Harog
Technology



ZHEJIANG HAROG TECHNOLOGY CO., LTD.

FOCUS ON CARBON&GRAPHITE

Quality Management System: ISO 9001:2015 IATF 16949:2016

Health and Safety Management System: ISO 45001:2018

Environmental Management System: ISO 14001:2015

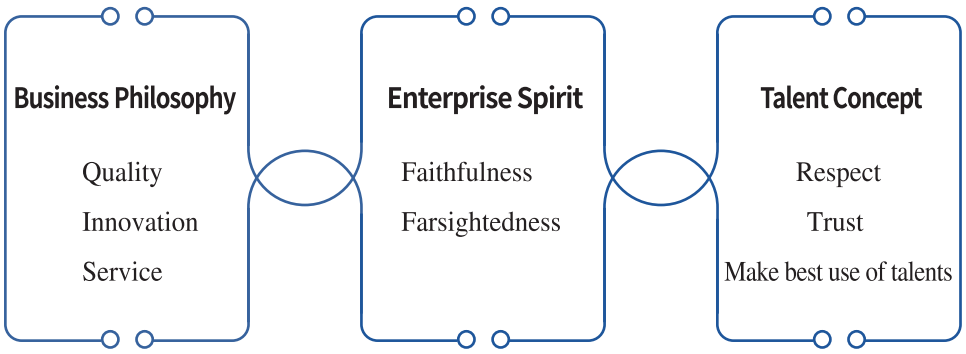
ABOUT US

Zhejiang Harog Technology Co., Ltd. is estabilished in april 2019. with a total investment of more than 500 million RMB possessing a factory of more than 80,000 m^2 located in Meishan Youth Science and Technology Park, Changxing County, Zhejiang Province, China.

With R&D center specialized in carbon & graphite materials and various department of fuel cell graphite bipolar plates, graphite modification (coating) and anti-oxidation graphite, semiconductor and PV graphite and thermal graphite sheet, Harog is dedicated to meet all your needs regarding carbon/graphite products.

Our R&D center has more than 50 staff and 80% of them are with titles as doctor, master, bachelor and engineer. We have a full production line that is capable of producing products from materials like carbon, graphite, carbon fiber and CFC(carbon fiber composite).

What we mainly produce are: PECVD graphite boats, fuel cell graphite bipolar plates, PGS (pyrolytic graphite sheet) thermal graphite sheets, graphite products in semiconductor field, graphite electrodes, graphite molds, graphite sealing parts, ingot casting products, CFC products, graphite felt, etc.. Meanwhile we also sell imported graphite raw materials.




华熔科技





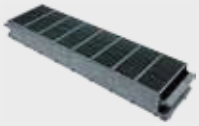




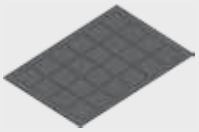








PECVD Graphite Boats



Carbon Fiber Composite



HAGS Conductive Graphite Sheet



Anti-oxidation Graphite



Graphite for Semiconductor Application



MOCVD Graphite Wafer



Industrial Printer Nozzle (Graphite)



Fuel Cell Graphite Bipolar Plates



High-end Specialty Isostatic Graphite

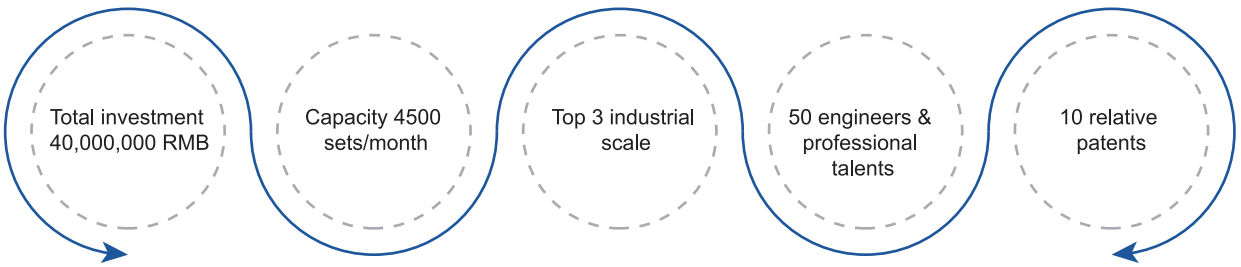


Carbon Fiber Felt

PECVD Graphite Boats

PECVD is short for Plasma Enhanced Chemical Vapor Deposition

Harog team has rich experience in producing, researching as well as technology developing. We are able to develop, design and produce whole graphite boats, relative accessories, tooling fixtures etc., meanwhile we also provide services of installing, repairing, outsourced maintenance and training.







