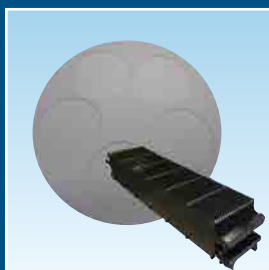
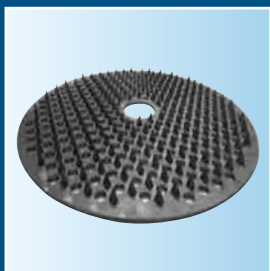


阿泰克的石墨制品

Specialty Graphite Made By Chengdu Artech



成都阿泰克特种石墨有限公司

Chengdu Artech Specialty Graphite Co., Ltd

公司简介

成都阿泰克特种石墨有限公司成立于 2002 年，是一家专门从事碳石墨加工的公司。我们的经营理念是清晰的，即无论是现在还是未来我们都一如既往地专注于碳石墨产品的加工制造，为以下关键工业领域的客户提供可靠的高品质的碳石墨产品。

- 光伏，电子及半导体
- 高温及真空电炉
- 传统工业（如有色冶金，模具制造，玻璃石英，（玻）光纤，电解（镀），水泥，人造金刚石工具等）
- 汽车及机械领域（如制造机械密封，真空泵及压缩机等）
- 电气工程用碳石墨（如电机用碳刷，机车的接地装置以及受电弓用碳滑板等）

阿泰克公司已取得了 ISO 9001:2008 质量认证。

Company Profile

Founded in 2002, Chengdu Artech Specialty Graphite Co., Ltd. is sole focused business, now and future in machining and supplying of reliable and qualified carbon and graphite items. We are totally committed to the development of carbon and graphite products to support key market development in following industrial fields which is our clear vision and philosophy.

- Photovoltaic, Electronics and Semi-conductor
- High Temperature and Electrical Vacuum Furnaces
- Conventional Industries (e.g. manufacturing of non-ferrous metals, molds, glass and quartz, optical and glass fiber, electrolysis and electroplating, cement and artificial diamond tools etc.)
- Automobile and Mechanical Applications (e.g. Manufacturing of mechanical seals, vacuum pumps and compressors etc.)
- Electrical Carbon (e.g. Making and supplying of carbon brushes for motors, grounding devices for rolling stocks and carbon current collectors for the pantographs etc.)

Artech are certified with ISO 9001:2008.



为何要选用石墨制品？ Why Choosing Graphite ?

石墨以下所列优异的材料性能决定了它在各个工业领域中所起的不可或缺的重要作用。石墨的优异性能主要表现在有

To have following outstanding properties which made graphite as an indispensable key material been widely used in so many different industries, which could be listed as below:

- 很高的热稳定性 /High thermal stability
- 良好的导电性 /Good electrical conductivity
- 良好的导热性 /High thermal conductivity
- 很好的耐热冲击性 /High resistance to thermal shock
- 很好的耐化学腐蚀性 /High resistance to corrosion
- 高纯度 /High purity
- 低浸润性 /Low wettability
- 良好的机械强度 /High mechanical strength
- 良好的自润滑性 /Good sliding properties

石墨的优异性能 Outstanding Properties of Graphite

密度 / Density

石墨单晶的理论密度是 2.26 g/cm^3 ，通常人造石墨的密度都在 $1.50\text{-}1.90 \text{ g/cm}^3$ 之间，固体热解碳的密度可达 2.1 g/cm^3 。纯石墨的密度值是其质量除以其体积（含所有的气孔）所得的商。

The theoretical density of monocrystalline graphite is 2.26 g/cm^3 . The density of artificial graphite is typically 1.5 up to 1.9 g/cm^3 and 2.1 g/cm^3 for solid pyrolytic carbon. The density of the highly pure graphite grades is defined as quotient between mass and volume including all pores.

开口气孔率 / Open Porosity

开口气孔率是石墨整体的组成部分，可用液体填充（如浸渍沥青，树脂或是熔融的金属等）。其定义可按 DIN 51918 标准所述。

The open porosity is that part of the whole volume which can be filled with liquid (e.g. impregnated with pitch, resin or melted metals). It is determined according to DIN 51918.

可加工性 / Machinability

石墨容易加工，其边缘强度和耐磨性好。结构复杂，公差要求严的部件都可以通过精加工获得。

Graphite can be machined easily, edge strength and abrasion resistance are high. Complicated parts with close tolerances can be machined with precision.

浸润性 / Wettability

石墨不会被熔融的玻璃或是大多数熔融的金属浸润。
Graphite is not wetted by molten glass or by most molten metals.

耐温性 / Temperature Resistance

石墨不会被熔化，但在 3900 K （约 3627 摄氏度）时会升华。在空气中，石墨能耐温至 750 K （约 477 摄氏度），高于这个温度石墨会被氧化，故在高温下，石墨应在真空或是有保护性的气氛中使用。

Graphite does not melt but sublimates at about 3900 K (around 3627°C). In air graphite is resistant to temperature up to about 750 K (around 477°C), it could be oxidized over this temperature, so graphite should be used either in vacuum or with protective gases under high temperature.

耐温变 / Resistance to Temperature Change

石墨具有非常好的耐热冲击性能。故快速地加热或是冷却石墨没有问题。

Graphite is extremely resistant to thermal shock, so rapid heating or cooling is not a problem.

石墨的优异性能 Outstanding Properties of Graphite

机械强度 /Mechanical Strength

不同于其它大多数的材料，石墨的抗张，抗折和抗压强度会随着温度的升高而增加，当达到 2700 K (约 2427 摄氏度) 之后，其强度会下降。在 2700 K 时，石墨的强度值较室温时要高一倍。(见图表 1)

Unlike most materials, the tensile, compressive and flexural strength of graphite increases as temperature increases to 2700 K (around 2427 °C) and above this temperature, strength falls. At 2700 K, graphite has about double the strength which it has at room temperature. (see diagram 1)

电阻 /Electrical Resistance

同其它金属不同，石墨电阻的温度系数是负数。石墨具有良好的导电性，接近绝对零度时，石墨只有少数几个自由电子充当绝缘体，随着温度的上升，石墨的导电性会增加。(见图表 2)

The temperature coefficient of electrical resistance of graphite is negative, unlike that of metals. Graphite has good electrical conductivity. Near absolute zero, graphite has only a few free electrons and acts as an insulator. As temperature rises, electrical conductivity increases.(see diagram 2)

导热性 /Thermal Conductivity

石墨的导热性较许多金属要好且其导热性会随着温度的升高而下降。石墨的导热性随着石墨石墨化程度的不同而有所不同。(见图表 3)

The thermal conductivity of graphite is higher than that of many metals and falls with increasing of temperature. The thermal conductivity of graphite varies with the degree of graphitization. (see diagram 3)

热膨胀 /Thermal Expansion

石墨的热膨胀系数在 $3 \times 10^{-6} \text{K}^{-1}$ 级别，因此它只相当于铁的四分之一。热膨胀系数随石墨牌号的不同而不同，也与其材料的各向异性和温度有关。(见图表 4)

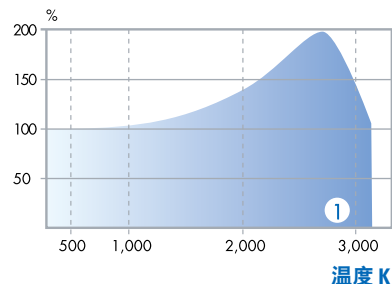
The coefficient of thermal expansion is in the order of $3 \times 10^{-6} \text{K}^{-1}$ and is, therefore, only about one quarter that of iron. It varies from grade to grade and is dependent on the anisotropic property of the material and the temperature. (see diagram 4)

