



百德机械
BETTER CERAMICS

本公司已通过 ISO9001 国际质量体系认证

山东百德陶瓷科技有限公司
潍坊百德机械设备有限公司
WEIFANG BETTER CERAMICS CO.,LTD

反应烧结碳化硅制造商

SISIC(RBSIC) Manufacture

使用环境： work environment

耐高温，耐磨损，耐腐蚀，高强度，高硬度

high temperature resistance wear resistance corrosion resistance high strength excellent hardness



反应烧结碳化硅

Reaction Bonded Silicon Carbide

嘉言善行 源远流长

我们始终相信，高品质的产品和诚信的服务是维护客户与我长期合作的保证。

We always believe that ,high quality products and sincere service is the guarantee maintain customers long -term cooperation with us.

碳化硅性能指标 Technical Data

项目 ITEM	单位 /UNIT	指标 /DATA
最高使用温度 Max Temperature of Application	°C	1380°C
密度 Density	g/cm ³	>3.02 g/cm ³
气孔率 Open Porosity	%	<0.1
抗弯强度 Bending Strength	Mpa	250Mpa (20°C)
	Mpa	280 Mpa(1200°C)
弹性模量 Modulus of Elasticity	GPa	330GPa (20°C)
	Gpa	300 GPa(1200°C)
热传导系数 Thermal Conductivity	W/m.k	45(1200°C)
热膨胀系数 Coefficient of Thermal Expansion	K ⁻¹ *10 ⁻⁶	4.5
莫氏硬度 Moh' s Hardness		9.15
维氏硬度 Vickers Hardness HV	Gpa	20
耐酸性 Acid Alkaline-proof		Excellent

企业简介 || Enterprise profile

山东百德陶瓷科技有限公司（潍坊百德机械设备有限公司）是一家专业生产反应烧结碳化硅特种陶瓷的企业，公司位于诺贝尔文学奖获得者莫言的家乡高密市，地处胶东半岛和山东内陆的结合部，东临旅游名城青岛，西依世界风筝之都潍坊，境内交通便利，铁路公路四通八达，距离青岛机场仅 40 分钟车程，热烈欢迎新老客户到厂考察。

公司生产的碳化硅制品性能稳定，品质优良，已通过 ISO9001 质量体系认证。产品具有高强度，高硬度，耐高温，耐磨损，耐腐蚀，抗氧化，耐急冷急热，抗热震性能好，导热好，热效率高等特点。产品广泛适用于电厂脱硫除尘设备，陶瓷高温窑炉，钢厂淬火炉，矿山物料分级旋流器等等，产品分类涵盖碳化硅脱硫喷嘴、碳化硅喷火嘴套管、碳化硅换热器、辐射管内管、辐射管外管、碳化硅辊棒、碳化硅方梁、碳化硅坩埚等。

公司拥有专业的研发设计模具开发团队，可按客户要求定制各式产品。

百德一直奉行“进取 诚信 严谨 团结”的方针，不断开拓创新，以技术为核心、视质量为生命、奉用户为上帝，竭诚为您提供优质的碳化硅产品以及无微不至的售后服务。

我们始终相信，高品质的产品和诚信的服务是维护客户与我长期合作的唯一保证。

Weifang Better ceramics co., LTD is a professional production of Reaction Bonded Silicon Carbide (RBSiC Or SiSiC) ceramics enterprises, Our company is located in gaomi city located in the jiaodong peninsula and shandong inland junction, in the west of tourist city of Qingdao, the esst to the world kite city of weifang, the territory of convenient transportation, convenient railway highway from Qingdao airport only 40 minutes, we warmly welcome new and old customers to plant inspection.

BETTER' S RBSiC(SiSiC) products have stable performance and excellent quality, Our company has passed ISO9001 quality system certification. RBSiC(SiSiC) Product has high strength, high hardness, high temperature resistance, wear resistance, corrosion resistance, oxidation resistance, thermal shock resistance, good thermal shock resistance, good thermal conductivity, high thermal efficiency, etc. Our Products are widely applied in power plant desulfurization dust removal equipment, high temperature ceramic kiln, steel quenching furnace, mine material grading cyclone, etc., RBSiC(SiSiC) product categories include Desulfurization spray nozzle, RBSiC(SiSiC) burner nozzles, RBSiC(SiSiC) radiation pipe, RBSiC(SiSiC) heat exchanger, RBSiC(SiSiC) beams, RBSiC(SiSiC) rollers, RBSiC(SiSiC) lining ect.