Aa Core Technology of Graphite Boat

- The secondary purification process directly improves the purity of the material. Under long-term working conditions, the resistivity of each point of the graphite boat still maintains excellent uniformity, ensuring uniform current, reducing the color difference of the coating, and effectively slowing down the oxidation of the graphite boat, and eventually improving the service life.

- The C-coating process gives the surface of the boat plates perfect flatness and smoothness, enlarging the contact area between the graphite plates and the silicon wafers, therefore increasing the times of use and eventually prolonging the service life of the entire graphite boat.

- The balance processing technology eliminates the internal stress of the graphite boats to the greatest extent, the boats will not easily deformed after long-term use, effectively reducing thermal expansion by more than 80%.





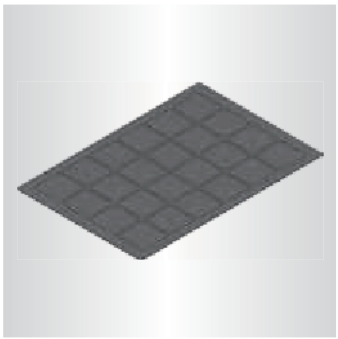
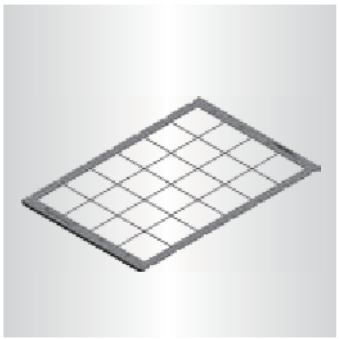
Bb Core Indicators of Graphite Boat

Technical Parameter	Unit	Data
Density	g/cm^3	1.87
Specific Resistance	μΩm	13
Flexural Strength	MPa	72
Ash content	PPM	25
CTE	1E−6 /℃	4.7
Piece Tolerance	mm	±0.01
Thermal Expansion	mm	⩽0.2
Grain Size	μm	7
Shore Hardness	HSD	70

Carbon Fiber Composite

A composite material formed by using carbon fiber or carbon fiber fabric as the reinforcement and resin, ceramic, metal, carbon or rubber as the matrix. Light weight, high mechanical strength and good elasticity. Widely used in electronics, environment and energy, aerospace, general industrial furnaces, automotive and other transportation fields.

- **Main Performance** HIGH mechanical strength, HIGH elasticity and HIGH toughness
- **Heat Resistant** Working temperature≥2000℃
- **Light in Weight, Easy to Handle** Density 80% lower than steel, ideal for lightweight design
- **High Thermal Conductivity** Higher than copper


Core Indicators of Carbon Fiber Composite

Technical Parameter	Unit	Data
Density	g/cm^3	1.6
Elasticity Modulus	GPa	70
Flexural Strength	MPa	≥200
Interlaminar Shear Strength	MPa	8
Working Temperature	℃	2000(3600)

HAGS Conductive Graphite Sheet

· Artificial thermally conductive graphite sheet is a new type of film material made of sintered polyimide film, which has thermal conductivity and excellent product design flexibility.

· The in-plane thermal conductivity number can reach up to 2200 W/m-k.



Aa Characteristic of HAGS Conductive Graphite Sheet

·Thermal conductivity up to 2200w/m-k
·Super light, super thin
·Easy to process and flexible to use

Bb Use of HAGS Conductive Graphite Sheet

Synthetic graphite thermal materials have been used widely in communications, medical devices, laptops, cell phones, PDP, PC memory modules and LED substrate.