比热 /Specific Heat

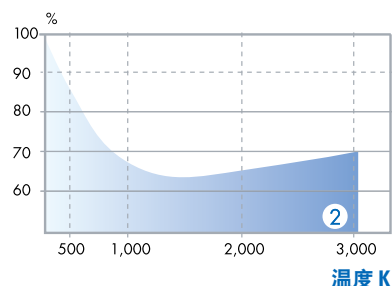
不同牌号的石墨其比热变化很小。(见图表 5)

Graphite grades differ only little in their specific heat. (see diagram 5)

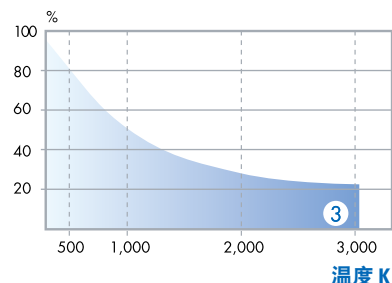
机械强度 /Mechanical Strength



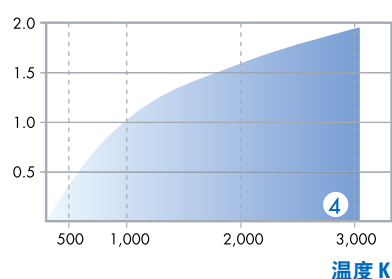
电阻 /Electrical Resistance



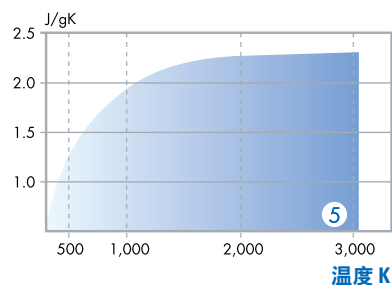
导热性 /Thermal Conductivity



热膨胀 /Thermal Expansion



比热 /Specific Heat



纯度 /Purity

不同的用途对石墨灰分的要求会有所不同。石墨的灰度可被纯化至 20-30 ppm (对石墨坯料而言) 或是小于 5 ppm (只针对加工好的成品)

Purity of graphite can be varied on different applications. Graphite can be purified to 20-30 ppm (in block) or less than 5 ppm for the finished items.

纯化后石墨中微量元素的含量如下表 /Typical Analysis of Element Concentration After Purified (in ppm)

石墨的灰分含量 Ash Content of Graphite	AL	B	Ca	Co	Cr	Cu	Fe	K	Mg
500 ppm	10-20	5-10	30-50	0.1-0.2	0.1-0.3	1-2	10-30	1-2	1-5
30 ppm	0.1	1	1	0.1	0.1	0.2	0.5	1	0.15
5 ppm	0.01	0.02	0.01	0.01	0.01	0.01	0.02	1	0.01
石墨的灰分含量 Ash Content of Graphite	Mn	Na	Ni	P	S	Si	Ti	V	Zn
500 ppm	0.1-0.3	1-5	1-3		10-20	30-50	10-20	10-20	<0.1
30 ppm	0.1	1	0.1	0.3	2	2	0.5	0.2	<0.1
5 ppm	0.01	1	0.02	0.3	2	0.5	0.01	0.02	<0.1
石墨的灰分含量 Ash Content of Graphite	Ag	Gd	Li	Mo	Sn	-	-	-	-
500 ppm	<0.5	<0.01	<0.05	0.1-0.2	<0.1	-	-	-	-
30 ppm	<0.5	<0.01	<0.05	<0.1	<0.1	-	-	-	-
5 ppm	<0.5	<0.01	<0.05	<0.1	<0.1	-	-	-	-

热解碳涂层 /Pyrolytic Carbon Coating (PyC)

在石墨基料的表面作热解碳或是热解石墨的涂层是在高温、高压通入碳氢化合物（如甲烷或乙炔）的气氛中，用化学气相沉积的方法获得的。

各向异性的特点来自热解碳在平行于晶格层面的生长层。热解碳的最佳涂层厚度为 20-30 um, 在进行涂层前，石墨部件要倒钝锐边角并要经过纯化处理

A pyrolytic carbon or graphite coating on a graphite substrate is produced at high temperature and pressure in a hydrocarbon atmosphere (e.g. methane or acetylene) using the CVD process.

The anisotropic property comes from the growth of the pyrolytic carbon layer in parallel lattice planes. PyC coated graphite parts with optimum coating thickness of 20-30 um. Edges of graphite parts should be chamfered before coating and also purified before the coating.

热解碳的特点 /Properties of PyC

- 高密度 /High Density
- 无气孔 /No Porosity
- 高度各向异性 /High Anisotropy
- 平面光滑 /Smooth Surface

石墨的优异性能 Outstanding Properties of Graphite

碳化硅涂层 /Silicon Carbide Coating (SiC)

石墨部件可作碳化硅涂层，其原理是在高温和毫巴级的压力下通入硅烷和碳化物气体，用化学气相沉积的方法完成涂层的。所用石墨基材的热膨胀系数应与所作的碳化硅涂层的热膨胀系数相匹配。通常的涂层厚度在 50-100 um 之间

Silicon carbide is used as a coating for graphite parts. SiC coating are deposited from gaseous silicon and carbon compounds at high temperature in the millibar range (CVD process). The coefficient of thermal expansion of the graphite material must be matched to that of the SiC coating. The typical thickness of the SiC coating on graphite is 50-100 um.

碳化硅的特点 /Properties of SiC

- 低气孔率（获得适当的涂层厚度后，石墨部件的表面可被完全封盖住）

Low Porosity (graphite parts can be sealed completely by appropriate thickness of coating)

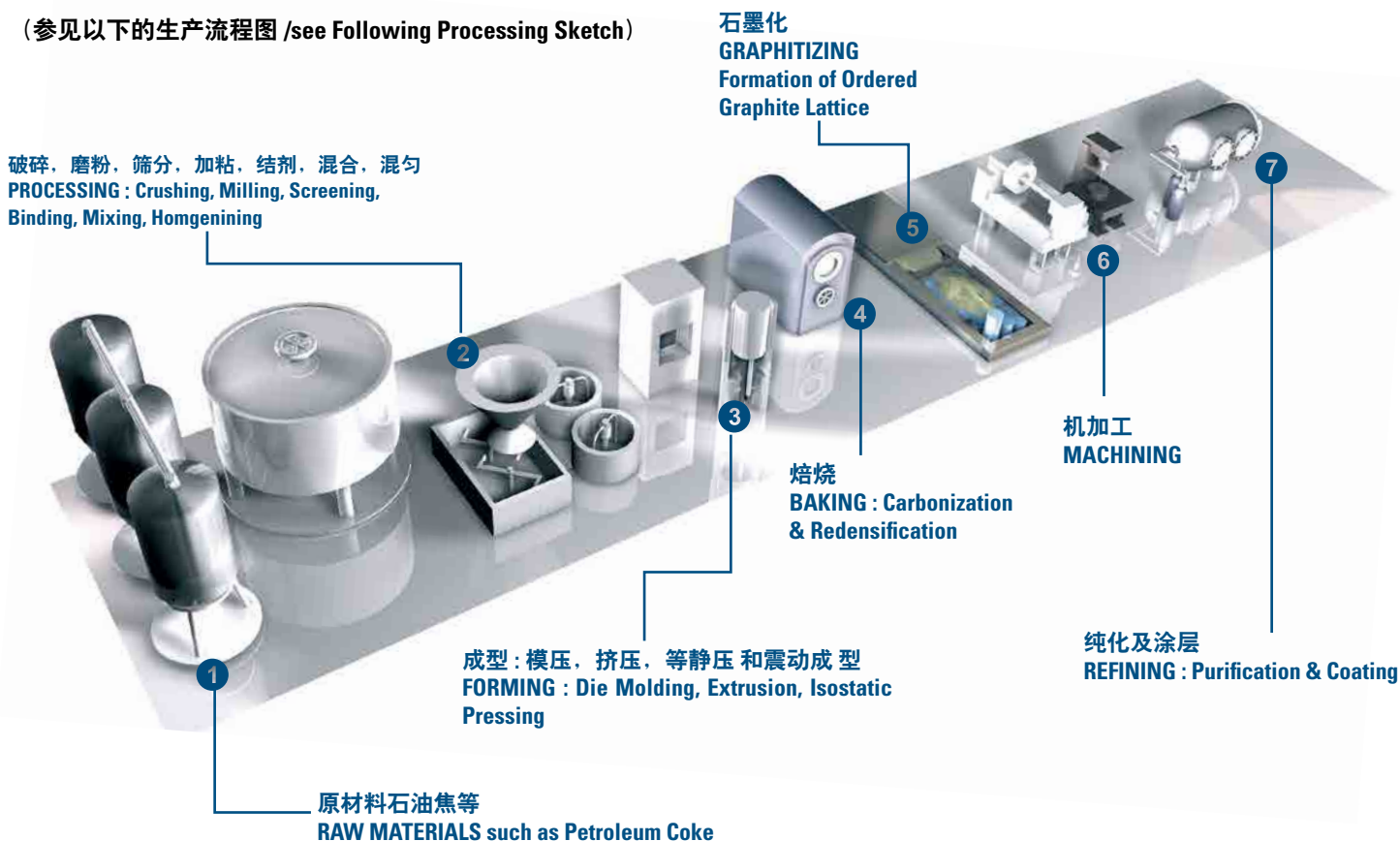
- 硬度高 /High Hardness Figure
- 导热好 /Good Thermal Conductivity
- 耐氧化 /High Oxidation Resistance
- 纯度高 /High Purity

