

Si3N4 or Sialon/Syalon 材料特性表

Item 项目		Material 材料	Silicon nitride 氮化硅	Sialon/Syalon 赛龙	Cast Iron 铸铁	Old Ceramics 旧陶瓷
No. 编号			SIN-01A	SINA	Fe	SiC-Si3N4-SiO2
Density 密度	g/cm ³		3.25	3.24	7.2 ~ 7.8	2.65 ~ 2.75
Water Absorption 吸水率	%		0	0	0 ~ 1	7 ~ 12
Flexural Strength 弯曲强度	MPa		680	780	200	50
Vickers Hardness 维氏硬度 Hv	MPa		1500	1720	340	-
Fracture Toughness 断裂韧性 K _{IC}	MPa ^{1/2}		6-7	5.5-6.5	-	2 ~ 4
Young's Modulus 杨氏模量	GPa		300	290	100	-
Poisson's Ratio 泊松比	—		0.28	0.26	-	-
Coefficient of Linear Thermal Expansion 线膨胀系数 (40 ~ 800°C)	×10 ⁻⁶ /°C		3.2	3.0	16.0	4.7
Thermal Conductivity 热传导率	W/m · K		25	37	54	16
Specific Heat 比热	J/kg · K		0.66 × 10	-	0.13 × 10	-
Heat Shock Resistance 耐热冲击	°C		>800	-	-	-
Volume Resistivity 体积电阻率	Ω · cm		>10 ¹⁴	-	10 ⁻⁶	10

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ZXSQ®



SILICON NITRIDE / SIALON / SYALON COMPONENTS & FIXTURES for

ALUMINUM FOUNDRY & CASTING

铝铸造用氮化硅、赛龙零部件

北京中兴实强陶瓷轴承有限公司

Beijing ZhongXing ShiQiang Ceramic Bearing Co., Ltd.

专供熔融的铝、锌、锡等特种金属 零部件制造领域 完美的解决方案 氮化硅、赛龙材料在铝合金及特种金属中的应用

北京中兴实强陶瓷轴承有限公司是中国第一家专业生产陶瓷轴承和陶瓷球的民营企业，从 1982 年开始至今，历经 30 多年对陶瓷轴承材料及其加工工艺、装备的潜心研发和不懈努力，积累了丰富的生产实践经验。企业几经变革，已经成为在陶瓷轴承，陶瓷材料制品加工方面的国内领军企业，目前，能够生产 Si₃N₄、Sialon/Syalon、SiC、ZrO₂、Al₂O₃ 及硬质合金等多种高性能材料制品。

现代工程陶瓷材料，具有耐各种强酸、强碱、盐等腐蚀性介质侵蚀，耐高温、耐磨损、结构重量轻、极限转速高、噪声低、电绝缘、高温下尺寸稳定、启动力矩小，可在润滑条件恶劣的工况下工作，具有较高的使用寿命，可广泛地应用于：航空、航天、航海、石油、化工、机械、汽车、机车、冶金、电力、轻纺、泵类、制药、食品机械、医疗器械、科研和国防军事技术等领域。是具有较大的社会和经济效益的新材料、高附加值的高科技产品。

目前，北京中兴实强陶瓷轴承有限公司生产的氮化硅（Si₃N₄）、赛龙（Sialon/Syalon）陶瓷材料制品，以其优良的耐高温、耐熔融金属腐蚀、抗热冲击、电绝缘、高导热系数、长寿命等特点，在冶金行业，替代传统金属材料制品，具有广泛的市场应用前景。

目前我公司拥有 ZXSQ® 和 CSQ® 两个商标。

尤其在铝合金压铸行业，氮化硅（Si₃N₄）、赛龙（Sialon/Syalon）材料制作：升液管、除气转子、发热体保护管、热电偶保护管等产品，具有其它金属和非金属材料所无法比拟的优势。



Specifically for molten Aluminum, Zinc, Tin and other special metals

Parts and components manufacturing

Perfect solution

Application for Si₃N₄ or Sialon/Syalon material in Aluminum alloy and special metals

Beijing ZhongXing ShiQiang Ceramic Bearing Co. Ltd. is the first enterprise in China, specialized in manufacturing ceramic bearing and ceramic balls. Since the year of 1982 we have accumulated abundant experience in the production over the past more than 30 years, devoting ourselves wholeheartedly to the research and development of ceramic bearing material, our processing technique and improvement of our equipments. Having undergone several evolution and transformation, our company has now become the leading enterprise in China domestic market in the fields of ceramic bearing and ceramic material products. At present, our factory can manufacture products made of Si₃N₄, Sialon/Syalon, SiC, ZrO₂ and Al₂O₃, as well as cemented carbide and other kinds of high property material.

Modern engineering ceramic materials, resistant to all kinds of acid, alkali, salt and other corrosive media erosion, high temperature, wear-resistant, light weight structure, extreme high speed, low noise, electrical insulation, dimensional stability under high temperature, low starting torque, can work under very poor lubrication condition with long life, can therefore be widely used in aviation, aerospace, marine, petroleum, chemicals, machinery, automobiles, locomotives, metallurgy, electric power, textile, pumps, pharmaceuticals, food machinery, medical equipment, defense and military research and technology, and many other fields. They are value-added high tech products with large social and economical benefits.

Currently ZXSQ silicon nitride(Si₃N₄) or Sialon/Syalon has started to replace the traditional metal material in metallurgical industry, and possess broad market application prospect, due to its excellent resistance to high temperature, molten metal corrosion, thermal shock, electrical insulation, high thermal conductivity, long life and other good characteristics.

In aluminum die-casting industry, in particular, silicon nitride(Si₃N₄) or Sialon/Syalon material is widely used in manufacturing stalk, degassing rotor, heater protection tube, thermocouple protection tubes, etc., with its unique property, against which no other metal and non-metal material can compare.