Cc Technical Parameter of HAGS Conductive Graphite Sheet

Thickness (mm)		10um	17um	25um	35um	40um	70um
		0.010+0.002	0.017+0.002	0.025±0.003	0.035±0.005	0.04±0.005	0.07±0.01
Thermal Conductivity	axis X-Y (w-mk)	2000–2200	1700–1900	1600–1900	1500–1700	1500–1650	1100–1450
	axis Z (w-mk)	15~20	15~20	15~20	15~20	15~20	15~20
Density	(g/m^3)	>2.1	>2.1	>2.1	1.8–2.0	1.8–2.0	1.55–1.7
Hardness	(shore A)	85	85	85	85	85	85
Tensile Strength	(psi)	650	650	650	650	650	650
Heat Temperature	(℃)	400	400	400	400	400	400
Thermal Resistance	(℃)	450	450	450	450	450	450
Electrical Conductivity	(s/cm)	20000	20000	20000	20000	20000	20000

*The thermal conductivity above is measured by a third-party testing agency (Netzsch, Germany) using laser scattering method.

*The heat temperature indicates the one of non processed products (graphite sheets)(PET film excluded)

Anti–oxidation Graphite

In the hot bending mold industry, glass production and other industries, the working temperature is relatively high, and graphite will gradually oxidize in the air at 450°C. It is necessary to modify graphite to ensure the uniform performance and durability of graphite under high temperature conditions.



1200°C Anti-oxidation Comparison

Aa Core technology of oxidation-resistant graphite

Harog Technology independently researches and develops impregnants, with superior formula and material composition, and has a whole graphite anti-oxidation modification production line, advanced anti-oxidation technology, and the graphite density has been increased from 1.8g/cm³ to 2.0g/cm³. When the conventional anti-oxidation temperature is increased from about 600 ℃ to 1200 ℃, the mass loss ratio is reduced by 98%.



Bb Core Indicators of Anti-Oxidation Graphite

Technical Parameter	Unit	Data
Density	g/cm³	2.0
Specific Resistance	μΩm	13
Flexural Strength	MPa	80
CTE	1E–6 /℃	4.9
Antioxidant Temperature	℃	1200
Mass Loss Ratio	%	2

Graphite for Semiconductor Application

The application of graphite in semiconductors mainly includes Czochralski process and ion implanter. Harog Technology has advanced production testing equipment and a class 1000 cleanroom. At the same time, we have stable top-level material suppliers and secondary purification suppliers to ensure product performance and quality stability. The team has strong technical strength, with a dozen of specialized technical talents and engineers, our research and development capabilities are at the forefront of the industry.