在进行涂层前，石墨部件要倒钝锐边角并要经过纯化处理。典型用途如硅片外延用石墨舟，MOCVD 用石墨舟，石墨舟皿及快速热处理承载器等

Edges of graphite parts should be chamfered before coating and also purified before the coating. Typical applications such as epitaxy susceptors, MOCVD susceptors, boats, susceptors for rapid thermal processing (RTP).

石墨是如何制造出来的 How to Manufacturing of Graphite ?

(参见以下的生产流程图 /see Following Processing Sketch)



特种石墨的典型用途

Typical Applications of Graphite Specialities

光伏及电子半导体领域用石墨

Graphite for Photovoltaic, Electronics and Semiconductor Applications

在这个工业领域里，石墨制品的典型用途有：

Some typical applications in this field:

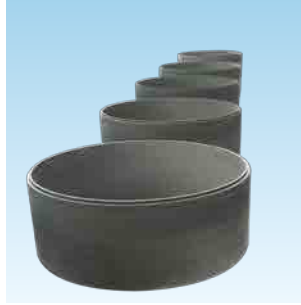
- 生产多晶硅用石墨热屏，石墨电极和石墨卡瓣，夹头
Graphite susceptors, graphite electrodes and carbon chucks for production of poly-silicon
- 铸造多晶硅用石墨热场
Graphite hot zones for casting of poly-silicon
- 拉制单晶硅，锗以及 III/V 族化合物单晶用石墨热场
Graphite hot zones for crystal pulling of silicon, germanium and III/V monocrystals
- 切单晶棒用石墨垫
Slicing beams of carbon and graphite for cutting monocrystal rods
- 区熔半导体材料和其它金属用的石墨舟皿和坩埚
Graphite boats & crucibles for zone refining semiconductor materials and metals
- 硅外延用石墨舟，液相外延用石墨舟，金属有机物气相外延用石墨舟和等离子体蚀刻化学气相沉积用石墨舟
Si epitaxy susceptors, graphite boat assemblies for liquid phase epitaxy (LPE), graphite susceptors for metal organic gas phase epitaxy (MOCVD) and PECVD graphite wafer trays
- 离子注入和等离子蚀刻用石墨
Graphite for ion implantation and plasma etching
- 电子束蒸发用石墨内衬
Graphite for electron beam evaporation (EBE)
- 钎焊及玻璃金属封接用石墨舟
Brazing and glass to metal sealing jigs of graphite



生产多晶硅的氢化炉用石墨热场
Graphite Hot Zone for Poly-silicon
Production



生产多晶硅用石墨隔热屏
Graphite Susceptor for Production of
Poly-silicon



生产多晶硅氢化炉用石墨内胆
Graphite Liner for Hydrogenation
Furnace of Poly-silicon Production

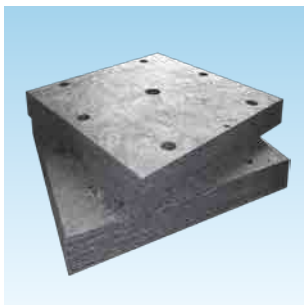


生产多晶硅用石墨卡瓣
Carbon Chuck for Production
of Poly-silicon

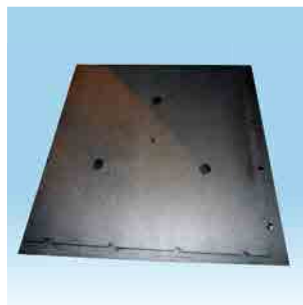
特种石墨的典型用途 Typical Applications of Graphite Specialities



多晶硅铸锭用石墨热场
Graphite Hot Zone for Poly-silicon Casting



多晶硅铸锭炉用的石墨热交换台
Graphite Heat Exchange Plate for Poly-silicon Casting



多晶硅铸锭用石墨硬毡
Graphite Rigid Felt for Casting of Poly-silicon



拉制单晶硅用石墨热场
Graphite Hot Zone for Monocrystal Pulling



拉制单晶硅用石墨加热器
Graphite Heater for Pulling of Mono-silicon



拉制单晶硅用三瓣式石墨坩埚
Graphite Crucible in Three Segments for Pulling of Mono-silicon



拉制单晶硅用石墨外导流筒
Graphite Outer Guide for Pulling of Mono-silicon



盘式石墨加热器
Graphite Heater



石墨加热器
Graphite Heater



石墨加热器
Graphite Heater



拉制蓝宝石单晶用石墨加热器
Graphite Heater for Pulling of Crystal Sapphire



拉制蓝宝石单晶用石墨毡保温桶
Graphite Felt Insulation Cylinder for Pulling of Crystal Sapphire



激光晶体材料用石墨加热体
Graphite Heater for Producing of Laser
Crystal Material



拉制蓝宝石晶体用石墨两瓣筒
Graphite Heater for Pulling of Sapphire



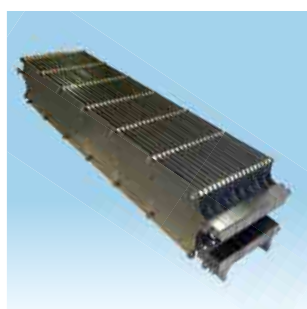
生产化合物晶体用石墨筒
Graphite Cylinder for Production of
Chemical Compound Crystal



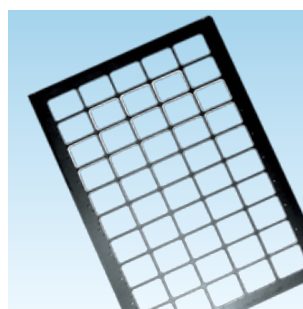
金属有机物化学气相沉积用石墨舟
MOCVD Carrier



金属有机物化学气相沉积用石墨舟
MOCVD Carrier



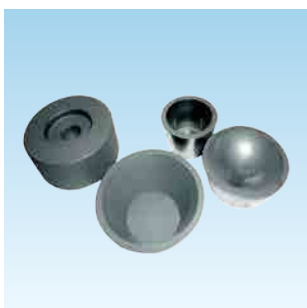
等离子体增强化学气相沉积石墨舟
PECVD Carrier



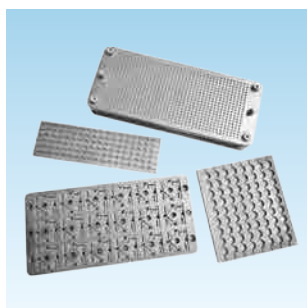
PECVD用CFC框架
CFC Carrier for PECVD



等离子体蚀刻用石墨电极
Graphite Electrode for Plasma
Etching Equipment



电子束蒸发镀膜用石墨坩埚
EBE Graphite Liner



二极管封接用石墨舟
Graphite Jigs for Brazing and
Glass-to-Metal Sealing



拉制光纤用石墨加热器
Graphite Heater for Pulling
of Fibre-optical



生产光电材料用石墨加热器
Graphite Heater for Producing of
Photoelectric Material

特种石墨的典型用途 Typical Applications of Graphite Specialities

高温及真空电炉用石墨

Graphite for High Temperature and Vacuum Furnaces

在这个工业领域里，石墨制品的典型用途有：

Some typical applications in this field:

- 石墨发热管（棒）
Graphite heating tubes (rods)
- 石墨电桥
Graphite bridges (connectors)
- 石墨屏（筒，箱）
Graphite susceptors
- 石墨紧固件
Graphite fasteners
- 烧结用石墨舟皿
Graphite sintering boats and plates
- 保温用石墨软毡和硬毡
Graphite soft felt and rigid felt for thermal insulation
- 碳纤维增强碳材料制成的热处理用装料架
Charging trays made of CFC materials for heating treatment
- 碳绳
Carbon cords
- 石墨箔和石墨垫片
Graphite foils and graphite sheets

使用金属或是陶瓷作为加热元件，通常真空电炉的使用温度限制在 2000 度以下，而采用石墨作为发热元件的真空电炉可被用至 2200 度，若是在有还原性或是惰性气体的保护气氛中可被用至 3000 度。

Whereas the use of metal and ceramic heating elements is usually limited to about 2000 °C ,specialty graphite material can be used for the entire range of temperature up to 2200 °C and it can be used up to 3000 °C under non-oxidizing, reducing or inert protective atmospheres.

允许的最大电负荷是由电炉的使用温度决定的。我们建议当炉温在 1000 度左右连续运行时，加热区表面的电负荷不应超过 35W/cm²，在短期运行时，加热元件的电负荷可在 50W/cm² 或以上，当炉温超过 1000℃ 时，电负荷应降低。

The maximum electrical loading permitted is dependent on temperature. We recommend a loading not exceeding 35 W/cm² on the hot-zone surface for continuous operation at temperature up to around 1000 °C . Short-term operation of heaters at 50 W/cm² or more is possible. The maximum loadings should decrease at temperatures above 1000 °C



真空电炉用石墨加热系统
Graphite Heating System in Vacuum
Furnace



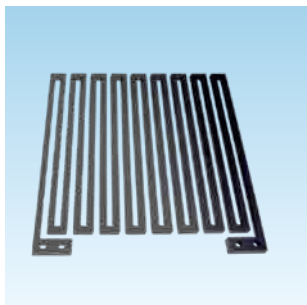
真空电炉用石墨发热管
Graphite Heating Tubes for Vacuum
Furnace



真空电炉用石墨筒
Graphite Susceptor for Vacuum
Furnace



真空电炉用石墨筒
Graphite Susceptor for Vacuum
Furnace



真空炉用石墨加热片
Graphite Heating Element for Vacuum
Furnace



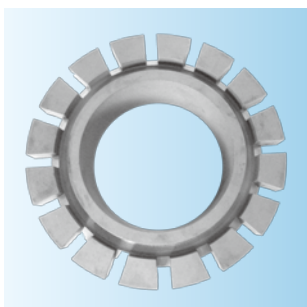
石墨箱
Graphite Susceptor



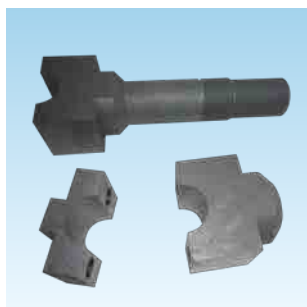
真空电炉用石墨连接件
Graphite Connector for Vacuum
Furnace



CFC 紧固件
CFC Fasteners



真空电炉用石墨连接件
Graphite Connector for Vacuum
Furnace



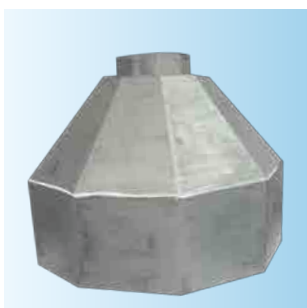
真空电炉用石墨连接件
Graphite Connector for Vacuum
Furnace



真空炉保温用石墨硬毡
Rigid Felt for Insulation of Vacuum
Furnace



石墨硬毡保温筒
Rigid Felt Insulation Cylinder



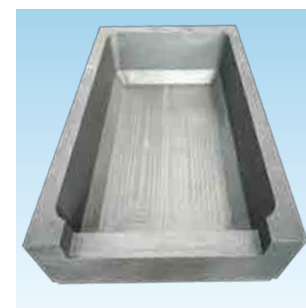
石墨硬毡保温筒
Rigid Felt Insulation Cylinder



碳碳复合材料板及保温用石墨硬毡板
CFC Plates and Rigid Felt Plates for
Thermal Insulation

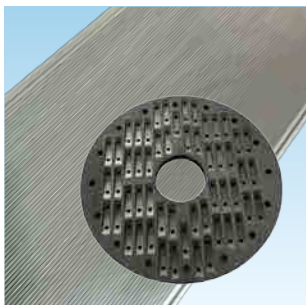


碳碳复合材料装料架
CFC Charge Tray

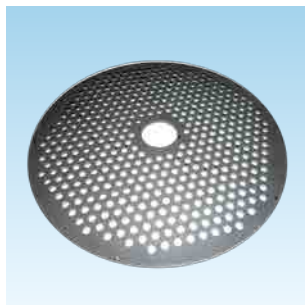


粉末冶金工业用石墨坩埚
Graphite Sintering Boat for
Powder Metallurgy

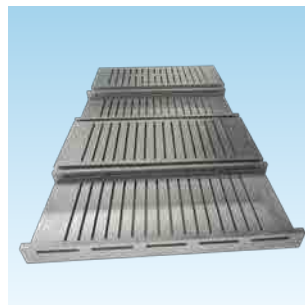
特种石墨的典型用途 Typical Applications of Graphite Specialities



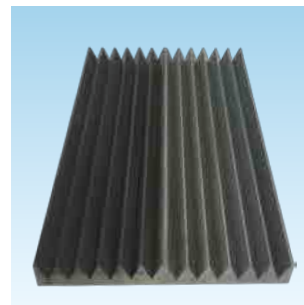
真空炉用石墨烧结舟皿
Graphite Sintering Boat



真空炉用石墨烧结舟皿
Graphite Sintering Boat



真空炉用石墨烧结舟皿
Graphite Sintering Boat



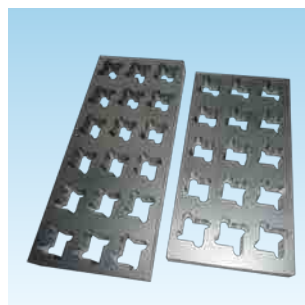
真空炉用石墨烧结舟皿
Graphite Sintering Boat



真空炉用石墨烧结舟皿
Graphite Sintering Boat



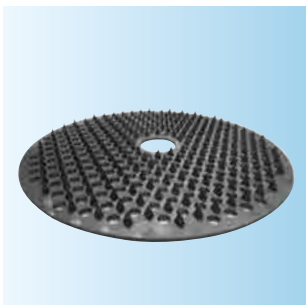
真空炉用石墨烧结舟皿
Graphite Sintering Boat



真空炉用石墨烧结舟皿
Graphite Sintering Boat



真空炉用石墨烧结舟皿
Graphite Sintering Boat



CVD炉用石墨舟皿
Graphite Boat for CVD



真空炉用石墨球壳
Graphite Sphere



生产硬质合金用石墨除蜡盒
Graphite Dewaxing Case for Production
of Tungsten Carbide



真空炉用石墨部件
Graphite Parts Used in Vacuum Furnace

特种石墨的典型用途 Typical Applications of Graphite Specialities

传统工业领域用石墨 Graphite for Conventional Industrial Applications

在这个工业领域里，石墨制品的典型用途有：
Some typical applications in this field:

- 有色金属连续铸造用石墨模（结晶器）
Graphite Dies for continuous casting of non-ferrous metals
- 电火花放电加工用石墨电极
Graphite electrodes for EDM (Electrical Discharge Machining)
- 生产浮法玻璃用石墨挡墙
Graphite bars for production of floating glass
- 生产石英用石墨模具
Graphite molds for quartz production
- 拉制光纤和玻纤用石墨加热器和石墨滚轮
Graphite heaters and rollers for production of optical fiber and glass fiber
- 生产金刚石工具用石墨加压烧结模
Graphite hot sintering molds for production of artificial diamond tools
- 铝工业用石墨转子，石墨泵和石墨油气润滑环
Graphite rotors, pumps and casting rings for manufacturing of aluminium
- 熔金属用石墨坩埚
Graphite crucibles for melted of metals
- 离心及加压铸造用石墨模
Graphite molds or dies for centrifugal and pressure casting
- 电解用石墨电极
Graphite electrodes for electrolysis



制做玻璃首饰用石墨模具
Graphite Molds for Making of Glass
Ornaments



生产浮法玻璃用石墨挡旗
Graphite Bar for Production of
Floating Glass



生产玻纤用石墨集束轮
Graphite Roller for Production of
Glass Fiber

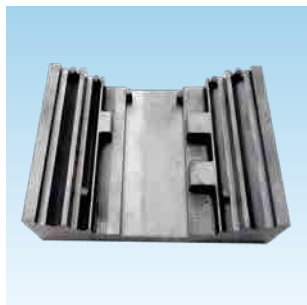


生产石英用石墨模具
Graphite Mold for Quartz Production

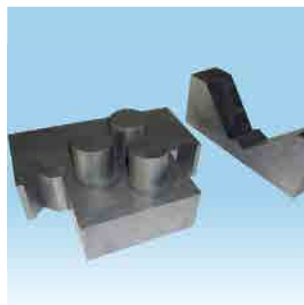
特种石墨的典型用途 Typical Applications of Graphite Specialities



生产石英用石墨模具
Graphite Mold for Quartz Production



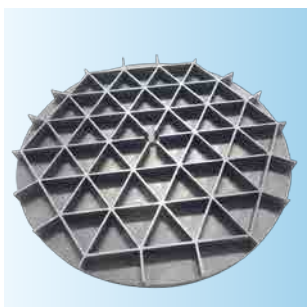
生产石英用石墨模具
Graphite Mold for Quartz Production



生产石英用石墨模具
Graphite Mold for Quartz Production



电火花放电加工用石墨电极
Graphite Electrode for EDM



电火花放电加工用石墨电极
Graphite Electrode for EDM



电火花放电加工用石墨电极
Graphite Electrode for EDM



有色金属连续铸造用石墨结晶器
Graphite Dies for Continuous Casting
of Non-ferrous Metals



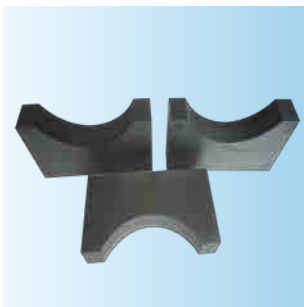
铸铝棒用石墨油气润滑环
Graphite Casting Ring for Casting of
Aluminum Rods



铝液除气用石墨转子
Graphite Rotor and Shaft for Degassing



铝工业用石墨捣锤
Graphite Stamp Hammer for AL Industry



铝工业用石墨刮板
Graphite Drawing Template
for AL Industry



生产钛合金用石墨测量孔板
Measuring Plate for Production of
Titanium



电解锂用石墨阳极
Graphite Anode for Electrolysis of
Lithium



熔金石墨坩埚
Graphite Crucible for Melten of Gold



加压烧结用石墨模具
Graphite Mold for Hot Pressure
Sintering



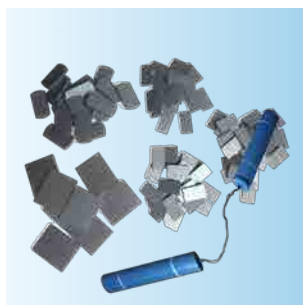
加压烧结用石墨模具
Graphite Mold for Hot Pressure
Sintering



镁合金试棒模具
Graphite Mold for Production
of Mg Alloy



石墨焊接模
Graphite Mold for Welding



防雷接地用石墨电极
Earthing Electrode for
Lightning Protection



原子吸收光谱分析仪器用石墨管
Graphite Tubes for Atomic Absorption
Spectroscopy



莱宝镀膜机用石墨加热器
Graphite Heater for Leybold Film
Coating Machine



石墨换热器
Graphite Heat Exchanger



带嘴石墨坩埚
Heterotypical Graphite Crucible



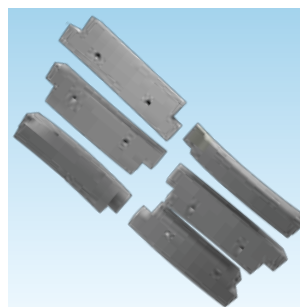
铸铁用石墨模具
Graphite Casting Mold

特种石墨的典型用途 Typical Applications of Graphite Specialities

汽车及机械领域用石墨 Carbon & Graphite for Automobile and Mechanical Application

在这个工业领域里，碳石墨制品的典型用途有：
Some typical applications in this field:

- 动密封用碳石墨密封环
Carbon & graphite seal rings for dynamic sealing
- 碳石墨轴承
Carbon & graphite bearings
- 无油真空泵用石墨旋片
Carbon vanes for oilless vacuum pumps



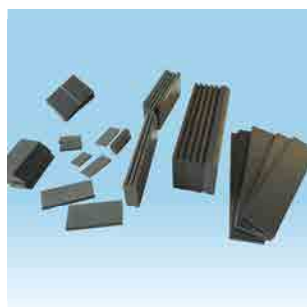
生产水泥回转窑用石墨端面密封环
Graphite End Sealing Ring
for Rotating Kiln



水轮机用28瓣石墨密封环
Graphite Seal Ring in 28 Segments
for Hydroturbine



气泵转子
Vane Pump Parts



真空泵用石墨旋片
Carbon Vanes for Vacuum Pump



石墨密封环
Graphite Seal Rings



石墨密封环
Graphite Seal Rings



碳石墨轴承
Graphite Bearings



碳石墨轴承
Graphite Bearings



石墨轴瓦
Graphite Bearings



石墨轴瓦
Graphite Bearing

特种石墨的典型用途 Typical Applications of Graphite Specialities

电气工程用碳石墨 Carbon & Graphite for Electrical Applications

在这个工业领域里，碳石墨制品的典型用途有：
Some typical applications in this field:

- 各种直流电机和滑环电机用碳刷
Carbon brushes for DC motors and slip ring motors
- 电力机车及地铁受电弓用碳滑板
Carbon current collectors for pantographs of electrical locomotives and subways
- 电力机车及地铁的接地回流装置
Grounding devices for electrical locomotives and subways



受电弓用碳滑板
Carbon Current Collectors for Pantos



各种电机用碳刷
Various Carbon Brushes



风力发电机用碳刷
Carbon Brush for Wind Turbine



风力发电用碳刷
Carbon Brushes for Wind Turbine



机车接地装置
Grounding Device



风力发电机用滑环
Slip Ring Been Used in Wind Turbine



风力发电机用滑环
Slip Ring for Wind Turbine



在上海库存的进口碳刷坯料
Imported Brush Plates on Stock in Shanghai

阿泰克公司常用石墨的技术参数及标准坯料尺寸表

Data Sheets and Standard Block Dimensions of Graphite Feedstock Used in Artech

Data Sheet on Chinese Die Molded Graphite (for Industrial Applications)

