

SIC TECH[®]

硅 碳 棒

SILICON CARBIDE HEATING ELEMENT



江苏环能硅碳陶瓷有限公司

Jiangsu Huanneng Silicon Carbon Ceramics Co.,Ltd.



Company profile

江苏环能硅碳陶瓷有限公司致力于研发高性能碳化硅电热元件（硅碳棒）及碳化硅陶瓷，自2001年成立以来，以不断创新的精神制造高技术、高品质的产品。

公司自2006年起，与多家高等院校研究所合作研究新型碳化硅电热元件（硅碳棒），并采用高起点的生产设备、新建的生产工艺技术，率先打破了传统国产碳化硅电热元件（硅碳棒）生产方式，经过多年来的不懈努力、不断创新，掌握了碳化硅电热元件（硅碳棒）的核心技术，并成功研发出自主知识产权的独有生产工艺。我司生产的SICTECH品牌碳化硅电热元件（硅碳棒）产品质量达到了世界先进水平。

SICTECH提供各种规格高品质硅碳棒(碳化硅电热元件):GD(直棒)、HGD(高密度直棒)、U型、W(三相)型、LD(单螺旋)型、LS(双螺旋)型等产品(可根据客户设计需要定制特殊规格的硅碳棒),已经广泛用于玻璃、陶瓷、磁材、粉末冶金等热处理行业,并出口到世界30多个国家和地区。

我公司拥有一批优秀的技术人员,可根据我们的生产经验和产品特点,选择最佳的设计方案,免费为用户提供设计服务。也可按照客户的特殊要求和设计,为广大客户提供在特殊使用条件使用的特殊定制产品。

Jiangsu Huanneng Silicon Carbon Ceramics Co., Ltd. is committed to the development of high-performance silicon carbide heating elements (sic heater) and silicon carbide ceramics. Since we establishment in 2001, it has been manufacturing high-tech, high-quality products with continuous innovation.

Since 2006, we had cooperated with a number of institutions of higher learning to research new silicon carbide heating elements (sic heater), and have taken the lead in breaking the traditional domestic silicon carbide electric heating elements by using high-start production equipment and new production technology. We are the first to adopt advanced production of silicon carbide heating elements in China, after years of unremitting efforts and continuous innovation, mastered the core technology of silicon carbide heating elements (sic heater), and successfully developed a unique production process of independent intellectual property rights. The quality of SICTECH brand silicon carbide heating element (sic heater) produced by our company has reached the world advanced level.

Now, SICTECH provides various specifications of high-quality silicon carbide heating elements (sic heater): GD series (rod shaped), HGD (high density, rod shape), U series (U shape), W series (three phase type), LD series (single spiral type), LS series (double spiral type) and so on, which has been widely used in glass, ceramics, magnetic materials, powder metallurgy and heat treatment industry. Till now, our products had been exported to more than 30 countries and areas.

We have a group of excellent technicians, who can choose the best design plan according to our production experience and product features, and provide design services for users free of charge. According to the special requirements and design of customers, we can also provide our customers with special customized products for special use conditions.

JIANGSU HUANNENG SILICON CARBON CERAMICS CO., LTD.

SIC TECH[®] 硅碳棒

SIC TECH silicon carbide heating elements

SICTECH MHD 硅碳棒采用目前国内外最新的发热体工艺，最高使用温度可达1625摄氏度，具有高致密性、低气孔率，能有效抵抗有害气体、水蒸气、金属氧化物的侵蚀，大幅度降低老化速度，更长的使用时间，减少更换频率，为用户降低生产成本，适合用于玻璃、电子、贵金属材料等要求苛刻的现场。

环能SICTECH硅碳棒可提供多种发热体材质及结构，空心管状发热体、实心发热体、螺旋形发热体，可根据客户的要求设计多种外观几何尺寸。

SICTECH硅碳棒还可以根据各种炉内生产环境提供多种表面涂层；可有效阻隔水蒸气、氮气、氢气、碱性气体、金属氧化物等有害气体挥发物，有效减轻有害气体挥发物对硅碳棒的侵蚀。

SICTECH MHD silicon carbide heating element adopts the latest heating element technology at China and abroad. The maximum temperature can reach 1625 degrees Celsius. It has high density and low porosity. It can effectively resist the erosion of harmful gases, water vapor and metal oxides. Aging speed, longer use time, reduced replacement frequency, lowering production cost for users, suitable for demanding sites such as glass, electronics and precious metal materials.