特点

1、耐热冲击性

氮化硅、赛龙具有优良的耐热冲击性和高温机械强度，使用时对其进行预热。经预热后，就能比普通陶瓷实现更好的可靠性。

2、耐腐蚀性

氮化硅、赛龙具有优良的耐腐蚀性与熔融铝几乎不会发生反应。因此可以确保使用寿命更长。

3、无浸润性

氮化硅、赛龙属于共价的陶瓷材料，对熔融金属有着极低的浸润性，因而无需涂层。也不会产生很多的结渣和吸附物，且易于清理。

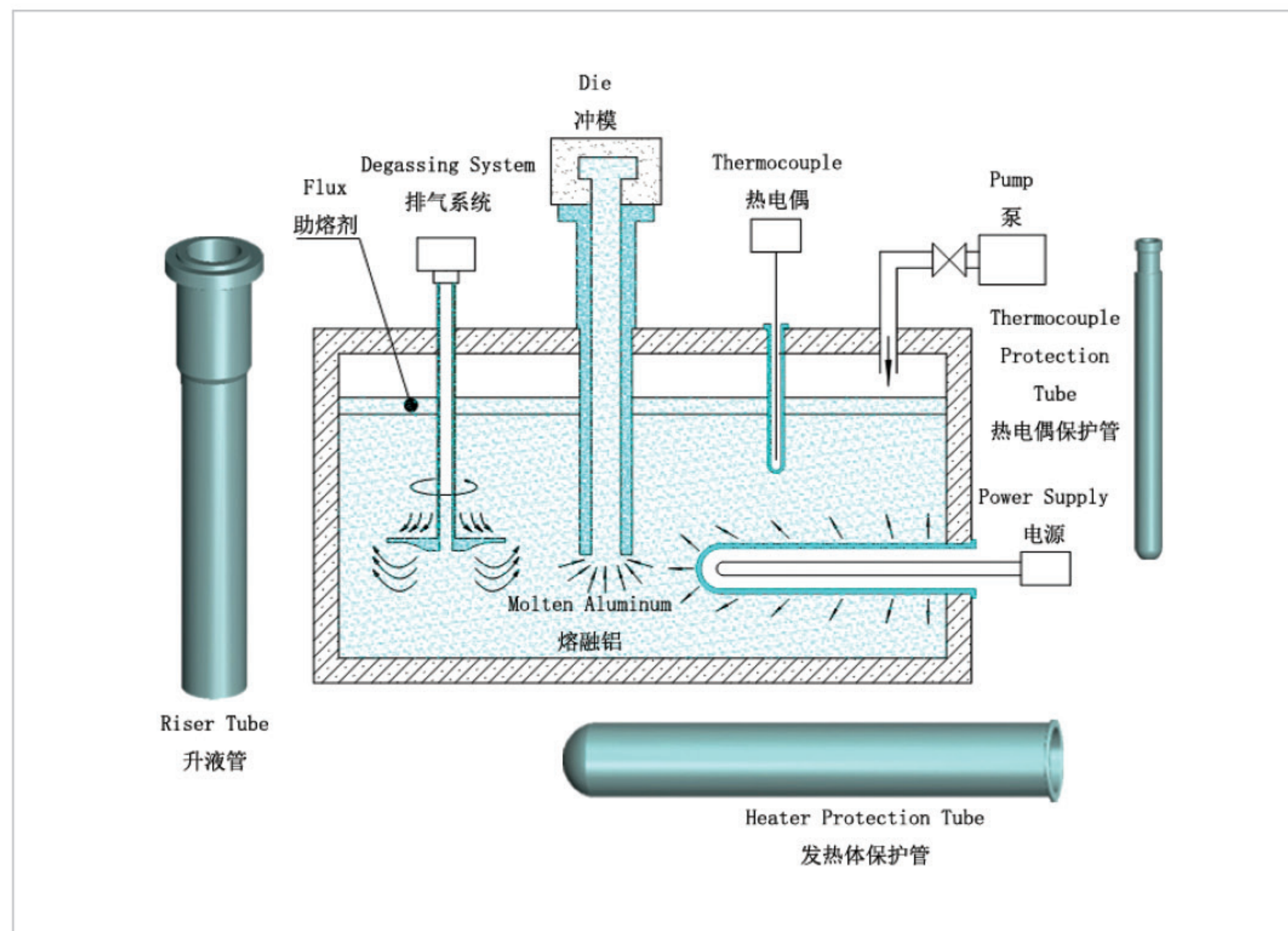
4、低导热性

氮化硅、赛龙具有导热性低的优点。其特有的低比热允许热损失最小。这就使得热电偶保护管的温度测量更为精确，便于熔融金属在轴管中传热。这一特点可以降低熔融金属的温度以及能源总成本。

5、高强度、长寿命

氮化硅、赛龙在 800°C 以下均可保持原有强度。其耐腐蚀和优良的强度特性，可使其产品的壁厚可以设计得较薄，更易于操作，维修更换更加便捷。

铝铸造的应用 Application for Aluminum Foundry & Casting



Advantages

1. Resistance to thermal shock

Si₃N₄ or Sialon/Syalon has superior thermal shock resistance and high temperature mechanical strength.

Prior to the application of Si₃N₄ or Sialon/Syalon products, preheating is necessary. The preheating process can realize better reliability than conventional ceramic.

2. Resistance to corrosion

Si₃N₄ or Sialon/Syalon has excellent corrosion resistance, being almost inert against molt aluminum, thus ensuring longer life.

3. Low- wettability

As a covalent binding ceramic, Si₃N₄ or Sialon/Syalon has low wettability against molten metal and does not require coating. It will not generate much scorification and material adsorption, as a result, it is easy to clean.

4. Low heat conduction

Si₃N₄ or Sialon/Syalon has the advantage of low heat conduction. Its low specific heat reduces loss of heat to the minimum. This guarantees the accuracy in temperature measurement for the thermocouple protection tubes, and facilitates molten metal heat to convey in stalk tube. This can reduce the temperature of molten aluminum and save overall energy costs.

5. High strength, long life

Si₃N₄ or Sialon/Syalon keeps its original strength even at high temperature of up to 800°C. Its corrosion resistance and excellent strength characteristics permit a relative thin wall in thickness of the products, making it easy to handle and operate, and for maintenance and replacement.

Reaction Against Molten Metal 与熔融金属发生反应

Molten Metal 熔融金属	Temperature 温度	Duration 时间	Result 结果
Al	800°C	950Hr	○
Pb	400°C	144Hr	○
Sn	300°C	144Hr	○
Zn	550°C	500Hr	○
Mg	750°C	20Hr	×
Cu	1150°C	7Hr	×

除气轴和转子

氮化硅、赛龙材料适用于熔融铝液的除气轴和转子。

为去除熔融铝液中的氢，使用 Si₃N₄、Sialon 材料轴管送入氮气或氩气。转子在熔融的铝液中搅动，分散并打碎气泡，从而将氢元素随气泡带出，到达除氢的目的。

- 优良的高温机械强度和耐接触疲劳的特性，确保转子在高速旋转运转时可靠、稳定、持久。
- 氮化硅、赛龙材料与石墨材料的不同之处在于，氮化硅升温时几乎不会因遇到空气而氧化、挥发，这就使其使用寿命更长。这一点在铝合金的铸造工艺中更为适用。
- 高耐热冲击性能允许在操作时，反复从熔融铝中插入和拔出，而不会炸裂、破损，使用维护更加便捷。
- 优良的耐腐蚀性、耐磨性和无的浸润性，可耐熔融铝液的腐蚀，使其使用寿命更长，结渣物更少，如日常维护得当，使用寿命达 2—3 年以上。
- 根据用户实际情况，我公司可对转子叶轮的结构形式进行了优化设计，让除气效果更好！