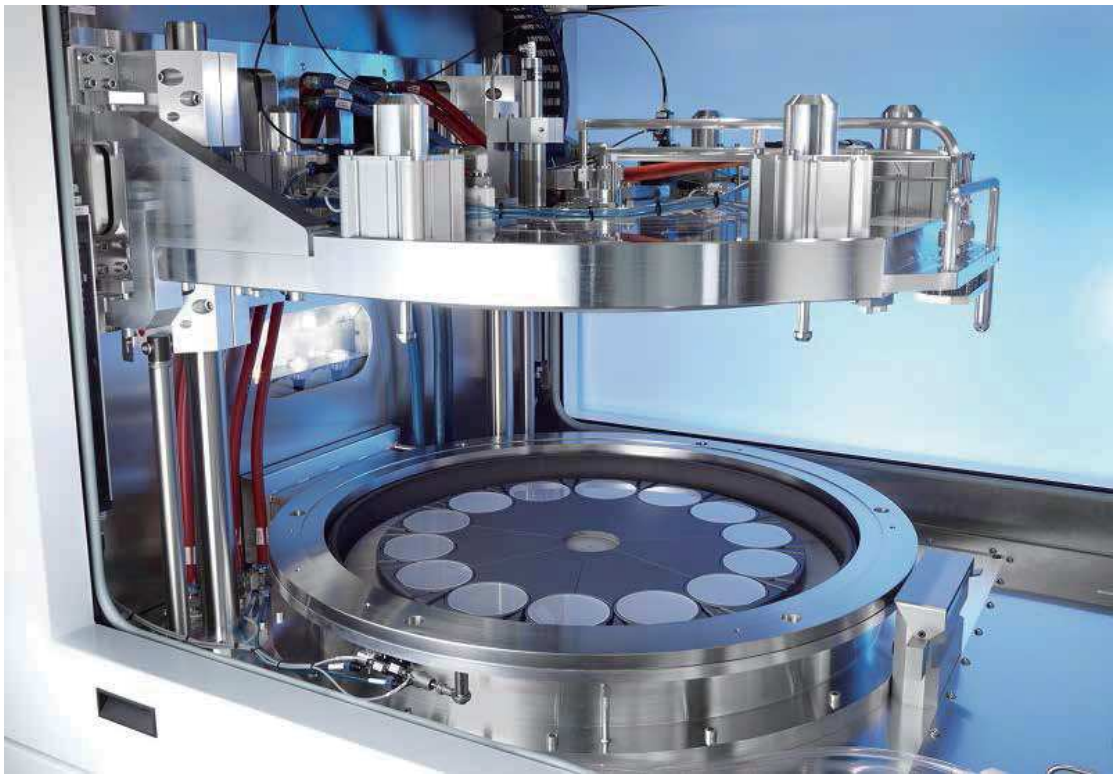


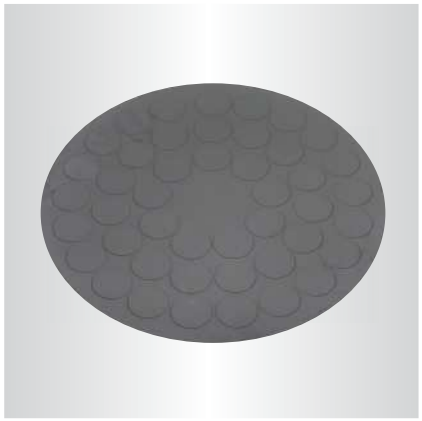
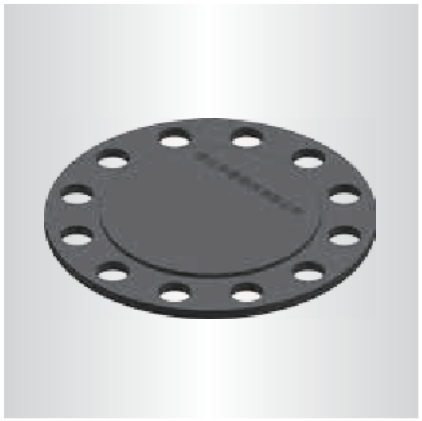
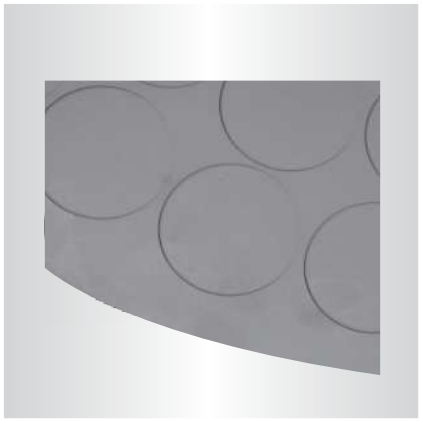
Core Indicators of Graphite for Semiconductor Application

Technical Parameter	Unit	Data
Density	g/cm^3	1.82
Specific Resistance	μΩm	⩽12
Flexural Strength	MPa	⩾60
Compressive Strength	MPa	⩾125
Ash Content p30	PPM	⩽10
Ash Content p5	PPM	⩽2
Shore Hardness	HSD	75

Graphite Wafer Carrier for MOCVD

MOCVD is short for Metal Organic Chemical Vapor Deposition)。
As the market for compound semiconductor devices such as GaAsMMIC, InPMMIC, and GaN blu-ray LED continues to expand, the demand of MOCVD systems continues to grow. In the epitaxial coating process of MOCVD reaction equipment, the performance of MOCVD base material has a very important influence on the coating. The choice of susceptor graphite material and the processing technology have a close influence on the SiC coating. Factors including material purity, hardness, coefficient of thermal expansion and thermal conductivity are all very important.