Huanneng SICTECH silicon carbide heating element can provide a variety of heating body materials and structures, hollow tubular heating elements, solid heating elements, spiral heating elements, and can be designed according to customer requirements.

SICTECH silicon carbide heating element can also provide a variety of surface coatings according to various furnace production environments; it can effectively block volatile gases such as water vapor, nitrogen, hydrogen, alkaline gases, metal oxides, etc., effectively reducing the erosion of silicon carbide heating element by harmful gas volatiles.

物理特性 Physical Characteristics

项目 Characteristics Items	单位 Unit	品种 Type			
		GD/U	HGD	LS/LD	MHD
真比重 Pretension Density		3.2	3.2	3.1	3.1
表观比重 Bulk Density		2.5	2.58	2.8	2.8
气孔率 Apparent Porosity	%	23	12	5	5
抗弯强度 Bending Strength	MPa at 25°C	50	50	98	98
比热 Specific Heat	kJ/kg+°C at 25°C-1300°C	1.0	1.0	1.0	1.0
热传导率(热端) Heat Conductivity	W/m+°C at 1000°C	14-19	14-19	16-21	16-21
比抵抗(热端) Nominal Resistance	Ω cm at 1000°C	0.1	0.1	0.016	0.016
热膨胀率 Coefficient of Thermal Expansion	1000°C(X 10 ⁻⁶ /°C)	4.5	4.5	4.5	4.5

SIC TECH[®] 硅碳棒

SIC TECH silicon carbide heating elements

SICTECH硅碳棒表面温度可以达到1625摄氏度，广泛用于行业：

SICTECH silicon carbide heating element can reach 1625 degrees Celsius of surface temperature and are widely used in the industry:

- 玻璃 glass
- 磁性材料 magnetic material
- 粉末冶金 Powder metallurgy
- 贵金属 precious metal
- 冶金 metallurgy
- 铸造 casting
- 陶瓷 ceramics



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GD/HGD型硅碳棒 GD/HGD shape silicon carbide heating element

GD/HGD型硅碳棒由3段组合焊接而成，中间为发热部，两端为冷端，最高使用温度1500° C。

GD/HGD shape silicon carbide heating element is welding by three parts, the middle is hot zone and the end is cold zone, the maximum using temperature is 1500°C



型号: GD /HGD 外径:OD

发热部长度:HZ

冷端长度:CZ

总长:OL

例如:GD 型,OD=55mm HZ=1575mm

CZ=419mm OL=2413mm, resistance:0.9ohm

表示为:GD 55/1575/2413/0.9ohm

Type: GD/HGD Outer diameter:OD

Hot zone length:HZ

Cold zone length:CZ

Overall Length:OL

Order example:

GD type,OD=55mm HZ=1575mm CZ=419mm OL=2413mm, resistance:0.9ohm

Expressed as:GD 55/1575/2413/0.9ohm

直径 Diameter OD (mm)	10	12	14	16	18	20	25	30	32	35	38	40	45	50	55	60
最长发热长度 Hot zone HZ (mm)	350	500	600	600	800	900	1100	1300	1300	1450	2000	2000	2400	2400	2400	2400
最长总长 Overall length OL (mm)	650	950	1100	1300	1500	1600	1800	2100	2500	2500	3000	3800	3800	3800	3800	3800