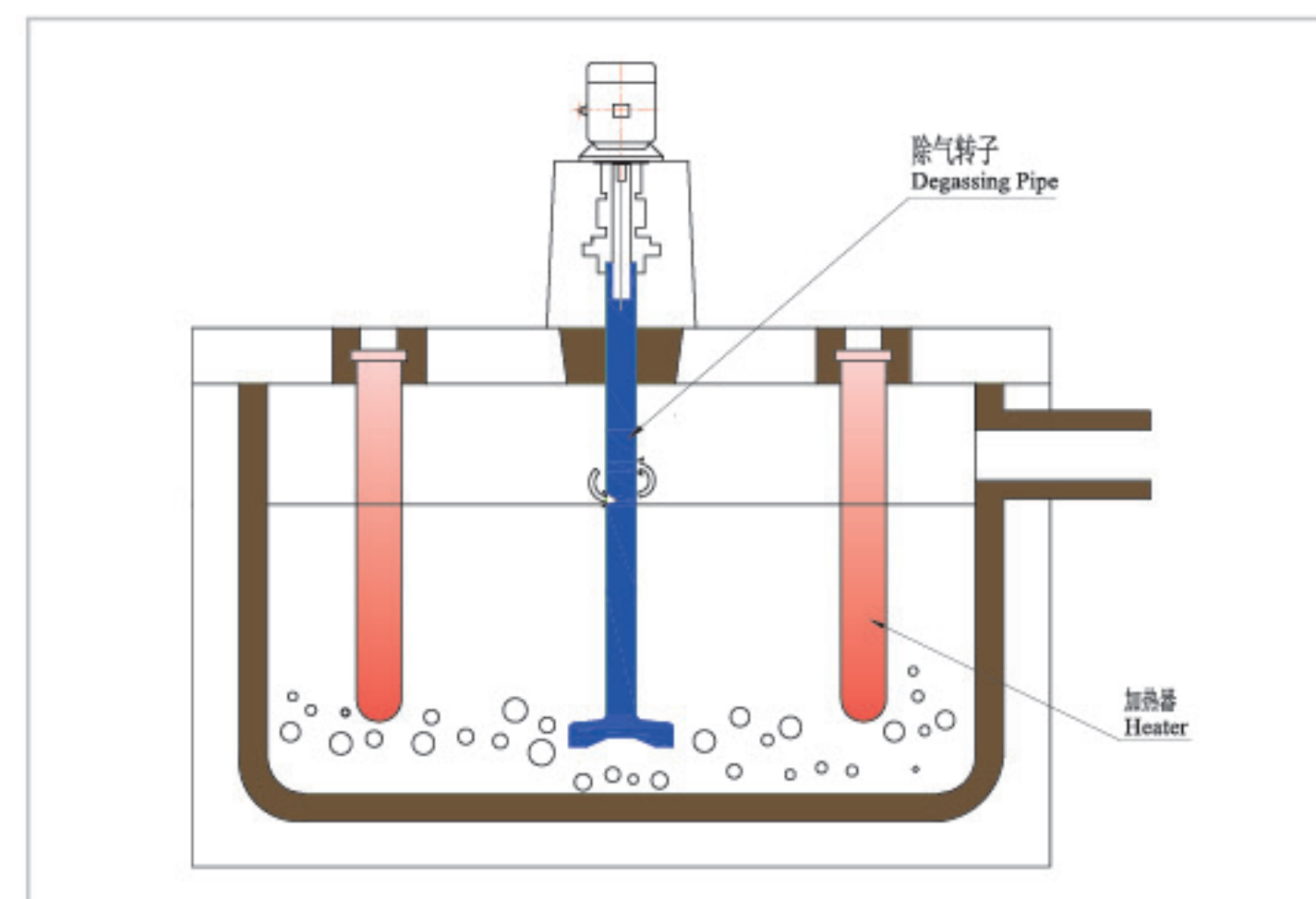


Degassing Pipe and Rotor

Si₃N₄ or Sialon/Syalon material is suitable for molten aluminum liquid degassing pipe and rotor.

In order to remove hydrogen from molten aluminum, a silicon nitride pipe is used to feed nitrogen or argon, while silicon nitride rotor is used to stir up and disperse the gas bubble, and then take the Nitrogen out with the bubble throughout the molten bath, thus get the result of hydrogen remove.

- The high-temperature mechanical strength and resistance to contact fatigue of Si₃N₄ material assures reliable, stable and long operation of rotor in high speed rotation.
- Unlike graphite, silicon nitride is hardly volatilized by oxygen at elevated temperature. This permits long operating life. And this character is most popular in the casting industry of aluminum alloy.
- High thermal shock performance allows the pipe and rotor to insert in and pull out repeatedly from molten aluminum in operation. Pipes and rotors will not be cracked and damaged. Therefore, operation and maintenance become very convenient.
- Excellent corrosion resistance, wear resisting and low wettability, resistance to molten aluminum liquid corrosion makes the operation life longer, and less slagging. If proper maintenance, the using life can be up to 2-3 years.
- According to actual working condition, our company is able to make optimized design of rotor impeller structure to achieve better degassing effect.



发热体保护管

氮化硅、赛龙材料适用于熔融铝液的发热体保护管和气体燃烧器的保护管。在铝、锡、铅、锌等多种冶金行业产品所使用。采用 Si₃N₄、Sialon 材料做发热体保护管的好处在于：

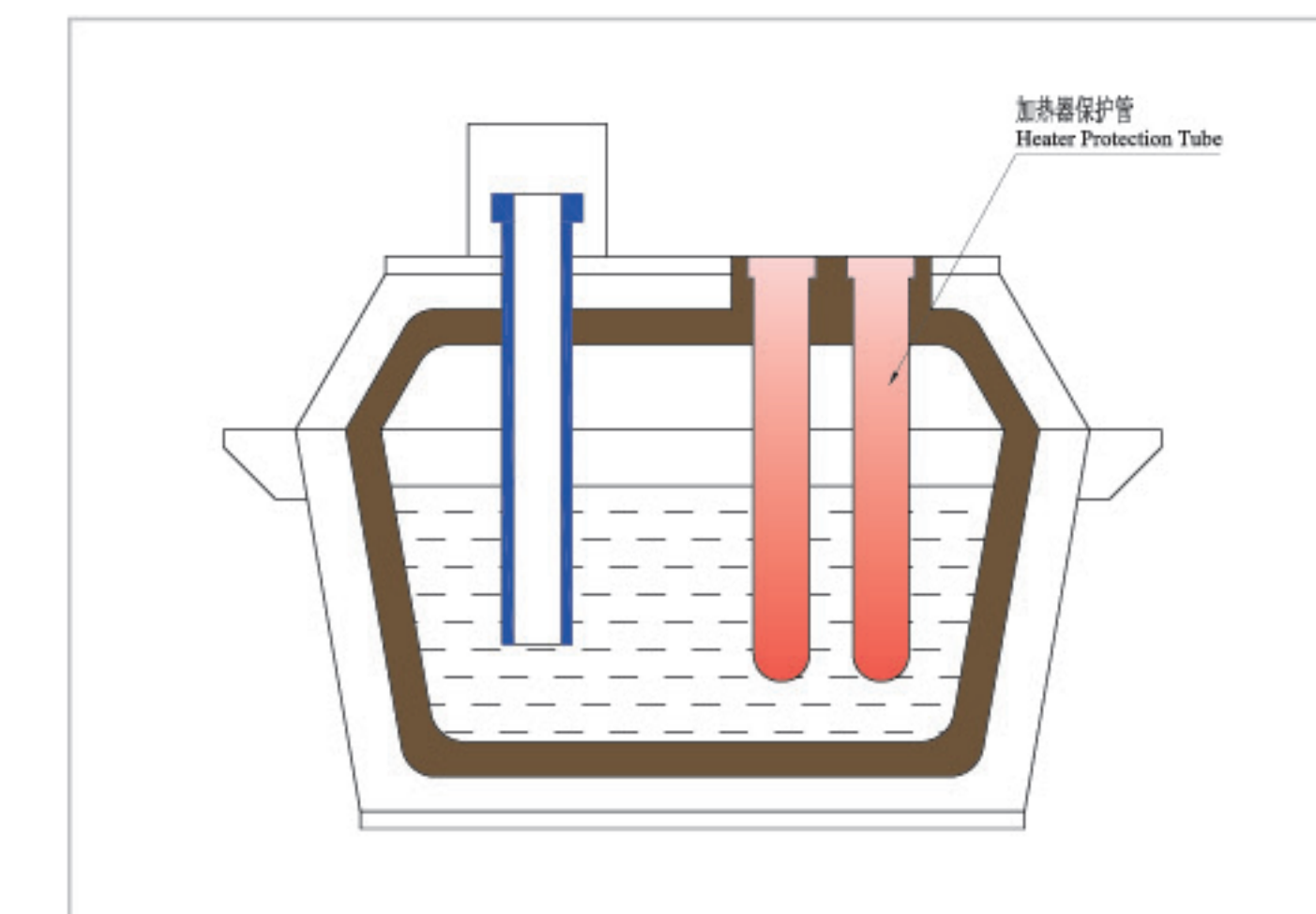
- 优良的耐高温性和高温机械强度，能够承受高温发热体的热负荷。即便是操作时插拔都不会影响产品性能。
- 优良的耐热冲击性，保证在铝液升温、降温，以及发热元件与铝液产生温差时，保护管仍能长时间工作。
- 对熔融金属的无浸润性，可大幅度降低保护管表面渣的附着，便于维护和操作。
- 优良的绝缘性，保证发热元件与铝液或其他熔融金属间良好的绝缘性。
- 优越的耐腐蚀性、耐磨性，可长期保护内部的发热体元件正常工作。如日常维护得当，使用寿命达 2—3 年以上。