国产模压成型工业领域用石墨技术参数

Grade 牌号	Density 密度 g/cm ³	Flexural Strength 抗折强度 MPa	Compressive Strength 抗压强度 MPa	Shore Hardness 肖氏硬度	Open Porosity 开口气孔率 %	Specific Electrical Resistance 电阻率 μΩ·m	CTE 热膨胀系数 10 ⁻⁶ /°C
ATM65	1.65	19	50	50	22	13	2.6
ATM78	1.78	27	60	50	20	13	2.6
ATM83	1.83	35	70	55	17	13	2.6

Standard Die Molded Blocks and Rods Available Dimensions in mm

模压成型石墨标准坯料尺寸表 (mm):

In Shape of Cuboids/长方体料

910x320x210, 800x600x210, 660x210x140, 600x500x200, 550x360x200, 450*260*150, 540x320x180, 500x400x200, 490x300x200, 490x290x180, 400*120*120, 400*200*100

In Shape of Rods/圆柱体料

Φ520x520, 520x400, 460x400, 400x400, 350x310, 340x250, 300x250, 260x300, 240x400, 210x250, 210x250, 190x250, 158x250, 135x250, 480x190, 345x320, 100x250, Φ330x240

Data Sheet on Chinese Vibrated Graphite

国产震动成型石墨技术参数

Grade 牌号	Density 密度 g/cm ³	Flexural Strength 抗折强度 MPa	Compressive Strength 抗压强度 MPa	Shore Hardness 肖氏硬度	Open Porosity 开口气孔率 %	CTE 热膨胀系数 10 ⁻⁶ /K	Max. Grain Size 最大粒度 mm	Specific Electrical Resistance 电阻率 μΩ·m
ATV70	1.70	13	30	50	22	2.5	2.0	8.5
ATV73	1.73	15	32	55	19	2.5	0.8	8.5

Standard Vibrated Blocks and Rods Available Dimensions in mm

震动成型石墨标准坯料尺寸表 (mm):

In Shape of Cuboids/长方体料

3200x850x400, 2320x670x550, 2320x670x350, 2300x1140x420, 2200x1120x500, 2200x660x510, 2200x650x330, 2100x1000x400, 1980x1000x550, 1940x790x550, 1930x530x530, 1900x850x440, 1870x630x630, 1870x670x550, 1870x670x440, 1860x960x510

In Shape of Rods/圆柱体料

Φ1810x560, 1600x540, 1550x500, 1470x540, 1420x500, 1310x630, 1310x440, 1270x580, 1170x690, 1120x610, 1050x660, 1000x610, 940x690, 916x620, 880x430, 790x790, Φ760x760, 730x540, 710x510, 690x630, 660x610

Data Sheet on Chinese Extruded Graphite

国产挤压成型石墨技术参数

石墨牌号 Graphite Grades	体积密度 Density g/cm ³	抗折强度 Flexural Strength MPa	抗压强度 Compressive Strength MPa	杨氏模量 Young's Modulus KN/mm ²	热膨胀系数 CTE X10 ⁻⁶ K ⁻¹ (20-200 °C)	电阻率 Specific Electrical Resistivity μΩ·m	导热率 Thermal Conductivity Wm ⁻¹ k ⁻¹	肖氏硬度 Shore Hardness	平均粒度 Average Grain Size in μm
ATE 60	1.60	7	15	6.5	2.6	6.5	130	30	2
ATE 72	1.72	7.5	20	7.5	2.8	7	140	35	0.8

Standard Extruded Blocks and Rods Available Dimensions in mm

挤压成型石墨标准坯料尺寸表 (mm):

In Shape of Cuboids/长方体料

400x400x1800, 400x400x1800, 530x530x2200, 680x430x2200,

In Shape of Rods/圆柱体料

Φ500x1800, Φ450x1800, Φ400x1800, Φ350x1800, Φ103x1500, Φ153x1650, Φ203x1650, Φ253x1700, Φ303x1800, Φ353x1800, Φ403x1800, Φ453x1800, Φ470x1850, Φ510x710, Φ610x710, Φ710x710

阿泰克公司常用石墨的技术参数及标准坯料尺寸表

Data Sheets and Standard Block Dimensions of Graphite Feedstock Used in Artech

Data Sheet on Chinese Isostatic Graphite

国产等静压成型石墨技术参数

Grade 牌号	Density 密度 g/cm ³	Flexural Strength 抗折强度 MPa	Compressive Strength 抗压强度 MPa	Shore Hardness 肖氏硬度	Open Porosity 开口气孔率 %	CTE 热膨胀系数 10 ⁻⁶ /°C	Max. Grain Size 最大粒度 um	电阻率 Specific Electrical Resistivity μ Ω m
ATD76	1.76	36	68	50	20	4.3	25	13
ATD83	1.83	40	80	55	16	4.5	25	13

Standard Isostatic Blocks and Rods Available Dimensions in mm

等静压成型石墨标准坯料尺寸表 (mm):

In Shape of Cuboids/长方体料

1950x480x400, 1300x620x400, 1300x500x300, 1000x520x160, 1000x500x300, 600x400x400, 500x400x400, 400x400x400

In Shape of Rods/圆柱体料

Φ 810x700, 750x650, 680x650, 640x630, 590x600, 560x500, 520x370, 480x500, 450x450, 400x450

Data Sheet on Chinese Die Molded Graphite (for Mechanical Applications)

国产模压成型机械用碳石墨技术参数

Grade 牌号	Density 密度 g/cm ³	Flexural Strength 抗折强度 MPa	Compressive Strength 抗压强度 MPa	Shore Hardness 肖氏硬度	Open Porosity 开口气孔率 %	CTE 热膨胀系数 10 ⁻⁶ /K	Max. Temperature Be Used 最高使用温度 °C	Remarks 备注
ATM06H	1.62	60	190	90	1.0	4.8	200	"H"-浸渍过环氧树脂 "H"-Impregnated with epoxy resin
ATM20H	1.70	55	182	90	1.0	4.8	200	
ATM54H	1.80	45	100	55	1.0	4.5	200	
ATM06K	1.62	70	190	85	2.0	4.7	200	"K"-浸渍过呋喃树脂 "K"-Impregnated with furan resin
ATM20K	1.70	65	190	80	2.0	4.7	200	
ATM54K	1.70	60	165	65	2.0	4.5	200	
ATM06F	1.62	75	190	85	1.0	4.8	200	"F"-浸渍过酚醛树脂 "F"-Impregnated with phenolic resin
ATM20F	1.70	70	190	80	1.0	4.8	200	
ATM54F	1.80	65	165	65	1.0	4.5	200	
ATM06D	2.20	70	230	85	3.0	5.0	500	"D"-浸渍过锑 "D"-Impregnated with antimony
ATM20D	2.20	65	230	80	3.0	5.0	500	
ATM54D	2.20	65	190	60	3.0	5.0	500	
ATM06P	2.40	80	240	85	2.0	5.0	500	"P"-浸渍过铜锡合金 "P"-Impregnated with Cu-Sn alloy
ATM20P	2.40	75	230	80	2.0	5.0	500	
ATM54P	2.60	65	190	60	2.0	5.0	500	
ATM06B	2.30	85	235	80	2.0	5.5	180	"B"-浸渍过巴氏合金 "B"-Impregnated with Babbitt metal
ATM20B	2.30	80	210	70	2.0	5.5	180	
ATM54B	2.30	65	155	65	1.5	5.2	180	
ATM06R	1.90	75	210	110	1.5	4.6	600	"R"-浸渍过熔融的玻璃 "R"-Impregnated with molten glass
ATM20R	1.90	65	210	95	1.5	4.6	600	
ATM54R	1.90	65	155	65	1.5	4.6	600	
ATM177F	1.83	70	220	93	2.0	9.0	200	"F"-浸渍过酚醛树脂 "F"-Impregnated with phenolic resin