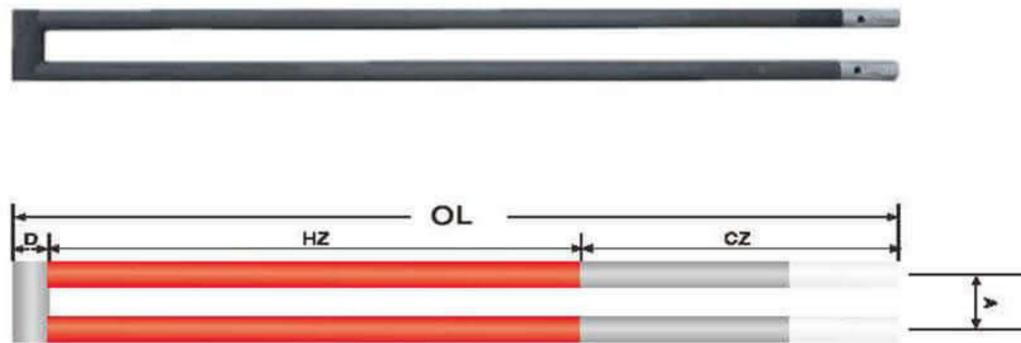
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SIC TECH silicon carbide heating elements

GDU硅碳棒 GDU shape silicon carbide heating element

GDU硅碳棒采用的是两支发热部和两支冷端链接而成，与GD型硅碳棒比少2支冷端，在使用的时候可节能10-20%，最高使用温度1500° C.

GDU shape silicon carbide heating element is using two hot zones, compare with GD shape silicon carbide heating element less than two cold zones, you can save 10-20% power when you use GDU shape silicon carbide heating element, the maximum using temperature is 1500°C.



型号: GDU 外径:OD

发热部长度:HZ

冷端长度:CZ

总长:OL

间距:A

连接桥:D

例如:GDU 型,OD=20mm HZ=300mm CZ=400mm OL=700mm,resistance:2.2ohm

表示为:GDU 20/300/400/60/2.2ohm

直径 (mm) 有10、12、14、16、18、20、25、30、32、35、38、40、45、50、55

长度可做到3500mm

Type: GDU Outer diameter:OD

Hot zone length:HZ

Cold zone length:CZ

Overall Length:OL

Shank Spacing:A

Bridge:D

Order example:

GDU type,OD=20mm HZ=300mm CZ=400mm OL=700mm,resistance:2.2ohm

Expressed as:

GDU 20/300/400/60/2.2ohm

Diameter(mm):10、12、14、16、18、20、25、30、32、35、38、40、45、50、55

Whole Length(mm):100-3500

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SIC TECH silicon carbide heating elements

W型（三相）硅碳棒 W shape(three phase) silicon carbide heating element

浮法玻璃锡槽用硅碳棒

在浮法玻璃生产过程中，由于硅碳棒长时间处于严酷的锡槽环境中，对锡槽用硅碳棒有特殊严格的要求，一般碳化硅发热体不能承受高温、腐蚀性气体的侵蚀，所以锡槽用硅碳棒必须要有超长使用寿命的高密度发热体。

SICTECH硅碳棒为客户提供多种高性能发热体选择，可选MHD超高密度硅碳棒发热体、HD高密度实心发热体、HD高密度空心发热体。

W形硅碳棒发热体材质可选：

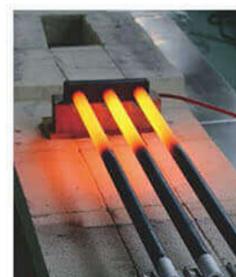
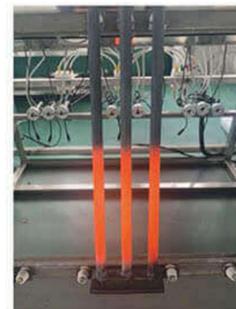
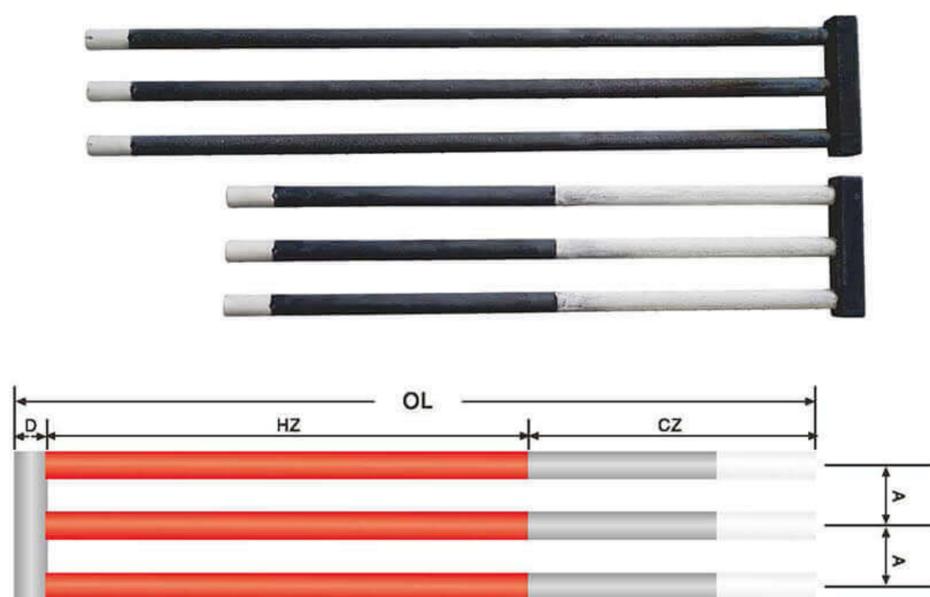
- 1、MHD发热体材质密度 $>2.8\text{g/cm}^3$ 表面温度 1625°C
- 2、HD实心发热体材质密度 $>2.58\text{g/cm}^3$ 表面温度 1500°C
- 3、HD空心发热体材质密度 $>2.58\text{g/cm}^3$ 表面温度 1500°C