Heater Protection Tube

Si₃N₄ or Sialon/Sylon material is applicable for making molten aluminum liquid heater protection tube and the gas burner protection tube in metallurgical industry like aluminum, tin, lead, zinc etc. The advantages of Si₃N₄ material are as follows:

- With good thermal shock resistance and high temperature mechanical strength, therefore, the products can withstand severe thermal load of high temperature heaters. Repeated insertion and withdrawal of the products in the course of operation will not affect the performance.
- High thermal shock performance assures long working time when warming and cooling of molten aluminum, and also temperature difference between heater and liquid.
- Low wettability against molten aluminum can reduce the contacting of slag on the protection tube, and provides easy maintenance and operation.
- Excellent insulation can assure no contact (insulation) between heater and molten aluminum or other molten metal.
- With good high-temperature mechanical strength, corrosion resistance and low wettability, the Si₃N₄ material can protect the normal working of heater element in the tube for a long time. If proper maintenance, the actual using life can be up to 2-3 years.



升液管

氮化硅、赛龙材料适用于熔融铝液的升液管。升液管是在铝合金压铸过程中向模腔内输送铝液的管件。采用 Si3N4、Sialon 材料做升液管的好处在于：

- 优良的耐热冲击性和高温机械强度，在 800 度的铝液或其他熔融金属中其强度不变，使用时如能对升液管进行预热，则效果更佳。
- 对熔融铝液的无浸润性，可以减少管内吸附物和结渣，使日常维护更加轻松。
- 优良的低导热性，使保温性能好，从而减少热损失。
- 优良的耐腐蚀性、耐磨性，在压铸过程中，可承受高压的铝液或其他熔融金属的反复冲刷，工作持久稳定。如日常维护得当，使用寿命达 2—3 年以上。

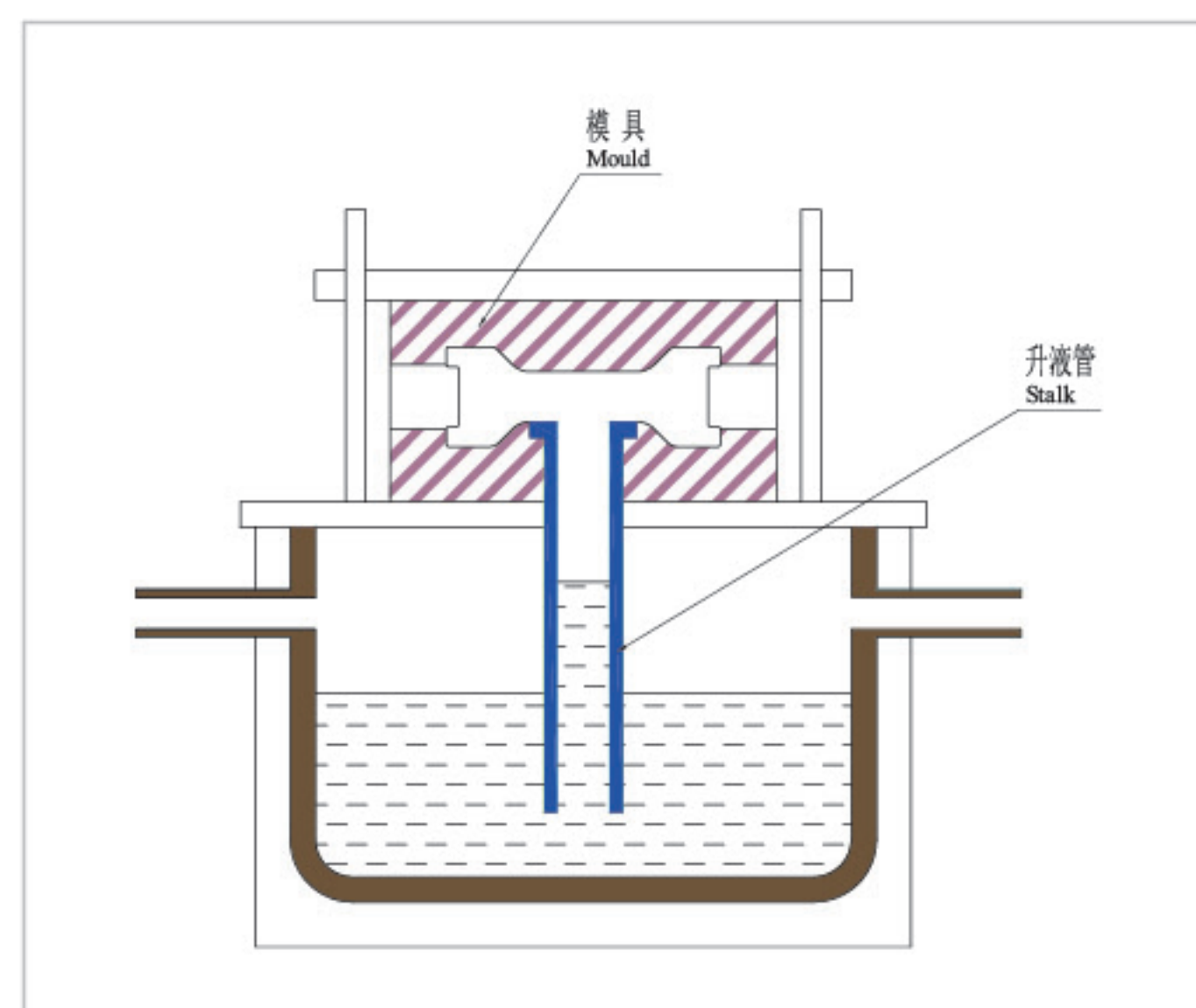


Stalk (Feed Pipe)

Si3N4 or Sialon/Syalon is the suitable material for making aluminum liquid stalk.