BETTER has a professional research and development design mold development team, can be customized according to customer's request all kinds of products.

We always believe that high quality products and sincere service is the only guarantee maintain customers long-term cooperation with me.



反应烧结碳化硅

Reaction Bonded Silicon Carbide

【术语和定义】

碳化硅特性：

由细颗粒 α -SiC 和添加剂压制素坯，在高温下与液态硅接触，坯体中的碳与渗入的 Si 反应，生成 β -SiC，并与 α -SiC 相结合，游离硅填充了气孔，从而得到高致密性的陶瓷材料，称为反应烧结碳化硅。

致密

烧结部件密度超过碳化硅的理论密度 -3.02 g/cm^3 的 98%。最小密度： 3.0 g/cm^3

硬

反应烧结碳化硅是仅次于金刚石的最硬的高性能材料之一，其莫氏硬度为 9.15。

耐腐蚀、氧化和侵蚀

反应烧结碳化硅的高密度、低孔隙率和化学惰性使得它即使在超高温下 (1380°C) 也能工作于热的气体 and 液体环境，以及氧化和腐蚀性气氛和强酸和强碱中。

耐高温

反应烧结碳化硅的高热导率，结合其低热膨胀，带来远优越于碳化钨、氧化铝和反应结合氮化硅的出色抗热震性。这些性能使得它成为在高温应用中取代韧性金属的理想候选材料。

导热性好

反应烧结碳化硅的导热系数为 45 w/m.k ，其中含有少量的游离硅，导热性能大大提高。

抗氧化性

高温氧化时，表面生成致密的 SiO_2 保护膜，抑制了碳化硅进一步的氧化。

耐磨损

烧结碳化硅的超高硬度和密度使得它可以理想地用于易受到高磨损和滑动磨损的部件。

易于成型

反应烧结碳化硅可以通过注浆、等静压压力成型、挤压成型实现复杂形状的生产。

Reaction Bonded Silicon Carbide (RBSiC or SiSiC) has high strength and excellent hardness, wear corrosion resistance. Oxidization resistance and thermal shock resistance, ect. It is one of the most popular refractory ceramics.

In comparison with Recrystallized Silicon Carbide (ReSiC) and Nitride Bonded Silicon Carbide (NBSiC), RBSiC (SiSiC) ceramic displays Better Performance in Long term applications.

The Slip-casting in conjunction with our net-shape sintered technologies and superior advanced machine process ability. Which enables production of complex shapes and superior sizes with tight dimensional tolerances.

碳化硅辊棒 || SISIC(RBSIC) Rollers

主要用途：该产品主要用于日用瓷、卫生瓷、建筑瓷及磁性材料等辊道窑，具有超长的使用寿命。主要特点：该产品具有高温强度大、抗热震、抗高温蠕变、抗氧化性强、耐磨性好等主要性能。

SISIC(RBSIC) Rollers is mainly used for daily porcelain, sanitary porcelain, building ceramics and magnetic materials, such as roller kiln, high temperature burning with ideal kiln, with a long service life. It has high temperature strength, thermal shock resistance, high temperature creep resistance, strong resistance, good wear resistance, etc..



反应烧结碳化硅辊棒的抗弯强度按 250MPA 计算,取 5 倍安全系数,承载力按长度 1 米求得。若制品长度为 L 时,承载力可按以下公式计算:集中力 = 表中值 x1/L, 均布力合力 = 集中值 x1/L。此承载力适应温度为 1380°C

The Bending Strength of Beams is 250MP safety coefficient is 5.

Concentrated Loading=the Value in The Table x1/L.

Uniformly Distribute Loading= The Value in the Table Accordingly x 1/L.

