluminum alloy smelting process, hydrogen generated by chemical reaction with water vapor diffuses into the molten aluminum, causing internal structural defects in aluminum products. To avoid this defect, most aluminum plants use dissolved gas flotation to purify the molten aluminum by injecting inert gases such as nitrogen and argon into the molten aluminum. As inert gas diffuses and rises, hydrogen is brought to the surface of the molten aluminum.

The aluminum degassing graphite rotor forms bubbles on the contact surface between the molten aluminum and inert gas, and increases the gas–liquid contact area, thereby accelerating the diffusion and removal of hydrogen. At the same time, the aluminum degassing graphite rotor can also adsorb and remove oxidization residues in the molten aluminum, and improve the quality and performance of the aluminum alloy.

Features

- High mechanical strength, low coefficient of thermal expansion and good thermal shock resistance
- Good chemical stability, and excellent resistant to acids, bases and organic solvents
- No wettability to meolten aluminum, and do not chemically react with aluminum

Specifications of Aluminum Degassing Graphite Rotor

Grade	Density (g/cm^3)	Particle Size	Specific Resistance (μΩ.m)	Porosity	Shore Hardness	Compressive Strength (MPa)	Flexural Strength (MPa)	CTE ($\times10^{-6}\,^{\circ}\,C^{-1}$)
GE-1	1.72	0.8/2mm	7.5	–	–	35	14	2.4
GE-2	1.60	0.8/2mm	9.5	–	–	25	10	2.9
MD-1 (Molded)	1.78	25μm	12	20%	48	80	40	5
IS-3 (Isostatic)	1.85	10μm	12	13%	48	85	46	4.3

Notes :
1 MPa = 10.2 kgf/cm^2; 1 W/m.k = 0.86 $^{k}cal/cm.h.^{\circ}C$
These properties are typical values and not guaranteed.

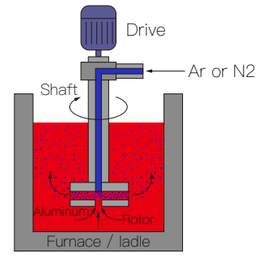
Special Treatment

- **Impregnation anti-oxidation treatment:** To extend the service life of the aluminum degassing graphite rotor shaft, we fill the pores of the graphite material with exclusive technology and nano-antioxidants, and cover the surface of the graphite rotor shaft to improve its heat resistance and anti-oxidation performance.
- **Coating anti-oxidation treatment:** Except for the threads, exclusive coating materials are applied to the impregnated anti-oxidation graphite rotor and shaft. The coating material does not penetrate into the aluminum, but adheres well to the graphite material. Due to its heat resistance, anti-oxidation, corrosion resistance, and abrasion resistance, the service life of the aluminum degassing graphite rotor and shaft is greatly extended after further coating treatment.
- **Based on the actual application of the user, we can strengthen the most vulnerable parts at the lowest cost to obtain the longest service life of the aluminum degassing graphite rotor and shaft.**

Working Principle

The working principle of the aluminum degassing graphite rotor is that the transmission system drives the graphite rotor to rotate, and inert gas (argon or nitrogen) is blown into the aluminum molten liquid through the rotor rod and nozzle. The high-speed rotating graphite rotor disperses the argon or nitrogen entering the aluminum molten liquid into many small bubbles, dispersed in the molten metal. When the bubbles contact each other, the bubbles in the molten liquid absorb hydrogen and oxidization impurities by relying on the gas pressure difference and surface adsorption principle, and are brought out of the molten liquid surface with the rise of the bubbles, thereby purifying the molten liquid.

Rotary degasser for molten aluminum



Semiconductor Graphite Parts

Semiconductor graphite parts are parts made of special graphite and used in the production process of semiconductors, including graphite consumables in the crystal growth thermal zone as well as high-precision graphite components in wafer processing equipment. As the core of modern electronics industry, semiconductors are widely used in the fields of computers, power supplies, LED, the Internet, solar cells, etc.

We have advanced machining equipment and technology, and can provide semiconductor graphite parts precision machining according to customer drawings and requirements to ensure product accuracy and quality. Meanwhile, we use high purity graphite material, and its ash content can be purified to 5 ppm that can perfectly meet the purity requirements of materials in the semiconductor manufacturing process.