Core Indicators of Graphite Wafer Carrier for MOCVD

Technical Parameter	Unit	Data
Density	g/cm^3	1.83
Specific Resistance	μΩm	13
Flexural Strength	MPa	60
Ash Content	PPM	⩽5
CTE	1E–6 /℃	4.9

Industrial Printer Nozzle (Graphite)

Harog Technology has complete processing technology and graphite modification capabilities, and the properties of flatness, position, and finish can meet customer technical requirements, so that the nozzle liquid flow can be controlled more smoothly.



Aa Core Technology of Industrial Printer Nozzle



◦Position deviation ⩽7μm, to ensure more accurate liquid flow positioning

◦Processing capacity of cross section>1000 small holes with a diameter of 0.23mm

◦Flexural strength of ⩾70MPa, compressive strength of ⩾130PMa, to ensure longer service life



Carbon Fiber Felt

Example 1: QH-P 014 < carbon fiber felt, the carbon fiber is PAN carbon, with bulk density of 0.14g/cm³
M R S

Example 1: QH-Y 008 < carbon fiber felt, the carbon fiber is rayon carbon, with bulk density of 0.08g/cm³
M R S

M-product type H-carbon fiber felt R-felt type P-PAN carbon Y- rayon carbon S-bulk density of felt 008-014 0.08-0.14g/cm³





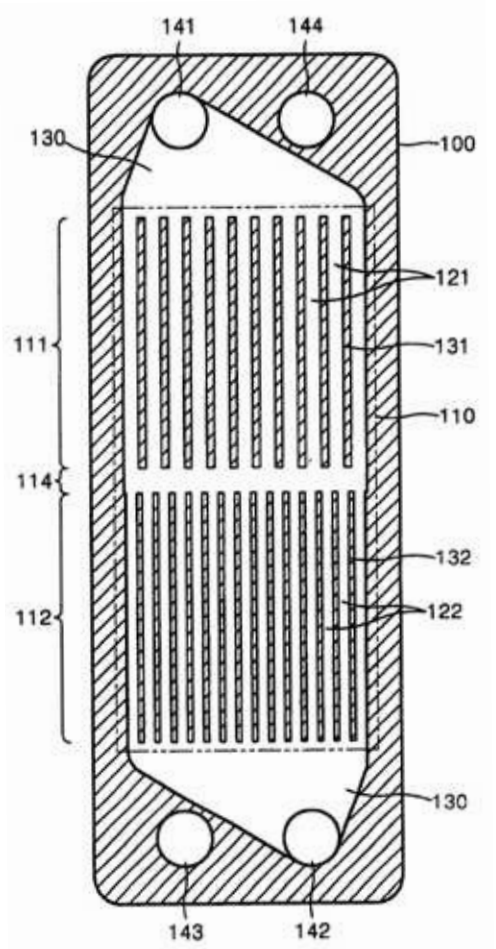
Aa Core Indicators of Carbon Fiber Felt

Technical Parameter	Unit	PAN Carbon	Rayon Carbon
Density	g/cm³	0.08–0.14	0.08–0.14
Working Temperature	℃	2000–2200	2000–2200
Ash Content	PPM	≤300	≤300
Thermal Conductivity	W/(m.k)	0.12–0.16	0.08–0.12

Fuel Cell Graphite Bipolar Plate

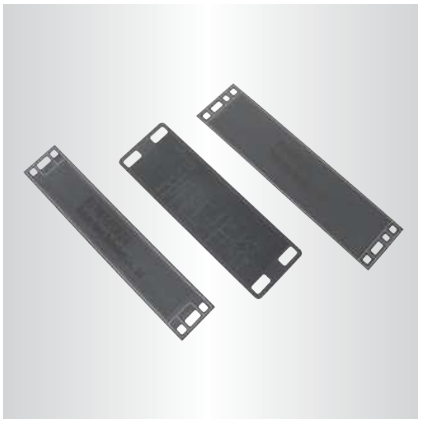
Fuel cell is a new type of zero-emission clean energy system device. It is a new energy product that is supported and vigorously promoted by the state. It is also one of the internationally recognized ultimate solutions for clean energy in the future. It has a broad market prospect. Graphite bipolar plates are one of the core components of the system.