Stalk is the pipe fitting which transports aluminum liquid to the die cavity in the process of aluminum alloy die-casting. The advantages of Si3N4 material are as follows:

- Si3N4 has better thermal shock resistance and high temperature mechanical strength, and the strength will not alter at the 800°degree or other molten metal. If preheated at the time of use, it will get the best effect.
- Low-wettability of molten aluminum can reduce the adsorbates and slag on the tube, making it easier to do the daily maintenance.
- Si3N4 material has low heat conduction and superior heat preservation performance, preventing from heat loss.
- Due to its excellent corrosion resistance and low wettability, the tube can stand repeat washing of molten aluminum or other molten metal.
- With good high-temperature mechanical strength, corrosion resistance and low wettability, the Si3N4 material can protect the normal working of heater element in the tube for a long time. If proper maintenance, the actual using life can be up to 2-3 years.



热电偶保护管

氮化硅、赛龙材料适用于热电偶保护管，使用寿命长，无需维护。

热电偶保护管作为测温的必备手段，被铝、锡、铅、锌等多种冶金行业产品所使用。采用 Si3N4、Sialon 材料做热电偶保护管的好处在于：

- 优良的耐热冲击性和高温机械强度，重量轻，强度高，易于操作。即便是在生产过程中更换，也不会产生炸裂，便于操作和维护。
- 导热性低的优点。其特有的低比热使热损失最小。这就使得热电偶保护管的温度测量更为精确。
- 对熔融铝液的无浸润性，可大幅度降低保护管表面渣的附着，便于维护和操作。
- 据有优良的耐腐蚀性、耐磨性，可以确保使用寿命更长，如日常维护得当，使用寿命达 2—3 年以上。



Protection Tube for Thermocouple

Si3N4 or Sialon/Syalon material can be widely used as the main material of protection tubes for thermocouple, for long working life and free maintenance.

As the necessary means of measuring temperature, thermocouple protection tubes are applicable in metallurgical industry, such as aluminum, tin, lead, zinc etc. The advantages are:

- Si3N4 material has better thermal shock resistance and high-temperature mechanical strength, light weight, high strength and easy to operate. It will not burst even if exchange is done in the course of processing, making it easy for production and maintenance.
- Si3N4 material has the low conductive advantage. Its low specific heat minimizes loss of heat. This will be conducive to achieving the accuracy of temperature measurement for the thermocouple protection tube.
- Molten aluminum's low wettability prevents stick of slagging in the tube, thus easy to maintain and operate.
- Si3N4 has excellent corrosion resistance and wear resistance, and ensure longer working life. If proper maintenance, the actual using life can be up to 2-3 years.



止液阀

氮化硅、赛龙材料适用于熔融的铝液从熔炼炉注入保温炉、除气箱、低压铸造的储液箱的止液阀（俗称：堵头）

采用 Si3N4、Sialon 材料做止液阀的好处在于：

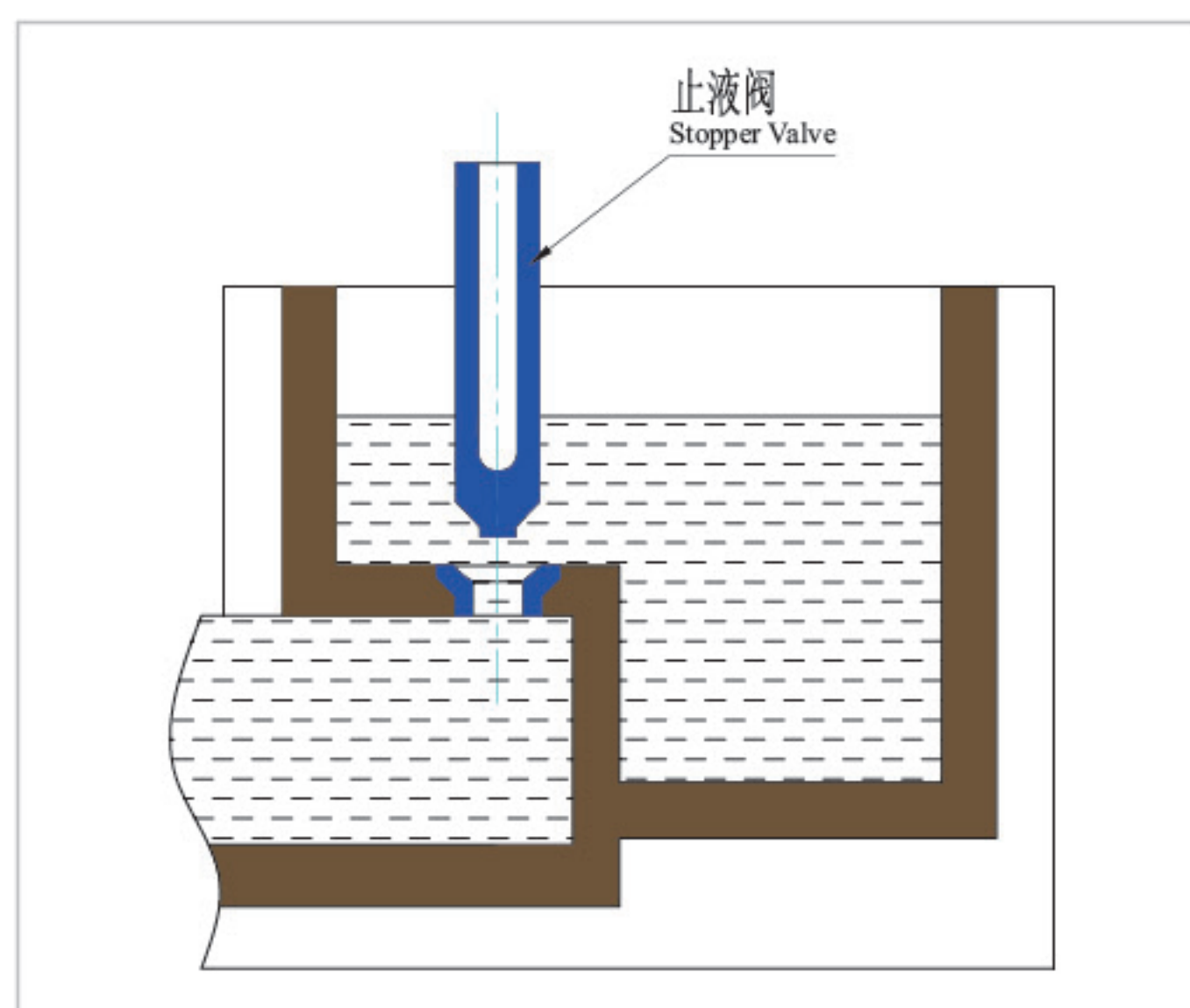
- 优良的耐热冲击性和高温机械强度，重量轻，强度高，易于操作。
- 对熔融铝液的无浸润性，可大幅度降低管道内表面渣的附着，便于维护和操作。
- 开启、关闭灵活，可保证及时输送铝液等优点。
- 在低压铸造时，为保持各腔室间的压力，需要有良好的气密性，因此优良的加工精度是其必不可少的保证。
北京中兴实强公司具有高精度陶瓷轴承的加工能力和水平，因此可保证该止液阀的良好气密性。
- 具有优良的耐腐蚀性、耐磨性，可以确保使用寿命更长，如日常维护得当，使用寿命达 2-3 年以上。