The temperature is 1380°C

棍棒载力表 Bearing Capacity SISIC(RBSIC) Rollers			
截面尺寸 Sectional Dimension(mm)	壁厚 Thickness(mm)	集中力 Concentrated Loading (kg,m/L)	均布力合力 Uniformly Distributed Loading(kg,m/L)
30	5	43	86
35	5	62	124
38	5	76	152
40	6	95	190
45	6	127	254
50	6	163	326
60	7	277	554
70	7	397	794



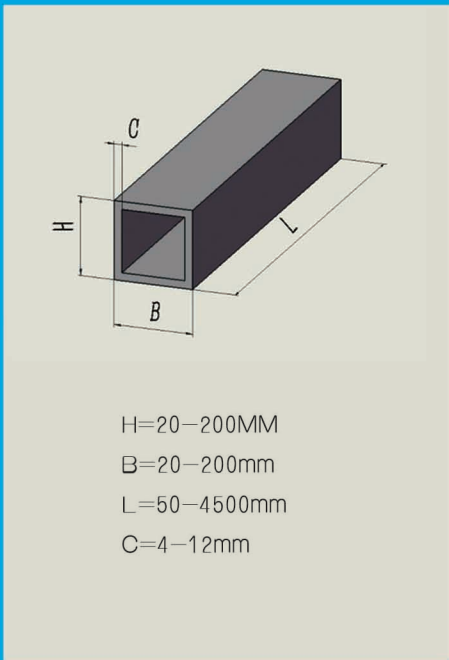
反应烧结碳化硅

Reaction Bonded Silicon Carbide

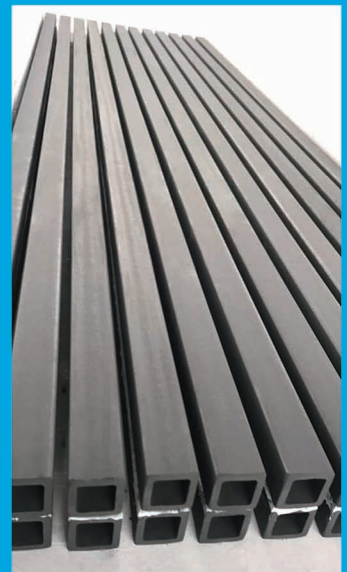
碳化硅横梁 || SISIC Cross BEAMS

反应烧结碳化硅横梁适用于隧道窑、梭式窑以及其他工业窑炉中的承重结构梁。具有高温承载力大,具有良好的导热性,长期使用不弯曲变形,使用寿命长等特点,是卫生瓷和电瓷等行业的理想窑具。

SISIC Cross Beams is suitable for bearing structure beam in tunnel kiln, shuttle kiln and other industrial furnaces. It has the advantages of high temperature bearing capacity, good thermal conductivity, long service life, no bending deformation, long service life, etc. It is an ideal kiln for sanitary porcelain and electric porcelain industry.



横梁承载力表 Bearing Capacity SISIC(RBSIC)Beam						
截面尺寸 Sectional Dimension(mm)		壁厚 Thickness(mm)	集中力 Concentrated Loading (kg.m/L)		均布力合力 Uniformly Distributed Loading (kg.m/L)	
B Side	S Side		B Side	S Side	B Side	S Side
30	30	5	72	72	144	144
30	40	5	115	93	230	186
40	40	5	146	146	292	292
50	50	6	278	278	556	556
50	60	6	367	324	734	648
50	70	6	464	371	928	742
60	60	7	471	471	942	942
80	80	7	916	916	1832	1832
100	100	8	1674	1674	3348	3348
110	110	10	2448	2448	4896	4896



可根据客户窑炉使用情况具体设计。

Specifications according to user requirements can be produced.

碳化硅烧嘴套 || SISIC (RBSIC) Burner Nozzles

碳化硅烧嘴套管具有优异的耐急冷急热和耐磨性、抗氧化、强度高、不落渣、不开裂、使用寿命长、更换方便,是辊道窑、隧道窑、梭式窑等理想的喷火窑具,适用于陶瓷、化工、玻璃、冶金等领域使用天然气、液化气、煤气、柴油等工业窑炉用喷火嘴,能有效控制窑内温度的均衡。是各种燃气、燃油等工业窑炉理想的燃烧室。尤其各式分火器对宽体窑或温差要求高的工业窑炉,能减少能耗并有效控制窑炉温差。

The RBSIC(SISIC)Burner Nozzles has excellent heat and wear resistance, oxidation resistance, shock resistance, high strength, no residue, no crack, long service life, convenient replacement.