Features

- **High purity:** We use high purity graphite material, and can purify the ash content to 5 ppm to meet the purity requirements of materials in the semiconductor manufacturing process.
- **High temperature resistance:** In the semiconductor manufacturing process, it requires high temperature processing. Our semiconductor graphite parts can withstand high temperature environments without deformation or breakage.
- **Corrosion resistance:** Chemical substances used in the semiconductor manufacturing process have strong corrosive properties. Our semiconductor graphite parts have good corrosion resistance and can operate stably for a long time.
- **Precision machining:** We have advanced machining equipment and technology, and can provide semiconductor graphite part precision machining according to customer drawings and requirements to ensure product accuracy and quality

Specifications of Semiconductor Graphite Part

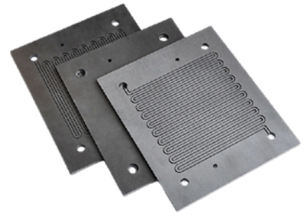
Model values	Density (g/cm^3)	Porosity (open) –	Grain Size (μm)	Hradness Rockwell B 5/100 (HRB)	Young's mouldus (Mpa)	Flexural Strength (Mpa)	Compressive strength (Mpa)	Specific electrical resistance (μΩ.m)	Thermal expension ($x10^{-6}k^{-1}$)	Thermal conductivity ($Wm^{-1}K^{-1}$)	Ash Value (ppm)
RC-6340	1.72	15%	15	80	11000	40	85	16	3.2	105	100
RC-6500	1.77	14%	10	70	10500	45	90	12	4.2	90	100
RC-6510	1.83	10%	10	90	11500	60	130	13	4.2	105	100
RC-6650	1.84	10%	7	95	12500	65	150	14	4.1	95	100

Notes :
We have the ability to purify ash content to 5 ppm. If you have purity requirements, please contact us.
1 MPa = 10.2 kgf/cm^2; 1 W/m.k = 0.86 ^{k}cal/cm.h.° C
These properties are typical values and not guaranteed.

Graphite Bipolar Plates

Graphite bipolar plate is one of the important components of fuel cells and it's mainly used to connect electrodes and electrolytes. Meanwhile, it has good electrical conductivity, thermal conductivity, permeability, and supports membrane electrodes. It is the backbone and foundation of fuel cells.

As the raw material for hydrogen fuel cell bipolar plates, graphite material is relatively thick and more stable. It has certain advantages in durability, corrosion resistance and electrical conductivity, and can withstand high temperature and high pressure environments. In comparison, metal materials are prone to corrosion and require special coating processes. Therefore, graphite material has certain advantages in the selection of bipolar plates for hydrogen fuel cells.



Features

- **High conductivity:** It structurally acts as a series connection of single cells.
- **Impermeability:** It isolates the reacting gas and cooling water in each chamber.
- **High thermal conductivity:** It can quickly transfer the heat generated in the reaction area to the cooling fluid.
- **High strength, low density, and high heat capacity:** It can meet the requirements of structural strength, vibration resistance, power density, and low-temperature start-up of the battery.

Specifications of Graphite Bipolar Plate

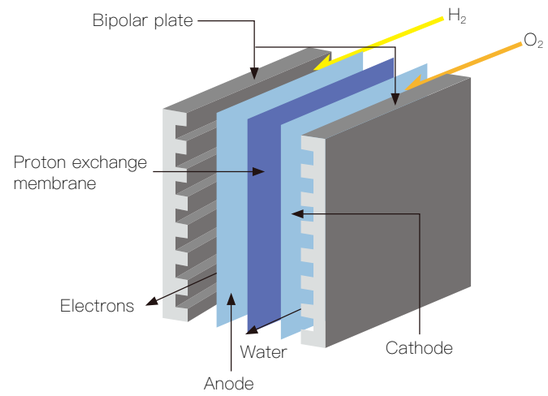
Model	Grain Size (μm)	Bulk Density (g/cm^3)	Compressive Strength (MPa)	Flexural Strength (MPa)	Specific Resistance (μΩ.m)	Shore Hardness	Air Leakage Rate(+100 KPa/100cm2) (sccm)
FC-1	15	1.92	135	75	12	55	≤ 0.1

Notes :
1 MPa = 10.2 kgf/cm^2; 1 W/m.k = 0.86 ^{k}cal/cm.h.° C
These properties are typical values and not guaranteed.

Working Principle

A hydrogen fuel cell is a device that generates electrical energy by utilizing the chemical reaction between hydrogen and oxygen. In a hydrogen fuel cell, bipolar plate serves as one of the main structural components of the cell.