In the production process of float glass, since the silicon carbide heating element is in the severe tin bath environment for a long time, there are special strict requirements for the silicon carbon rod in the tin bath. Generally, the silicon carbide heating element cannot withstand the corrosion of high temperature and corrosive gas. So, the silicon carbide heating element for the tin bath must have a high-density heating element with an extremely long service life.

SICTECH silicon carbide heating element can provide customers with a variety of high-performance heating elements, including MHD ultra-high density heating elements, HD high-density solid heating elements, and HD high-density hollow heating elements.

The material of W-shape silicon carbide heating element optional:

- 1、MHD heating element material
Density $>2.8\text{g/cm}^3$ Surface temperature 1625°C
- 2、HD solid heating element material
Density $>2.58\text{g/cm}^3$ Surface temperature 1500°C
- 3、HD hollow heating element material
Density $>2.58\text{g/cm}^3$ Surface temperature 1500°C



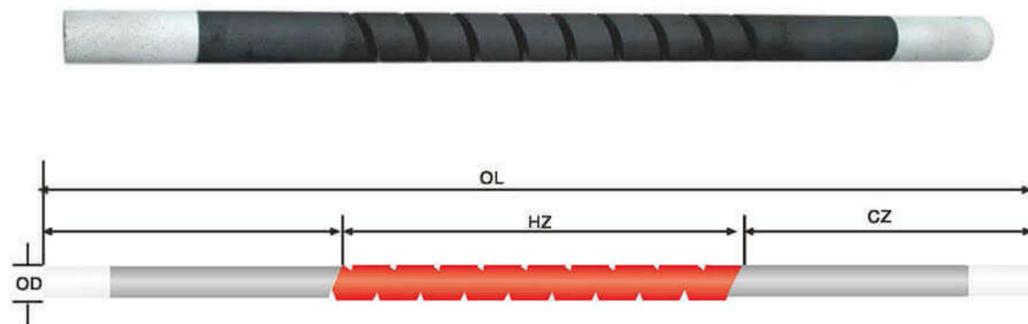
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LD高温(单螺旋)硅碳棒 LD shape(single spiral) silicon carbide heating element

LD硅碳棒发热部采用特殊材料制成，密度达到2.8g/cm³,最高使用温度1650℃，超长使用寿命，两端接线，可与GD\HGD互换。

The hot zone of LD shape silicon carbide heating element is made by special materials, the density of hot zone can be 2.8g/cm³, the maximum using temperature is 1650℃, very long working life, two end of the wire, can be exchanged with GD/HGD.