The RBSIC(SISIC)Burner Nozzles are used for tunnel kiln,shuttle kiln, roller hearth kiln as the flame tubes.The burner nozzles are also used for heating on either direct or indirect furnace systems.

The RBSIC(SISIC)Burner nozzles have been installed in most of the imported and domestic made kilns.



具体规格可根据用户需求制作。

Specifications according to user requirements can be produced.



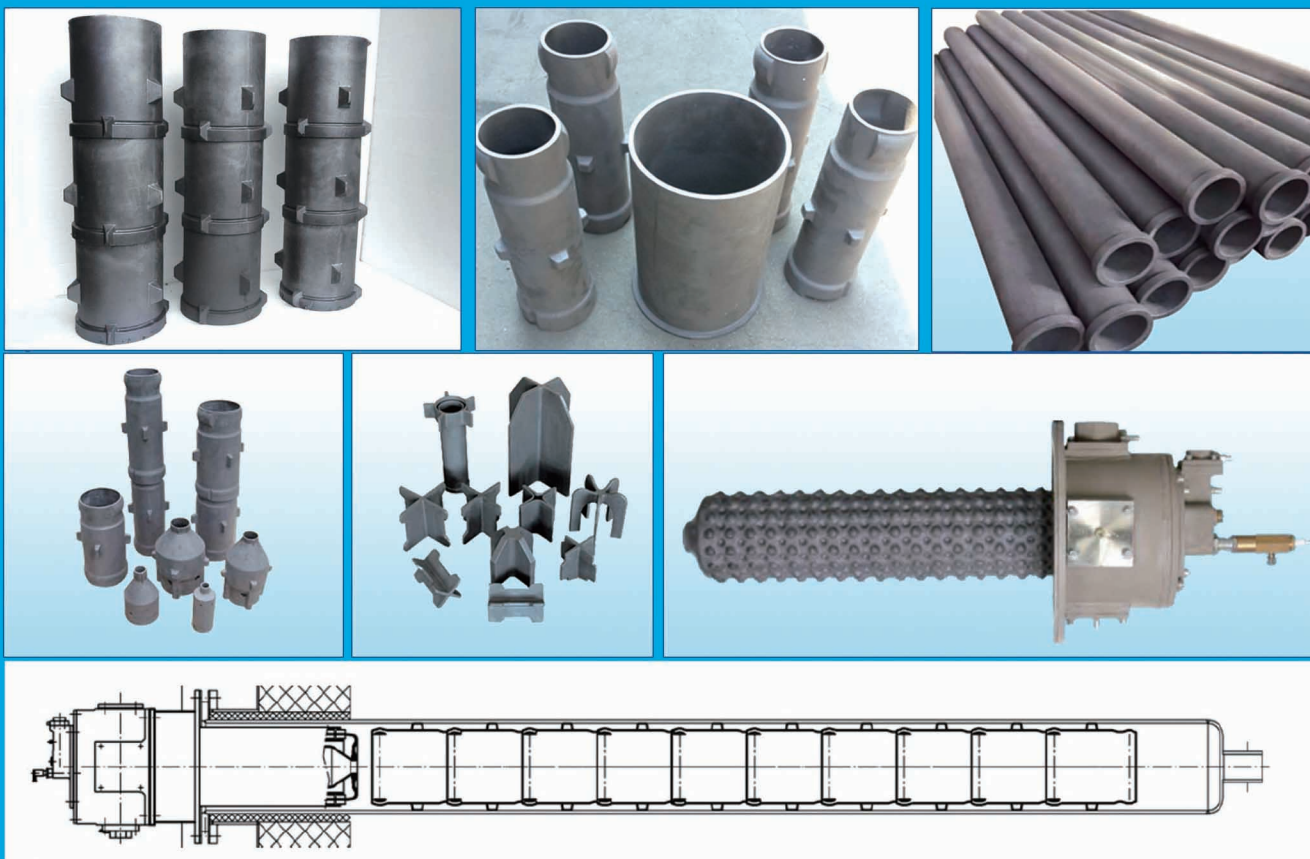
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辐射管导焰套 || SISIC Radiation Pipe