Stopper Valve

Si3N4 or Sialon/Syalon is the suitable material of stopper valve, which is used in the molten aluminum from smelting furnace infused to holding furnace, degassing tank and reservoir tank of low pressure casting. The advantages of Si3N4 material are as follows:

- Good thermal shock resistance and high-temperature mechanical strength, light weight, high strength, and easy to process.
- Molten aluminum's low wettability prevents stick of slagging in the tube, thus easy to maintain and operate.
- Flexible turning on and off, it can ensure the conveying the aluminum liquid in time.
- Good air tightness is needed to ensure the pressure of each cavity when in low pressure casting, so it's necessary to guarantee the good process precision. ZXSQ has the ability to process high precision ceramic bearing, we can promise the good gas tightness of such stopper valve.
- Si3N4 has excellent corrosion resistance and wear resistance, and ensure longer working life. If proper maintenance, the actual using life can be up to 2-3 years.



集装式加热器（新品）

该产品是我公司根据铝工业市场的加热器现状，全新研制的一款采用了全新的加热器元件与氮化硅保护管、热电偶全部三种元件集成于一体，具有结构小巧、功率大、加热速度快、热效率高等众多优点的集装式加热器。

- 采用全新的材料的加热器元件、独特的结构形式。使得热效率的转化可达 80~90%。
- 结构简单、易于安装，充分利用了氮化硅保护管的众多优点，使用寿命更长，可达 2-3 年以上！
- 可即时插拔，清渣更方便，使得日常维护更加便捷。
- 实现了小规格、大功率、加热速度快、热效率高等优点。
- 安全、环保、大幅度降低成本、可替代目前的国内及国外各种形式的加热器。经济价值、社会效益巨大！



Integrated heater (New-developed products)

According to the status of heater tubes in aluminum industry market, we developed one new heater element, with the integration of Si3N4 protection tube and thermocouple. This kind of integrated heater has many advantages, such as compact structure, large power, fast speed of heating, high heat efficiency.

- With the new material and unique structure, the heater element can make the thermal efficiency be up to 80~90%.
- It makes the full use of advantages of Si3N4 protection tube, --the simple structure and easy to install, makes the using life much longer, which can be up to 2-3 years.
- Insertion and extraction can be processed at any time. The more convenient slag removal makes the maintenance more convenient.
- It has the advantages of small structure, large power, fast heating and high heat efficiency.
- With its safety and environmental protection, this kind of heater can reduce the cost, and also replace the various heaters in domestic or foreign market. And its economic value and social benefit is very big.



精炼管

氮化硅、赛龙材料适用于熔融的铝液的精炼工艺中。

采用 Si3N4、Sialon 材料做精炼管的好处在于：

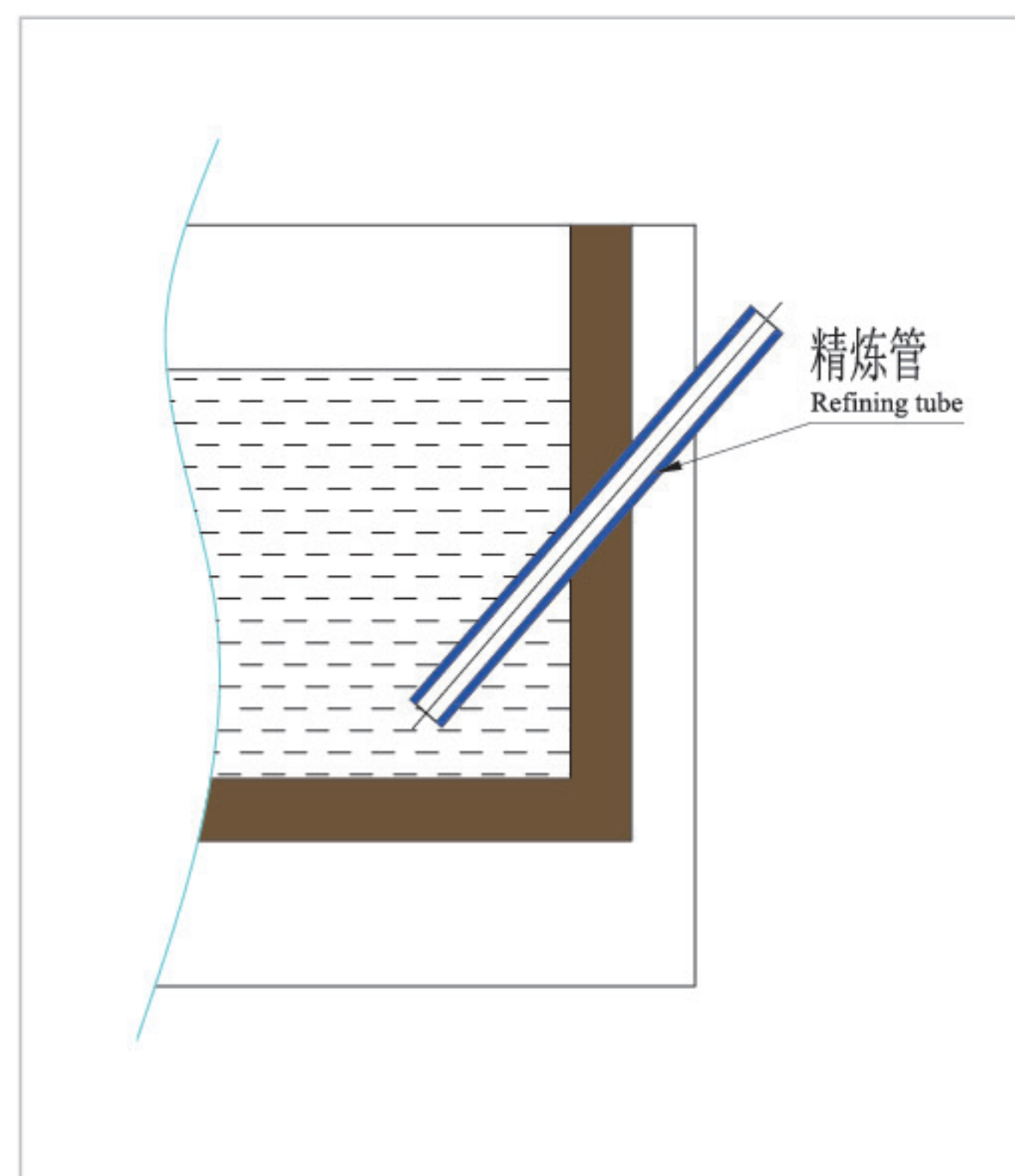
- 优良的耐热冲击性和高温机械强度，重量轻，强度高，易于操作。
- 对熔融铝液的无浸润性，可大幅度降低管道内表面渣的附着，便于维护和操作。
- 独特而新颖的结构，使精炼管本身伸缩自如，保证精炼粉吹入的及时。
- 具有优良的耐腐蚀性、耐磨性，可以确保使用寿命更长，如日常维护得当，使用寿命达 2-3 年以上。
- 我公司可根据客户的实际使用需求，为客户量身定制客户所需要的精炼管。



Refining tube

Si3N4 or Sialon/Syalon is the suitable material for the refining process in molten aluminum.