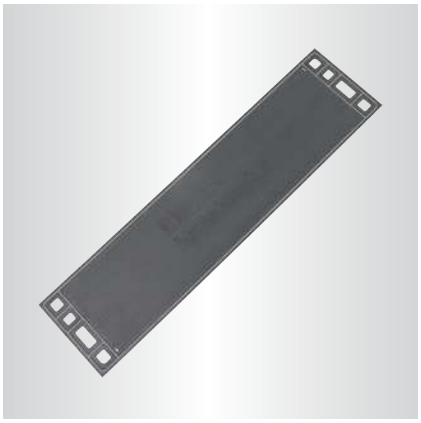
Harog graphite bipolar plate has its own patented technology (patent number: ZL202020200681.7), and its production process and application effect are both exceptional. In particular, the successful research and development of ultra-thin graphite bipolar plate will significantly increase the power per liter of the fuel cell and greatly reduce the weight of the system.



Core Technology of Fuel Cell Graphite Bipolar Plate

- Special plugging process and exclusive formulation of graphite modifier to ensure zero leakage under operating conditions for more than 20,000 hours
- Special surface processing technology to ensure contact resistance ⩽ 5mΩcm²
- Exclusively designed and developed large-area bipolar plate, the power per liter is greatly improved
- Light milling process, the plate can be as thin as 0.5mm (milling on one side)/0.8mm (milling on both sides)





Bb Core indicator of graphite bipolar plate for fuel cell:

Technical Parameter	Unit	Data	Note
Density	g/cm³	⩾20	100% inspection
Electrical resistivity	μΩm	⩽10	
Flexural Strength	MPa	>60	
Compressive Strength	MPa	>130	
Shore Hardness	HSD	>70	
Boundary Wall Thickness	mm	⩾0.3	
Air Permeability (@220kpag)	Sccm	<0.1	
Contact resistance	mΩcm²	⩽5	
Glycol compatibility	/	Excellent	
Acid resistance	/	Excellent	
Metal ion content	ppm	≤50	
Working life	h	>30000	
Applicable temperature	℃	-55-200	
Verification Test from Clients			
Fuel cell environmental cabin simulation working conditions (50% ethylene glycol + 50% deionized water mixed solution)	-35℃---95℃	Clients verify high and low temperature and cooling chamber with pressure (pressure 50kpag) cycle test (>1000h), no leakage	Boundary wall thickness 0.4mm
Bipolar plate 100°C water boiling experiment	5000h	No leakage	Boundary wall thickness 0.4mm
5000h power attenuation	%	<20	Boundary wall thickness 0.4mm

High–end Specialty Isostatic Graphite



Aa Technical Parameter of Ha01

Mainly used in mobile phone hot bending dies, high-end EDM

Technical Parameter	Unit	Data
Density	g/cm³	1.9
Grain Size	μ	2–3
Flexural Strength	MPa	65
Compressive Strength	MPa	130
Elastic Modulus	GPa	12
CTE	1E–6 /℃	4.0
Shore Hardness	HSD	75