辐射管具有耐高温、导热好、耐急冷急热、抗氧化、抗热震性好、使用寿命长等特点，适用于钢铁、冶金等行业的间接燃烧炉、自身预热燃烧炉、明火燃烧炉、回火炉、退火炉、淬火炉、焚烧炉等预处理或热处理设备的热传导装置及散热装置。

SISIC(RBSIC) radiation pipe is high temperature resistance, good thermal conductivity, extremely cold heat resistance, oxidation resistance, good thermal shock resistance and long service life, etc. It is used for indirect furnace steel, metallurgical and other industries, their preheating furnace, a fire burning furnace, tempering furnace, annealing furnace, quenching furnace, incinerator of pretreatment and heat treatment equipment such as heat exchange device and the radiator.



具体规格可根据用户需求制作。

Specifications according to user requirements can be produced.

碳化硅冷风管 || SiSiC Cooling Air Pipe

反应烧结碳化硅急冷风管具有抗氧化性强、耐急冷急热风冲击、热膨胀系数小以及抗热震和抗高温，且长期使用不老化、不弯曲变形。主要用于辊道窑的降温带，使用寿命是不锈钢管的10倍以上。

SiSiC Cooling Air pipes resistant to oxidation, rapid cooling and thermal shock. The pipe also have low coefficient of thermal expansion and good oxidation, high-temperature resistance. SiSiC Cooling Air pipes are used for the cooling area of roller hearth kilns. The operation life is more than 10 times than stainless steel pipes.



碳化硅板材 || SiSiC Batt





反应烧结碳化硅

Reaction Bonded Silicon Carbide

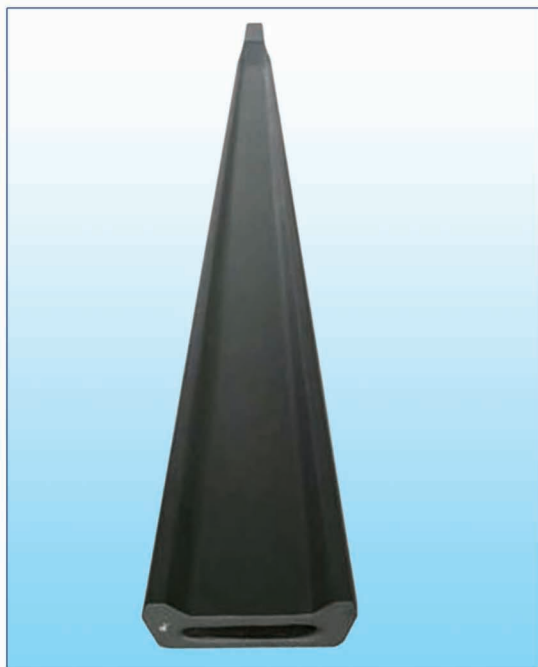
反应烧结碳化硅悬臂浆 || Reaction sintered silicon carbide Paddles

反应烧结碳化硅悬臂浆，是半导体晶圆装载系统的关键部件，主要应用于光伏新能源行业，扩散炉中对多晶硅硅片或单晶硅硅片的（扩散）涂层过程中，对硅片在高温环境中（1000—1300℃）的承载输送作用，产品规格可根据客户要求定制。

碳化硅悬臂浆使用性能稳定，在高温环境中不变形，晶圆装载力大，适用于机器人自动装载和搬运系统。由于悬臂浆截面稳定不变形，可利用现有的炉管制备更大规格晶圆。

Reaction sintered silicon carbide Paddles is a key component of semiconductor wafer loading system. It is mainly used in the new photovoltaic energy industry. In the process of coating polycrystalline silicon wafer or monocrystalline silicon wafer (diffusion) in diffusion furnace, the carrying and transporting function of silicon wafer in high temperature environment (1000-1300 C) can be customized according to customer requirements.