型号: LD 外径:OD

发热部长度:HZ

冷端长度:CZ

总长:OL

例如:LD 型,OD=25mm HZ=300mm CZ=200mm OL=500 resistance:1.3ohm

表示为:LD 25/300/500/1.3ohm

Type: LD Outer diameter:OD

Hot zone length:HZ

Cold zone length:CZ

Overall Length:OL

Order example:

LD type,OD=25mm HZ=300mm CZ=200mm OL=500 resistance:1.3ohm

Expressed as:

LD 25/300/500/1.3ohm

元件直径 Diameter(mm)	额定负荷 (1050℃时测试) Nominal loading (at 1050℃)			
	发热部 Hot zone		冷端 Cold zone	
	Ω/mm	W/mm	Ω/mm	W/mm
14.0	0.02567	6.59	0.00450	0.30
16.0	0.02094	7.54	0.00387	0.50
18.0	0.01948	8.43	0.00312	0.55
20.0	0.01677	9.42	0.00291	0.60
25.0	0.01365	11.78	0.00174	0.93
30.0	0.01020	14.13	0.00120	0.95
35.0	0.00669	16.49	0.00096	0.98
40.0	0.00624	18.84	0.00072	1.00
45.0	0.00546	20.91	0.00066	1.02

注: 电阻公差 ±20% Note: Resistance tolerance: 20%

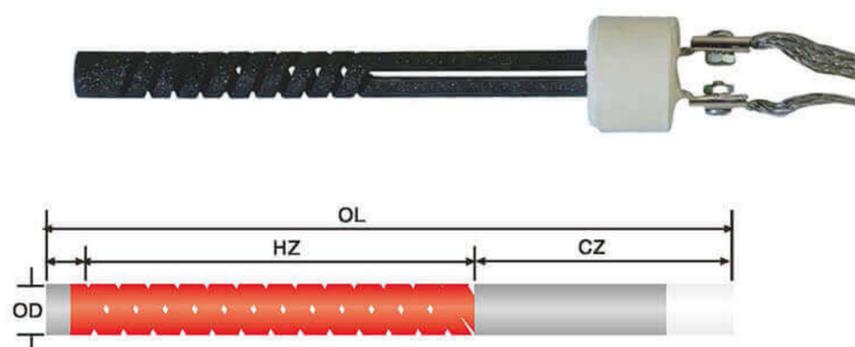
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SIC TECH silicon carbide heating elements

LS高温（双螺旋）硅碳棒 LS shape(double spiral) silicon carbide heating element

LS硅碳棒发热部采用特殊材料制成，密度达到2.8g/cm³,最高使用温度1650℃，超长使用寿命。该硅碳棒采用一端接线，安装方便。

The hot zone of Ls shape silicon carbide heating element is made by special materials,the density of hot zone can be 2.8g/cm³,the maximum using temperature is 1650° C,very long working life.One end of the wire,it is easy to install.



型号: LS 外径:OD

发热部长度:HZ

冷端长度:CZ

总长:OL

例如:LS 型,OD=30mm HZ=400mm CZ=300mm,OL=700mm resistance:1.8ohm

表示为:LS 30/400/700/1.8ohm

Type: LS Outer diameter:OD

Hot zone length:HZ

Cold zone length:CZ

Overall Length:OL

Order example:

LS type,OD=30mm HZ=400mm CZ=300mm,OL=700mm resistance:1.8ohm

Expressed as:

LS 30/400/700/1.8ohm

元件直径 Diameter(mm)	额定负荷 (1050℃时测试) Nominal loading (at 1050℃)			
	发热部 Hot zone		冷端 Cold zone	
	Ω/mm	W/mm	Ω/mm	W/mm
18.0	0.02158	8.48	0.00430	1.70
20.0	0.02302	9.42	0.00384	1.60
25.0	0.01969	11.78	0.00328	1.75
30.0	0.01523	14.13	0.00190	1.75
35.0	0.01224	16.49	0.00150	2.00
40.0	0.00905	18.48	0.00100	2.10
45.0	0.00960	20.91	0.00079	2.10
54.0	0.00636	25.43	0.00073	2.30