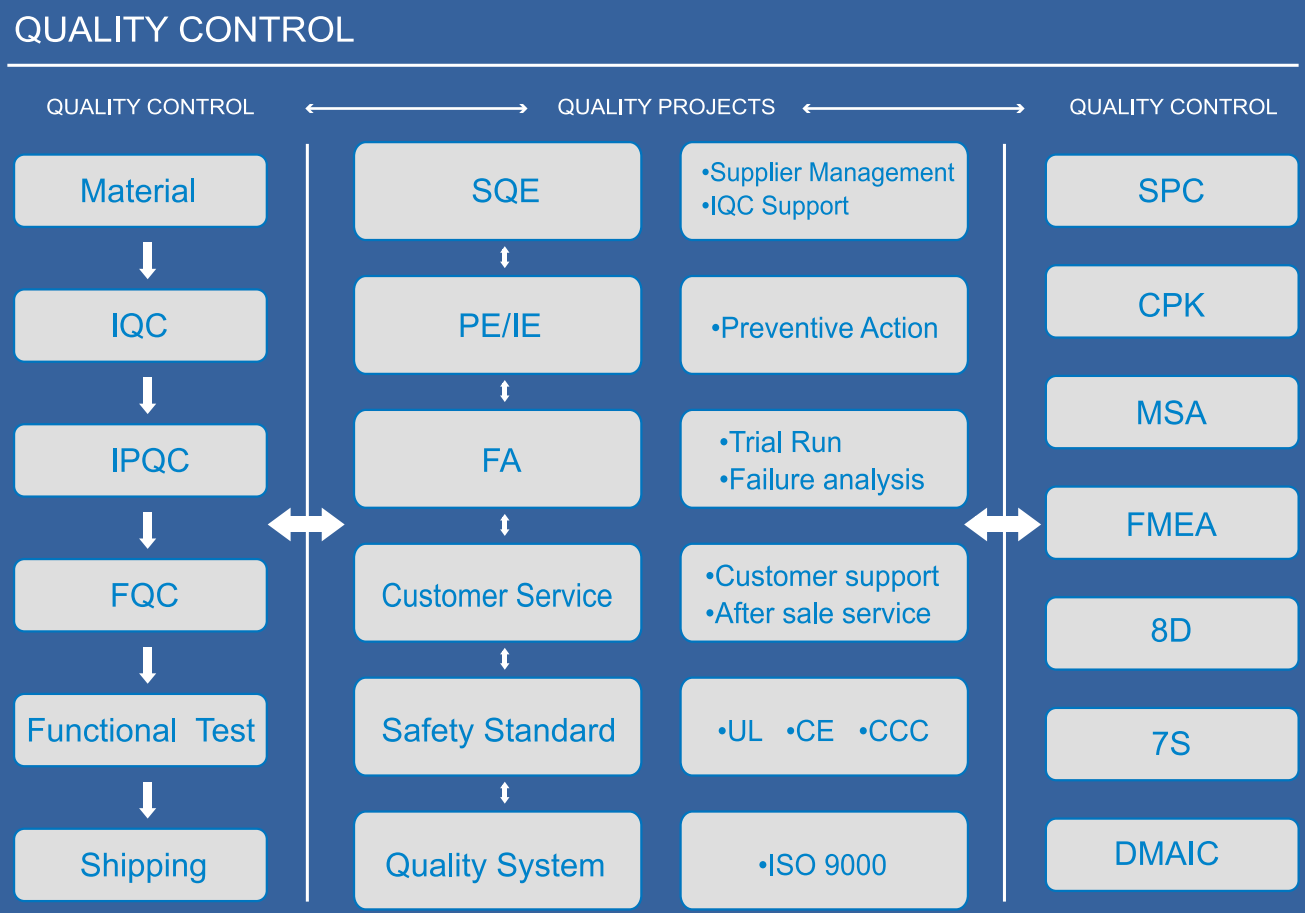
Bb Technical Parameter of Ha02

Mainly used in Graphite Wafer Carrier for MOCVD, photovoltaic graphite boat for PECVD

Technical Parameter	Unit	Data
Density	g/cm³	1.85
Grain Size	μ	7
Flexural Strength	MPa	65
Compressive Strength	MPa	130
Elastic Modulus	GPa	12
CTE	1E–6 /℃	4.8
Shore Hardness	HSD	69

Total Quality Control

- *Cultivate the quality concept of the whole company*
- *Be partners with suppliers*
- *Set up the design and quality standard for products based on customer requirements*
- *Implement the quality management training*
- *Establish standardized measurement indicators*
- *Control the cost reasonably*



Leading Manufacturer of High-end Graphite Products

Business Philosophy: Quality, Innovation and Service

Enterprise Spirit: Faithfulness and Farsightedness

Talent Concept: Respect, trust and make best use of talents

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