Silicon carbide Paddles has stable performance, no distortion in high temperature environment, and large wafer loading force. It is suitable for automatic loading and handling system of robots. Because the section of cantilever slurry is stable and not deformed, larger wafers can be prepared by using existing furnace tubes.



碳化硅悬臂浆

碳化硅坩埚匣钵 || SiSiC Crucible, Sagger

反应烧结碳化硅匣钵具有耐高温、热震稳定性好、膨胀系数小、抗腐蚀、耐剥落、抗粉化性好、有较好的高温蠕变性等特点。且热传导速度快，使承烧产品受热均匀，有效降低能耗和加快烧成速度，提高产量；广泛适用于电子元件、磁性材料及各种陶瓷粉体的烧结。

Reaction sintered SiC sagger has the characteristics of high temperature resistance, good thermal shock stability, small expansion coefficient, corrosion resistance, peeling resistance, good powder resistance and good high temperature creep. And the heat conduction speed is fast, which makes the products heated uniformly, effectively reduces energy consumption and speeds up the firing speed, and improves the output. It is widely used in the sintering of electronic components, magnetic materials and various ceramic powders.



碳化硅坩埚



碳化硅坩埚



反应烧结碳化硅

Reaction Bonded Silicon Carbide

旋流器碳化硅内衬 || SiSiC Ceramic Liner

高耐磨旋流器碳化硅内衬,是一种新型耐磨材料,这种内衬材料具有硬度高、特耐磨、抗冲击、耐高温、耐酸碱腐蚀等特点,实际使用寿命是聚氨酯的 6 倍以上,尤其适用于强磨蚀、粗颗粒物料的分级、浓缩、脱水等作业中,已在多家矿山得到成功应用。

SiSiC lining, is a kind of new wear-resistant material, the lining material with high hardness, abrasion resistance and impact resistance, high temperature resistance, acid and alkali resistance, corrosion resistance and other characteristics, the actual service life is 6 times more than polyurethane .Especially suitable for highly abrasive, coarse particles in the classification, concentration, dehydration and other operations and it has been successfully applied in many mines.



脱硫喷嘴 || Desulphurization Spray Nozzle

脱硫喷嘴是电厂吸收塔、大型锅炉，钢厂烧结机脱硫等脱硫除尘成套装置的关键部件。材质包括反应烧结碳化硅、不锈钢 316L 等。碳化硅材质脱硫喷嘴具有高强度、高硬度、抗强烈腐蚀、剧烈磨损、耐高温等优良的性能，在恶劣的条件下有超长的使用寿命。我公司生产的脱硫喷嘴，喷雾液滴分布均匀、流道通畅，无阻塞现象。目前有螺旋实心锥型、涡流空心锥型、涡流实心锥型、液柱型等多个品种。

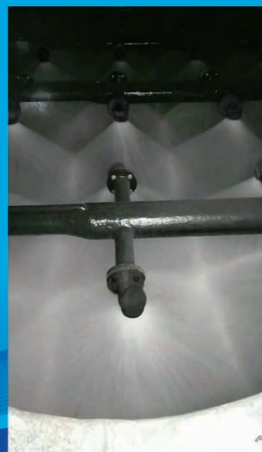
Desulfurization of spray nozzle is the key components of a large power plant absorption tower, boiler, steel sintering desulfurization desulfurization dusting of complete sets of equipment. The Material has reaction sintered silicon carbide and stainless steel 316 l, etc. SISIC desulfurization nozzle has the advantages of high strength, high hardness, strong corrosion resistance, high wear resistance, high temperature resistance and other excellent properties . The desulfurization nozzle,of our company has good spray droplet distribution is uniform, smooth flow channel, no blocking phenomenon. At present, there are many kinds of spiral solid cone type, vortex hollow cone type, vortex solid cone type, liquid column type and so on.