Standard Die Molded Blanks and Rods Available Dimensions for Mechanical Applications

模压成型机械用碳石墨标准坯料尺寸表 (mm):

In Shape of Cuboids/长方体料

115x125x40, 115x145x40, 63x150x40, 125x185x40, 165x165x40

In Shape of Rods/圆柱体料

Φ 360x160, 300x150, 260x160, 220x160, 200x140, 300x160, 145x130, 110x120, 50x100, 100x110, 90x110, 80x110, 70x110, 60x100, 140x120, 130x120, 120x120

阿泰克公司选用的德国进口的机械碳石墨的技术参数及标准筒料尺寸表

Data Sheet and Dimension List of Imported Mechanical Carbon Used in Artech

	牌号	浸渍物	体积密度	抗折强度	抗压强度	杨氏模量	洛氏硬度	热导率	热膨胀系数	开口气孔率	有氧气氛中使用温度	还原气氛中使用温度	圆柱料直径	圆柱料高度	长方料长度	长方料宽度	长方料厚度	典型用途
	Grade	Impregnation	Density g/cc	Flexural strength MPa	Compressive strength MPa	Young's Modulus GPa	Rockwell hardness HRB	Thermal conductivity W/mK	Coefficient of thermal expansion E-3/K	Porosity (open) Vol. %	Temperature resistance °C	Temperature resistance °C in red. atm.	Cylinder* (mm) Diameter	Cylinder* (mm) Height	Square Block* (mm) X	Square Block* (mm) Y	Square Block* (mm) Z	Typical applications
碳石墨基 Carbongraphite	EK 20	—	1,70	55	155	22	105 HR 5/100	12	3.0	11,0	350	1200	530	200	330	140	60	湿运转轴承 Wet running bearings
	EK 2200 [◆]	Resin 树脂	1,82	75	200	23	110 HR 5/100	13	4.0	2,5	200	200	530	200	330	140	60	高负载密封环、轴承 High loaded seals, bearings
	EK 2201 [◆]	Resin 树脂	1,82	75	200	23	110 HR 5/100	14	3.8	2,5	260	260	530	200	330	140	60	密封环、轴承 Seals, bearings
	EK 2203 [◆]	Resin 树脂	1,80	70	195	22	110 HR 5/100	14	3.8	2,5	180	180	530	200	330	140	60	密封环、轴承 Seals, bearings
	EK 2209	—	1,77	65	190	25	110 HR 5/100	15	3.6	2,5	350	400	530	200	330	140	60	高负载密封环、轴承 High loaded seals, bearings
	EK 3205	Antimony 锑	2,30	85	260	30	120 HR 5/100	18	4.0	2,5	350	550	530	200	330	140	60	高负载密封环、轴承 High loaded seals, bearings
	EK 2230 [◆]	Resin 树脂	1,85	60	160	22	110 HR 5/100	14	6.5	2,5	200	200	72	45	110	115	25	大批量生产的密封环、轴承 High volume seals, bearings
	EK 2239	—	1,80	55	150	20	105 HR 5/100	15	4.5	2,5	350	400	72	45	110	115	25	
	EK 3235	Antimony 锑	2,47	65	210	30	105 HR 5/150	20	5.1	2,5	350	550	72	45	110	115	25	
	EK 24	—	1,70	60	180	18	105 HR 5/100	14	4.1	8,0	350	1200	580	200	610	325	130	干运转及干湿混合运转 的密封环、轴承 Seals, bearings for dry running, mixed running
	EK 2240 [◆]	Resin 树脂	1,80	70	200	19	110 HR 5/100	15	5.0	2,5	200	200	580	200	610	325	130	
	EK 2241 ^{◆◆}	Resin 树脂	1,80	70	200	19	110 HR 5/100	15	4.8	2,5	260	260	580	200	610	325	130	
	EK 2243 [◆]	Resin 树脂	1,78	60	190	18	110 HR 5/100	16	4.6	2,5	180	180	580	200	610	325	130	
	EK 3245	Antimony 锑	2,20	80	250	22	120 HR 5/100	20	4.9	2,5	350	550	580	200	610	325	130	
	EK 25	—	1,69	45	125	16	100 HR 5/100	9	4.5	7,0	350	950	72	45	—	—	—	干运转及干湿混合运转 的密封环、轴承 Seals, bearings for dry running, mixed running
	EK 2250	Resin 树脂	1,80	50	160	17	110 HR 5/100	10	5.1	2,5	200	200	72	45	—	—	—	
	EK 3255	Antimony 锑	2,15	75	220	21	120 HR 5/100	12	5.2	2,5	350	550	72	45	—	—	—	
石墨基 Graphite	EK 40 [▲]	—	1,70	35	100	10	95 HR 5/100	25	4.5	14,0	500	2500	220	260	330	140	73	干运转的密封环、轴承 Seals, bearings for dry running
	EK 200 [◆]	Resin 树脂	1,82	50	200	13	115 HR 5/100	26	6.8	2,5	200	200	220	260	330	140	73	
	EK 201 ^{◆◆}	Resin 树脂	1,82	50	200	13	115 HR 5/100	26	6.2	2,5	260	260	220	260	330	140	73	
	EK 203 [◆]	Resin 树脂	1,80	40	160	13	115 HR 5/100	26	5.6	2,5	180	180	220	260	330	140	73	
	EK 204	Salt 盐	1,78	40	140	13	105 HR 5/100	27	4.6	12,0	600	1200	220	260	330	140	73	
	EK 305 [▲]	Antimony 锑	2,55	80	290	21	115 HR 5/100	33	6.0	2,5	500	550	220	260	330	140	73	
	V 1626	Salt 盐	1,85	58	150	13	90 HR 5/100	73	4.0	10,0	600	1200	—	—	330	240	6.5	高负载压缩机用旋片 Vanes f. high load. comp.
树脂粘结石墨 Resin Bond. Graphite	EK 60	—	1,73	80	120	22	80 HR 5/100	6	11.0	No	180	180	—	—	385	235	8.8	压缩机用旋片 Vanes for compressors
	V 1771 ¹	—	1,69	70	150	17	100 HR 5/100	5	18.0	No	220	220	—	—	385	235	8.8	大批量生产的压缩机旋片 Vanes f. high vol. comp.
	V 1352 ¹	—	1,62	75	200	18	110 HR 5/100	2	17.0	No	180	180	77/30	8/110	385	235	10	压缩机及泵用部件 Parts for compr., pumps
	V 1640 ^{1◆}	—	1,69	85	210	14	110 HR 5/100	3	16.0	No	180	180	77/30	8/110	385	235	10	