The bipolar plate transports hydrogen and oxygen to the reaction zone of the cathode and anode, respectively, while isolating the reaction gases in each chamber. In the reaction zone, the hydrogen on the cathode is decomposed into protons (positively charged hydrogen ions) and electrons (negatively charged) through a catalyst. The protons reach the cathode through a polymer electrolyte membrane (PEM), while the electrons flow to the anode through an external circuit. At the anode, oxygen combines with protons and electrons through a catalyst to form water, while releasing electrical energy.



SIC Coated Graphite Tray

SIC coated graphite trays are generally made of high purity graphite as the matrix, and provide SIC coating with extremely high purity and theoretical density through CVD (chemical vapor deposition). The CVD SIC coating is very hard, and can be polished to a mirror-like surface. Besides, it has ultra-high purity and extremely high wear resistance. As the coated products have excellent performance in high vacuum and high temperature environments, so SIC coated graphite trays are very suitable for the semiconductor industry and other ultra-clean environments. They are mainly used as a substrate in the process of forming epitaxial layers on semiconductor wafers.

Features

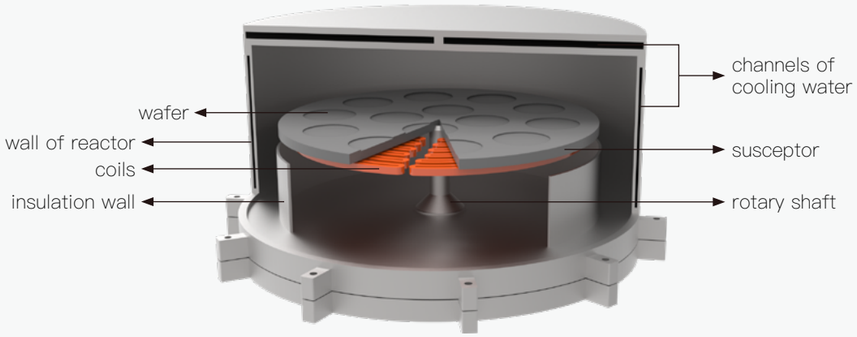
- Ultra-high purity
- Excellent thermal shock resistance
- Excellent physical impact resistance
- Machinability for complex shapes
- Excellent chemical stability
- Can be used in oxidizing atmospheres

Specifications of SIC Coated Graphite Tray

Projects	parameter
Apparent Density	1.85 g/cm^3
Electrical Resistivity	11 μΩ.m
Flexural Strenth	49 MPa (500 kgf/cm^2)
Shore Hardness	58
Ash	< 5 ppm
Thermal Conductivity	116 W/mK (100 kcal/mhr-°C)

Application

SThe SIC coated graphite tray is used as a base for fixing and heating semiconductor wafers during heat treatment. Energy can be absorbed and heat the chip through induction, conduction, or radiation, and its thermal shock resistance, thermal conductivity, and purity are essential for rapid thermal processing (RTP). In the silicon epitaxy process, the wafer is carried on a base, and the performance and quality of the base have a crucial effect on the quality of the wafer epitaxial layer.



Graphite Cluster Wheel

Graphite cluster wheel, also known as graphite oiling roller, is an accessory used in the textile machines. It is typically used in the glass fiber industry for the traction and transmission of glass fiber yarns. Its smooth surface helps to reduce the friction in the traction and transmission process, thereby reducing the loss and breakage of yarns.

In addition, graphite cluster wheel can withstand high temperature and high pressure, which is very important for the glass fiber industry as its processes often require to be carried out under high temperature and high pressure conditions.

Features

Graphite cluster wheel has high strength, high density, high purity, excellent self-lubrication, high temperature resistance, corrosion resistance, thermal shock resistance, good oxidization resistance, low impurity content and long lifespan, and is widely used in the glass fiber industry.

- **Thermal stability:** Specially design is carried out according to the rapid heating and cooling conditions of graphite molds to ensure the reliability of product quality.
- **Corrosion resistance:** The uniformly dense matrix design delays the degree of corrosion of the graphite mold.
- **Impact resistance:** Graphite can withstand high thermal shock intensity, so any process can be safely carried out.
- **High thermal conductivity:** High fixed carbon content ensures good thermal conductivity, shortens melting time, and significantly reduces energy consumption.
- **Metal contamination control:** Strict control of material composition ensures that the graphite mold does not pollute the metal during melting.
- **Quality stability:** The production technology and quality assurance system of high-pressure molding fully guarantee the stability of quality.