碳化硅涡流喷嘴
Vortex hollow cone spray nozzle



碳化硅螺旋喷嘴
Spiral spray nozzle





反应烧结碳化硅

Reaction Bonded Silicon Carbide

喷嘴的技术要求 || SiSiC Cooling Air Pipe

1. 喷嘴的布置要求

1. Nozzle layout requirements

喷嘴布置的间距应合理，要使喷嘴喷出的锥形水雾相互搭接，不留空隙，否则烟气可能接触不到液滴就从空隙中溜走，调整喷嘴布置密度和喷淋层数，可获得不同的喷雾重叠度。重叠度越高，脱硫效率也就越高，但阻力也会增加。一般喷雾重叠度为 200%–300%，同时喷嘴布置的另一要求是不冲刷塔壁，喷淋母管和支撑件（未避免塔壁防腐材料，可将吸收塔外圈喷嘴布置 90° 或者涡流实心锥喷嘴）。

The spacing of the nozzles should be reasonable. The conical water mist sprayed from the nozzles should be overlapped with each other, leaving no gaps. Otherwise, the flue gas may not touch the droplets and slip away from the gaps. Adjust the nozzle placement density and the number of spray layers. Different spray overlaps are available. The higher the degree of overlap, the higher the desulfurization efficiency, but the resistance will also increase. Generally, the spray overlap is 200%-300%, and another requirement of the nozzle arrangement is not to wash the tower wall, spray the mother tube and the support member (the tower wall anti-corrosion material is not avoided, the nozzle of the outer ring of the absorption tower can be arranged 90° or Vortex solid cone nozzle).

2. 喷嘴的角度

2. Angle of the nozzle



喷雾角是指浆液离开喷嘴口后形成的液膜锥的锥角，主要受喷嘴孔半径、旋转室半径和浆液入口半径等因素影响。选择喷雾角时，必须与喷嘴在塔内布置相结合，保证塔内覆盖均匀度与覆盖率，通常要求喷淋角为 $90^{\circ} \sim 120^{\circ}$ 。

The spray angle refers to the cone angle of the liquid film cone formed after the slurry leaves the nozzle port, and is mainly affected by factors such as the nozzle hole radius, the radius of the rotating chamber, and the radius of the slurry inlet. When selecting the spray angle, it must be combined with the nozzle arrangement in the tower to ensure uniform coverage and coverage within the tower, usually requiring a spray angle of 90° to 120° .

3. 喷嘴的压力

3. Nozzle pressure

喷嘴的喷嘴压降是指浆液通过喷嘴通道时所产生的压力损失，主要与喷嘴结构参数和浆液粘度等因素有关。压降越大，系统能耗也越大。一般喷淋系统喷嘴压降典型值为 $0.05-0.15\text{MPa}$ 之间。

The nozzle pressure drop of the nozzle refers to the pressure loss generated when the slurry passes through the nozzle passage, which is mainly related to factors such as nozzle structure parameters and slurry viscosity. The greater the pressure drop, the greater the system's energy consumption. Typical nozzle system pressure drop is typically between 0.05 and 0.15MPa .

4. 喷嘴的流量

4. Nozzle flow

喷嘴流量指单位时间内通过喷嘴的体积流量，喷嘴流量与喷嘴压力降、喷嘴结构参数等因素有关。在相同喷嘴压力降条件下，喷嘴孔半径越大，喷嘴流量越大。喷嘴流量的计算公式为：

$$Q = C_D \pi \cdot r_D \cdot r_D \cdot \sqrt{2R \Delta P / \rho}$$

式中， Q —喷嘴流量， m^3/s ； r_D —喷嘴孔半径， m ； C_D —流量系数； ΔP —喷嘴压力降， Pa ； ρ —浆液密度， kg/m^3 。

The nozzle flow rate refers to the volume flow rate through the nozzle per unit time, and the nozzle flow rate is related to the nozzle pressure drop and the nozzle structure parameters. Under the same nozzle pressure drop condition, the larger the nozzle hole radius, the larger

The average diameter of the atomized slurry is usually expressed by the average area diameter (Sauter average particle diameter). There are many factors affecting the average diameter of the slurry. At present, the experimental method can only be used to establish the equation. For a tangential inlet nozzle, the average slurry diameter is calculated as

$$DVS=572.8d^{1.589}\sigma^{0.594}\mu^{0.220}Q^{-0.537}$$

Where DVS - volume - area average diameter, μm ; d - nozzle aperture, mm; σ - surface tension, N / m; μ - slurry viscosity, N.s / m^2 ; Q - volume flow, m^3 / s .