阿泰克公司选用的进口等静压石墨技术参数及标准坯料尺寸表

Data Sheet And Dimension List of Imported Isostatic Graphite Used in Artech

Data Sheet of Imported Isostatic Graphite
进口等静压石墨技术参数表

石墨牌号 Isostatic Graphite Grades	体积密度 Density g/cm ³	抗折强度 Flexural Strength MPa	抗压强度 Compressive Strength MPa	杨氏模量 Young's Modulus KN/mm ²	热膨胀系数 CTE X10 ⁻⁶ K ⁻¹ (20-200℃)	电阻率 Specific Electrical Resistivity μ Ωm	导热率 Thermal Conductivity Wm ⁻¹ k ⁻¹	肖氏硬度 Shore Hardness	平均粒度 Average Grain Size in um	坯料的标准尺寸 Block Dimensions in mm
ATDJ-05	1.88	85	240	14.0	4.7	13	100	70	3	610x390x190
ATDJ-04	1.84	65	150	12.5	3.9	14	90	60	7	1230x480x260
ATDJ-03	1.83	60	125	11.5	4	13	100	60	10	1230x500x400, 1230x1020x330, Φ1030x450
ATDJ-02	1.77	50	120	10.5	3.9	14	80	55	10	1230x1030x340, Φ1000x800
ATDJ-01	1.72	45	90	10.5	2.9	12	90	55	15	1230x500x400
ATDJ-11	1.75	59	98	11	3.2	13	116	55	15	1000x620x330, 1000x500x300
ATDJ-12	1.80	80	140	12	3.6	13	110	62	10	Φ1050x170, Φ705x645, Φ645x645, Φ590x750, Φ760/Φ330x720, Φ860/ Φ450x770
ATDJ-13	1.85	69	137	12	4.1	15	81	70	6	1200x600x300
ATDJ-225	1.82	58	127	12	5.9	14	93	65	10	1850x620x300
ATDJ-331	1.79	39	90	9.8	4.8	13	104	56	10	2146x622x311, Φ610x640, Φ500x790
ATDJ-332	1.85	49	120	10.8	5.5	11	116	58	10	1245x622x311, 1200x1200x270, Φ610x640, Φ515x800
ATDJ-230	1.84	65	130	11	6	16.5	79	80	8	1850x620x300
ATDJ-240	1.76	45	95	10.6	4.7	13.7	95	55	13	1850x620x300
ATDJ-220	1.77	45	90	9.8	4.3	15.5	85	52	15	1830x635x530, 1080x1030x325
ATDJ-412	1.76	44	85	9	3.5	11.5	120	68	15	305*635*2032, 305*635*1220, 406*406*1651
ATDJ-511	1.77	39	78	9.8	4.5	11	116	51	10	1000x620x305, Φ585x1050
ATDJ-556	1.77	43.1	88.2	10.3	4.7	12.2	104	57	10	Φ1100x610, 1050x1050x450
ATDJ-570	1.83	47	102.9	11.8	4.6	10	128	58	10	1000x620x305, Φ460x1050
ATDJ-643	1.80	54	103	10.8	4.8	12.5	128	57	5	350x630x1020, Φ900*650
ATDJ-644	1.86	59	108	11.3	4.8	11	140	61	5	160x400x1020, Φ900*650
ATDJ-358	1.86	54	135	11	4.4	9.5	139	54	10	Φ970/Φ780x560, Φ900/ Φ760x560

阿泰克公司常用石墨的技术参数及标准坯料尺寸表

Data Sheets and Standard Block Dimensions of Graphite Feedstock Used in Artech

Data Sheet of HLM-Imported Extruded Graphite

HLM 进口挤压石墨的技术参数

参数 Properties	圆柱体料 In Shape of Rods				长方体料 In Shape of Cuboids			Remarks 备注
	Φ75-Φ350 mm	>Φ350-Φ780 mm	Φ915 mm	Φ1015 mm	<670 mm	760 mm	1220 mm	
密度 g/cm ³ Bulk Density	1.74	1.7	1.77	1.78	1.7	1.72	1.79	"P" value-parallel to longitudinal direction of grain
开口气孔率 % Open Porosity	16	17	21	21	17	23	20	以下 "V" 值是指垂直于石墨挤压方向的数值
最大粒度 in mm Max. Grain Size	0.8	0.8	1.65	1.65	0.8	0.8	1.65	"V" value-vertical to longitudinal direction of grain
电阻率 μΩm Specific Electrical Resistance	6.7	7.3	9.4	9.1	7.3	7.1	8.6	P
	9.2	9.4	12.4	10.2	9.4	10.7	10.7	V
杨氏模量 KN/mm ² Young's Modulus	14	10	10.2	9.7	10	11.3	10	P
	10	9	7.4	8.3	9	6.7	8	V
抗折强度 N/mm ² Flexural Strength	26	18	17	15	18	16.5	16	P
	19	17	15	15	17	13.8	16	V
抗压强度 N/mm ² Compressive Strength	55	39	44	42	39	37.2	42.7	P
	40	35	42.5	42	35	40	42.7	V
抗张强度 N/mm ² Tensile Strength	18	13	12	10	13	12.4	11.7	P
	13	12	10	10	12	10.3	11.7	V
线性热膨胀系数 μm/K.m Linear Coefficient of Thermal Expansion (20-200 °C)	2.1	2.1	2.1	2.2	2.1	1.4	2.4	P
	3.7	3.1	3.2	2.9	3.1	2.9	3.6	V
导热率 W/K.m Thermal Conductivity	200	180	140	140	180	180	150	P
	150	140	105	130	140	120	120	V
灰分含量 % Ash Content	<0.1	<0.1	0.3	0.3	<0.1	0.15	0.3	

Standard Extruded HLM Blocks and Rods Available Dimensions in mm

HLM挤压成型石墨标准坯料尺寸表 (mm):

In Shape of Cuboids/长方体料

300x300x1830, 400x400x1830, 500x500x1830, 500x500x2100, 610x610x1830, 610x610x2750, 610x610x3300, 460x670x2100, 610x760x1830, 610x760x2750, 610x1220x1830

In Shape of Rods/圆柱体料

Φ75-Φ1015x1830

阿泰克公司常用石墨的技术参数及标准坯料尺寸表 Data Sheets and Standard Block Dimensions of Graphite Feedstock Used in Artech

Standard Extruded CS Blocks & Rods Available Dimensions in mm CS 挤压成型石墨标准坯料尺寸表 (mm)

参数 Properties	Grade ATEJ7 石墨牌号 ATEJ7	备注 Remarks
		以下 "P" 值是指平行于石墨挤压方向的数值
		"P" value-parallel to longitudinal direction of grain
密度 Bulk Density g/cm ³	1.74	以下 "V" 值是指垂直于石墨挤压方向的数值
最大粒度 Max. Grain Size in mm	0.76	"V" value-vertical to longitudinal direction of grain
电阻率 Specific Electrical Resistance $\mu\Omega\text{m}$	7.1	P
	9.4	V
杨氏模量 Young's Modulus kg/cm ²	1120	P
	840	V
抗折强度 Flexural Strength kg/cm ²	215	P
	160	V
抗压强度 Compressive Strength kg/cm ²	470	P
	470	V
洛氏硬度 Rockwell Hardness	83	
线性热膨胀系数 Linear Coefficient of Thermal Expansion (to 100 °C) 10 ⁻⁶ /°C	2.5	P
	3.6	V
导热率 Thermal Conductivity W/K.m	160	P
	145	V
灰分含量 Ash Content %	0.09	

Standard Extruded CS Blocks & Rods Available Dimensions in mm CS 挤压成型石墨标准坯料尺寸表 (mm):

In Shape of Cuboids 长方体料

380x760x1830, 430x430x1830, 430x430x2230, 480x480x1830, 610x610x1830

In Shape of Rods 圆柱体料

Φ76-Φ914x1830

阿泰克 -
善做石墨

Artech-
An Expert in Graphite



本样本的编写是基于我们目前所掌握的知识，其目的是为客户大致介绍我们的产品及其用途。故不应该将所介绍的特定用途某种产品的技术参数视作其合格与否的保证值。

This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should not therefore be construed as guaranteeing specific properties of the products described or their suitability for a particular application.



阿泰克石墨
Artech Graphite

成都阿泰克特种石墨有限公司
Chengdu Artech Specialty Graphite Co., Ltd.

地址：四川省成都市崇州经济开发区华业路
Address: Huaye Road, Chongzhou Economic
Development Zone, Chengdu, Sichuan, 611230 China
邮编 /Postal Code: 611230
电话 /TEL: +86-28-8260 2128 / 8260 2818
传真 /FAX: +86-28-8260 2655 / 8260 2755

www.artech-graphite.com

上海销售处
Shanghai Office

地址：上海市浦东新区金皖路 389 号 706 室
邮编 /Postal Code: 201206
Address: Room 706, #389 Jinwan Road,
Pudong, Shanghai, 201206 China
电话 /TEL: +86-21-5031 5128 / 5031 5135
传真 /FAX: +86-21-5031 5102