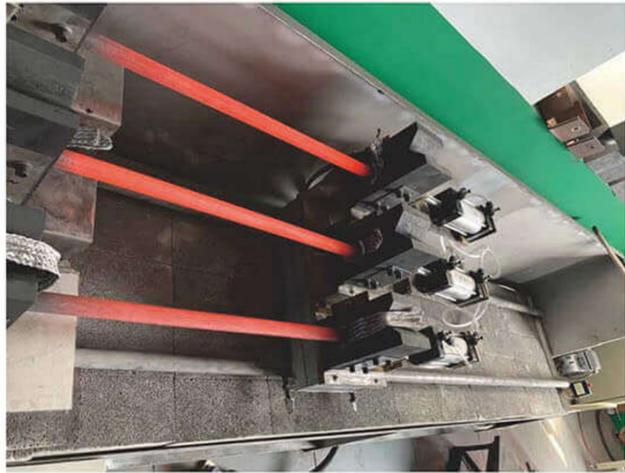
注：电阻公差 ±20% Note:Resistance tolerance: 20%

SIC TECH® 硅碳棒

SIC TECH silicon carbide heating elements

完善的检测 ▶▶▶

Perfect testing



Inspection equipment display



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SIC TECH silicon carbide heating elements

硅碳棒涂层介绍 Introduction of silicon carbide heating element coating

我公司根据硅碳棒使用环境的不同，开发了特殊使用环境中硅碳棒涂层，可使硅碳棒在使用过程中延长硅碳棒使用寿命；

SICTECH硅碳棒涂层是在硅碳棒制作好后在发热部表面涂的一种合成的表面薄膜，可在特殊的使用环境中起到延长硅碳棒使用寿命的作用，能阻隔加快硅碳棒老化的气体，起到保护硅碳棒的作用，详细介绍见以下介绍：

T涂层：用于高温情况下降低氧化速度的一种涂层，可使硅碳棒使用寿命延长30-60%，特别在高温(1380℃以上)使用情况下更能体现效果。

D涂层：该涂层用于在氮气的情况下。

S涂层：该涂层用于浮法玻璃三相棒。

Q涂层：该涂层用于水蒸气、氢气的情况下。

气氛	影响	对策	推荐涂层
水蒸气和湿气	比在干燥大气中的使用寿命缩短1/5	新炉子试运行或者旧炉子长时间不工作再使用时，要先低温充分干燥后再升温。	Q涂层
氢气	硅碳棒温度上升到1350℃以后电阻急速增加，机械强度也下降。而且根据气体干湿的不同寿命也差别很大。	建议在炉内温度为1300℃以下的状态下使用。表面负荷尽量小(5W/cm ²)。	
氮气	温度超过1400℃时氮气与碳化硅反应生成氮化硅，使硅碳棒变脆，寿命缩短。受露点的影响与氢气的状况相同	建议在炉内温度为1300℃以下的状态下使用。表面负荷尽量小(5W/cm ²)。	D涂层
氨气 (H ₂ 75%) (N ₂ 25%)	与氢气、氮气的状况相同。	建议在炉内温度为1300℃以下的状态下使用。表面负荷尽量小。	D涂层
分解反应气体(N ₂ 、CO、CO ₂ 、H ₂ 、CH ₂ O混合物)	加热过程中硅碳棒表面附着分解后的碳黑，造成棒体疏松。	经常向炉内输送空气，让多余的碳燃烧。在炉子构造方面，保持硅碳棒间足够的间隔以防止短路。	D涂层
硫(S、SO ₂)	硅碳棒温度升到1300℃以后，硅碳棒表面被侵蚀、电阻急剧增加。	将硅碳棒温度控制在1300℃以下。	D涂层
其他	由被处理物产生的各种物质，如铅、锑、碱金属的化合物与硅碳棒反应，使其寿命缩短。	预先将这些物质从处理物中除掉，炉内设排气口以便减弱其影响。	S涂层 S涂层

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SIC TECH silicon carbide heating elements

硅碳棒涂层介绍 Introduction of silicon carbide heating element coating

SICTECH Silicon carbide heating element coating is a kind of synthetic film, which is coating the surface of hot zone after production silicon carbide heating element, it can extend the life of silicon carbide heating element in the special using environment, Can be separated from the gas to accelerate the aging of silicon carbide heating element, to protect the silicon carbide heating element, for more details of coating please see the following introduction:

1. T coating: this coating is using for lower oxidation rate in normal use, make the silicon carbide heating element extend working life of 30–60%.
2. D coating: this coating is using in the case of nitrogen
3. S coating: this coating is using in three phase rods (W type silicon carbide heating element) float glass
4. Q coating: this coating is using in the case of steam or hydrogen

Atmosphere	Effect	Countermeasure	Recommended coat
Water Vapor	Heater's lifespan is sometimes cut to less than one fifth of the expected lifespan under dry open-air conditions.	It is important to raise the temperature after purging moisture sufficiently at a low temperature when initiating a new furnace or starting to use one after a long suspension.	Q coating
Hydrogen gas	the resistance increases rapidly and its mechanical strength deteriorates quickly if the temperature exceeds 1350°C in a hydrogen gas atmosphere. The service life, however, depends very much on the intensity of moisture of the gas.	It is recommended that it shall be used at a temperature of less than 1300°C in the furnace chamber. It is recommended that the surface load shall be decreased as much as possible. (5W/cm ²)	
Nitrogen gas	Nitrogen gas reacts with silicon carbide, forming silicon nitride when the temperature exceeds 1400°C, and this shortens the service life. With regard to moisture, it is the same as in the case of hydrogen.	It is recommended that it shall be used at a temperature of less than 1300°C in the furnace chamber. It is recommended that the surface load shall be decreased as much as possible. (5W/cm ²).	D coating
Ammonia converted gas (H ₂ 75%), (N ₂ 25%)	This is the same as in the cases of hydrogen gas and nitrogen gas.	It is recommended that it shall be used at a temperature of less than 1300°C in the furnace chamber. It is recommended that the surface load shall be decreased as much as possible.	D coating
Decomposition reaction gas (N ₂ , CO, CO ₂ , H ₂ , CH ₂ O etc.)	Decomposed hydrocarbon attaches on the surface of heating elements and may cause short-circuiting in an atmosphere including hydrocarbon.	It is necessary to burn off carbon by occasionally introducing air into the furnace. The electric furnace should be designed with wide spacing between EREMA heating elements to prevent short-circuiting.	D coating
Sulfur gas (S, SO ₂)	The surface of heating elements will be damaged and resistance rapidly increases if the temperature of EREMA exceeds 1300°C	Use the heating elements under 1300°C	D coating
Others	Various substances, emitted from processed materials during calcination, including such halides as lead, antimony, alkali and alkaline earth, as well as oxides, chemical compounds thereof may occasionally stick to heating elements and corrode them.	It is important to remove these beforehand from processed materials or exhaust them by installing an exhaust port.	S coating
			S coating

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SIC TECH silicon carbide heating elements

硅碳棒配件 ▶▶▶



硅碳棒夹

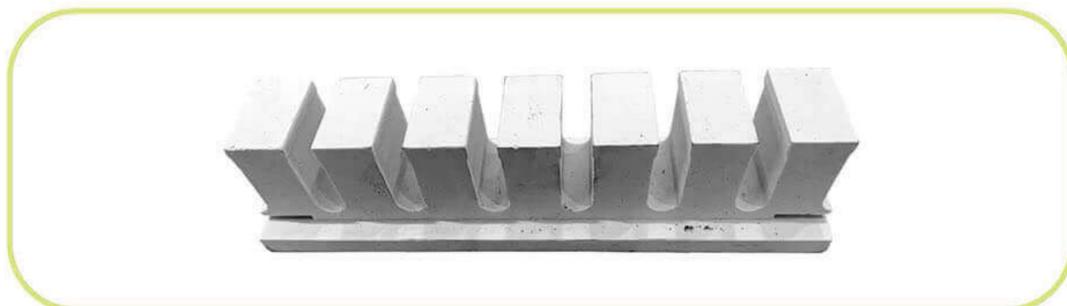
Silicon carbide bar clamp

导电带

Conduction band

耐火陶瓷

Refractory ceramics



浮法玻璃硅碳棒接线夹和绝缘卡座

Float glass silicon carbide bar connection clamp and insulating clamp base

SILICON CARBIDE PARTS

SIC TECH[®] 硅碳棒

SIC TECH silicon carbide heating elements

硅碳棒包装 ▶▶▶



PACKING OF SILICON CARBIDE ROD

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