- Good thermal shock resistance and high-temperature mechanical strength, light weight, high strength, and easy to process.
- Molten aluminum's low wettability prevents stick of slagging in the tube, thus easy to maintain and operate.
- With unique and novel structure, the refining tube can guarantee refined powder get into the furnace timely, with its retractile character.
- Si3N4 has excellent corrosion resistance and wear resistance, and ensure longer working life. If proper maintenance, the actual using life can be up to 2-3 years.
- Our company can supply the refining tube as per customers' needs.

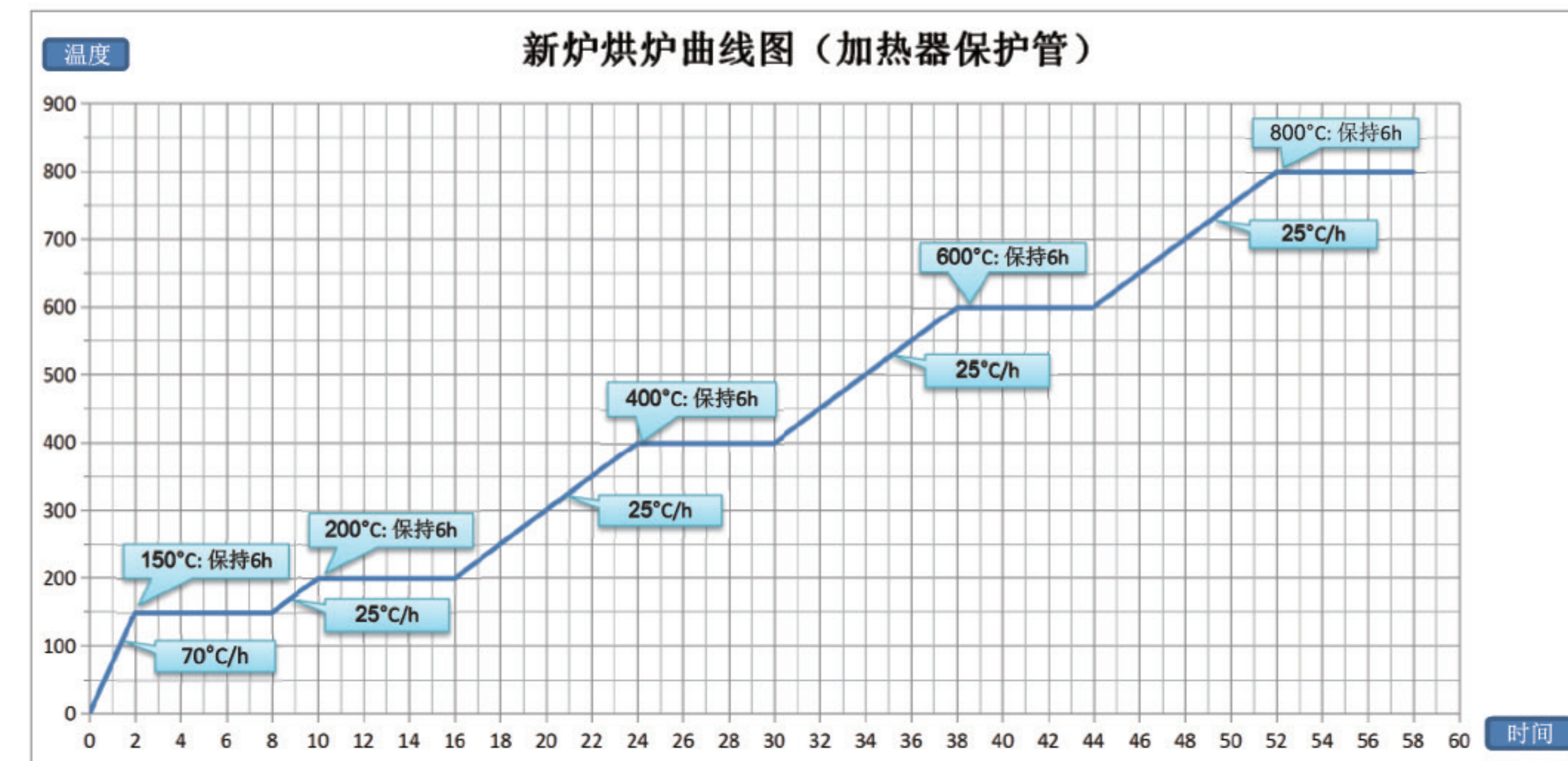


使用注意事项：

A、预热：

1、安装时尽可能对零件进行预热；如是新炉子投产时，则只要将上述零件中的加热器、热电偶等安装好后随烘炉的过程即可达到预热的目的。

附：新炉子烘炉升温曲线图



新炉子在烘炉过程中，炉内的炉气温度达到 800 度时保持 6 个小时后，此时切断加热器电源等待 20 分钟后，再加入铝液。

- 2、如除气转子、升液管类的零件，在维修更换新的备件时，则按如下过程操作：将安装好的零件在炉口处，距液面 200mm 处悬停 15-20 分钟后，即可放入铝液中开始工作；
- 3、如加热器保护管、热电偶保护管类的零件，在维修更换新的备件时，则按如下过程操作：将零件安装在炉盖上的指定位置并固定好后，将炉内的铝液放掉，吊装炉盖就位后给加热器升温，15 分钟后停止加热，放入新的铝液即可开始正常工作；