Specifications of Graphite Cluster Wheel

Model	Density (g/cm^3)	Particle Size (μm)	Specific Resistance (μΩ.m)	Porosity	Shore Hardness	Compressive Strength (MPa)	Flexural Strength (MPa)	CTE (× 10^{-6}° C^{-1})	Application
IS-3 (Isostatic)	1.85	10	12	13%	48	85	46	4.3	Sintering/ all kinds of machining
IS-4 (Isostatic)	1.90	5	12	13%	48	85	46	4.3	Sintering/ all kinds of machining
MD-1 (Molded)	1.78	25	12	20%	48	80	40	5	Sintering/ all kinds of machining

Notes :
1 MPa = 10.2 kgf/cm^2; 1 W/m.k = 0.86 ^{k}cal/cm.h.° C
These properties are typical values and not guaranteed.

Spectral Graphite Rod

Spectral analysis is a method that uses the spectrum emitted by elements or compounds for analysis. In spectral analysis, spectral graphite rod is used as an auxiliary electrode for liquid samples or poorly conductive samples. By using the spectral graphite rod as an electrode, ions already present in the sample are collected, and then the spectral graphite rod is heated to release energy, producing specific spectral lines to determine the chemical elements and their contents in the sample.

Spectral graphite rods can be applied in the fields of emission spectroscopy, atomic absorption spectroscopy, and gas analysis, and are an important component in many types of spectroscopy.

Features

- Good self-lubrication
- Great oxidization resistance
- Excellent chemical corrosion resistance
- High thermal conductivity and thermal stability
- High mechanical strength and impact resistance

Spectral Graphite Rod Technical Data

Model	Bulk Density (g/cm^3)	Compressive Strength (MPa)	Flexural Strength (MPa)	Specific Resistance (μΩ.m)	Ash Content (ppm)
SPC-1	1.7	40	35	8	≤ 5

Notes :
1 MPa = 10.2 kgf/cm^2; 1 W/m.k = 0.86 $^k cal/cm.h.^\circ C$
These properties are typical values and not guaranteed.

Specification of Spectral Graphite Rod

Size	Let's take MSS80 as an example
Grain size (mm)	0.025、0.045、0.80、2.00
Diameter (mm)	3、6、8、10、13、15
Length (mm)	300、310、360

Graphite Lubrication Column

Graphite lubrication column is a solid lubricant, typically made of high-strength and high-purity graphite. Its main role in embedded copper bearings is to reduce friction and wear of the copper bearings. Bearings are an important part of mechanical equipment, and their main function is to support and rotate mechanical parts, enabling the normal operation of the machinery. By using graphite lubrication columns, the performance of copper bearings can be improved, thereby extending their service life and reducing the frequency of maintenance and replacement required.

Features

Using graphite lubrication column in cooper bearings can have the following functions.

- **Reduce the friction of copper bearings:** Copper bearings generate friction during operation. Using graphite lubrication columns can reduce the friction of copper bearings, thus reducing energy consumption and heat generation.
- **Reduce the wear of copper bearings:** Copper bearings tend to wear out over time. Using graphite lubrication columns can effectively reduce the wear of copper bearings and extend their service life.
- **Improve the efficiency of copper bearings:** Using graphite lubrication columns can reduce the friction and wear of copper bearings, thus improving their efficiency and performance.

Specifications of Graphite Lubrication Column

Model	Density (g/cm^3)	Particle Size (μm)	Specific Resistance (μΩ.m)	Porosity	Shore Hardness	Compressive Strength (MPa)	Flexural Strength (MPa)	CTE ($\times 10^{-6}℃^{-1}$)	Application
IS-2 (Isostatic)	1.76	20	15	20%	60	95	50	5.9	Heat Exchanger/ All kinds of Machining
IS-3 (Isostatic)	1.85	10	12	13%	48	85	46	4.3	Sintering/ All kinds of Machining
IS-4 (Isostatic)	1.90	5	12	13%	48	85	46	4.3	Sintering/ All kinds of Machining
MD-1 (Molded)	1.78	25	12	20%	48	80	40	5	Sintering/ All kinds of Machining
MD-2 (Molded)	1.72	25	12	19%	45	60	32	5	Sintering/ All kinds of Machining
MD-3 (Molded)	1.56	25	12	23%	35	38	16	5	Sintering/ All kinds of Machining

Notes :
1 MPa = 10.2 kgf/cm^2; 1 W/m.k = 0.86 $^k cal/cm.h.^\circ C$
These properties are typical values and not guaranteed.

Graphite Solutions for Tomorrow's Innovations

XURAN NEW MATERIALS LIMITED

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