喷嘴的喷雾雾滴粒径分布对于多数应用都很重要，对于湿法脱硫系统更是有非常重要的意义。对于某一特定的工况而言，脱硫塔内的雾滴粒径有一个最优值。如果能喷出与最优值粒径均匀度很高的雾滴，就能减少投资及实现系统的经济运行。

雾滴粒径分布的均匀度通常用 RSF 表示： $RSF = (DV_{0.9} - DV_{0.1}) / DV_{0.5}$

在湿法脱硫一般要求，雾滴的 Sauter 平均粒径小于 $2100 \mu\text{m}$ ，RSF 小于 1。

The spray droplet size distribution of the nozzle is important for most applications and is of great importance for wet desulfurization systems. For a particular operating condition, the particle size of the droplets in the desulfurization tower has an optimum value. If a droplet with a uniform particle size uniformity can be ejected, the investment and economic operation of the system can be reduced.

The uniformity of the droplet size distribution is usually expressed in RSF: $RSF = (DV_{0.9} - DV_{0.1}) / DV_{0.5}$

In wet desulfurization, it is generally required that the Sauter average particle size of the droplets is less than $2100 \mu\text{m}$ and the RSF is less than 1.

6. 自由畅通直径

6. Free and unobstructed diameter

自由畅通直径是指喷嘴允许通过球形杂质的最大直径。自由畅通直径越大，其防堵塞的性能越好。

The free unobstructed diameter refers to the maximum diameter of the nozzle that allows passage of spherical impurities. The larger the free diameter, the better the anti-clogging performance.



反应烧结碳化硅

Reaction Bonded Silicon Carbide

涡流喷嘴流量参数指标

Vortex Nozzle Flow Rate Data

入口连接 尺寸 Inlet connection Dimensions(inch)	额定入口 孔径 Inlet Aperture (mm)	额定出口 孔径 Outlet Aper- ture (mm)	压力1bar=1kg, 流量L/min Inlet Pressure(bar)Flowrate(L/min)						可选择 喷雾角度 Spray angle	
			0.3bar	0.5bar	0.7bar	1bar	1.5bar	2bar		
1/2	15	14	23	41	50	68	81	98	90°	120°
3/4	20	18	40	68	80	94	112	132	90°	120°
1	25	20	66	78	95	121	146	195	90°	120°
		25	106	137	168	186	237	264	90°	120°
		27	131	169	180	198	246	279	90°	120°
1-1/4	32	30	156	190	210	239	267	298	90°	120°
1-1/2	40	31	172	198	241	276	298	332	90°	120°
		38	198	261	282	312	390	410	90°	120°
2	50	38	240	309	366	390	465	498	90°	120°
		45	312	365	410	439	489	562	90°	120°
2-1/2	65	45	332	372	456	524	601	741	90°	120°
		50	349	451	534	598	646	785	90°	120°
3	80	55	424	548	628	720	850	1121	90°	120°
		60	514	664	781	820	1002	1230	90°	120°
4	100	55	585	680	784	860	1040	1356	90°	120°
		60	657	848	910	1080	1289	1400	90°	120°
		70	704	909	1080	1260	1400	1689	90°	120°
		80	758	962	1200	1402	1521	1720	90°	120°



螺旋喷嘴流量参数指标

Spiral Nozzle Flow Rate Data

入口连接尺寸 Inlet connection Dimensions(inch)	可选择喷雾角度 Sprtay angle		压力1bar=1kg, 流量L/min Inlet Pressure(bar)Flowrate(L/min)				额定喷孔孔径 Rated orifice diameter
			0.5	0.7	1	2	
1/2	90	120	50	62	75	106	11
3/4	90	120	68	101	136	154	13
1	90	120	152	183	218	306	19
1.5	90	120	272	322	385	545	26
			309	366	438	619	28
2	90	120	451	534	638	804	32
			570	600	702	902	36
2.5	90	120	756	812	902	1205	46
3	90	120	1090	1290	1550	2190	50
4	90	120	1690	2000	2390	2800	63





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