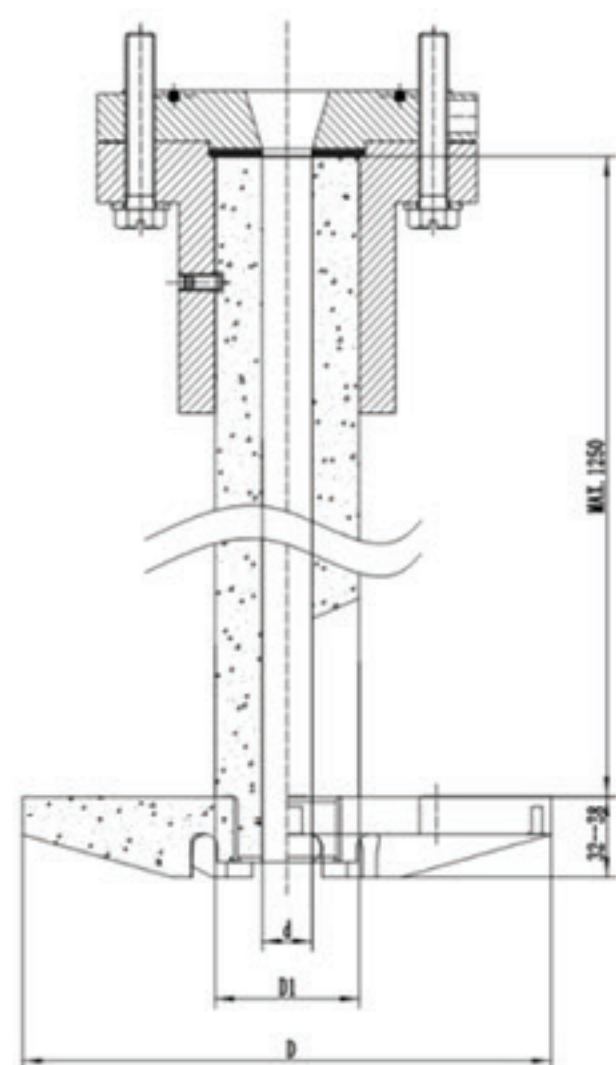
B、除渣：

- 1、除渣时，尽可能避免外力敲击、撞击、机械性冲击等对其造成的损坏；
- 2、刚刚从炉内取出时，尽量趁热除去附着在表面的渣（采用刮、铲的方式为好）；
- 3、如表面附着的渣已经冷却凝固，而无法趁热去除，就请将该零件放入盐酸中浸泡 2-3 小时后，再慢慢刮去表面的浮渣。

由于氮化硅材料属于脆性材料，故本公司不负责上述零件的任何安全责任！

Si3N4/Sialon/Syalon Degassing Pipe

Shape and Sizes



Standard Sizes(mm)

Impeller Size	Inner Dia.	Outer Dia.
180	35	60/62
200	40	60/62
210	40	60/62
220	40	60/62

No.	1	2	3	4	5	6	7	8	9
L (inch)	400 (15.75)	500 (19.65)	600 (23.62)	700 (27.56)	800 (31.50)	900 (35.43)	1000 (39.37)	1100 (43.31)	1250 (49.21)

shapes and sizes can be customized

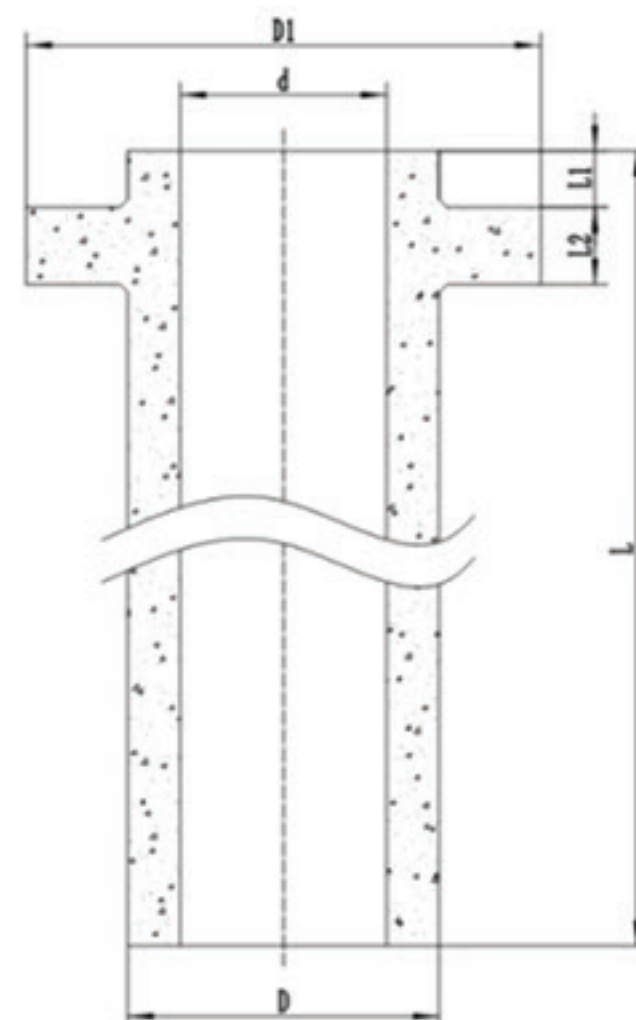
Handling and Maintenance Handling

Avoid severe mechanical impact
Avoid rapid cooling over a wide temp range
Assemble and install only in moisture free Conditions

Remove slag deposits before solidification from heater protection tube weekly

Si3N4/Sialon/Syalon Riser Tube

Shape and Sizes

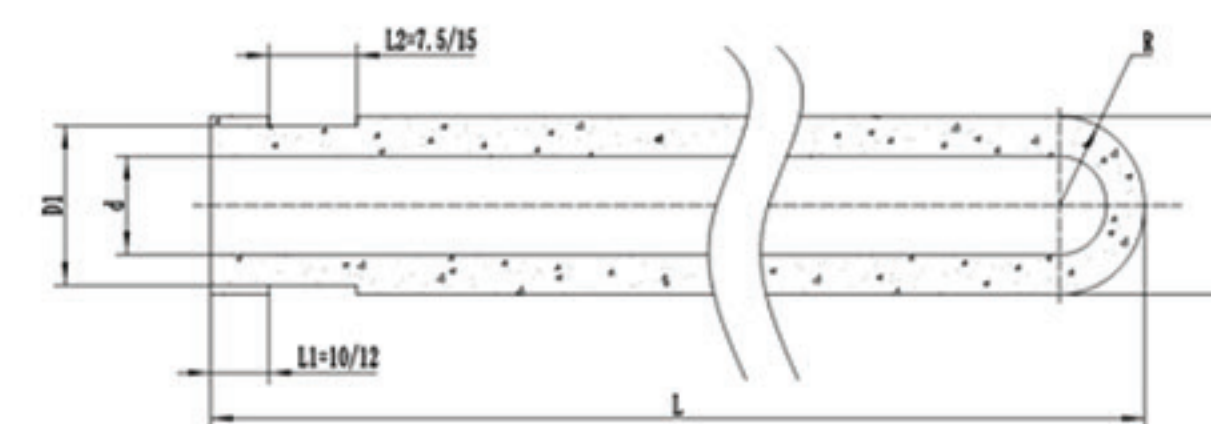


Standard Sizes(mm)

Inner Dia.	Outer Dia.
50	70
60	80
70	90
80	100
90	112
100	124
110	134
120	144
150	174

Si3N4/Sialon/Syalon Thermocouple Protection Tube

Shape and Sizes



Standard Sizes(mm)

Outer Dia	Inner Dia	Setting Groove
11.5	6.5	10
15	9	10
22	14	14.5
29	16	14.5
30	16	14.5
32	20	14.5

No.	1	2	3	4	5	6	7	8	9
L (inch)	400 (15.75)	500 (19.65)	600 (23.62)	700 (27.56)	800 (31.50)	900 (35.43)	1000 (39.37)	1100 (43.31)	1250 (49.21)

shapes and sizes can be customized

Handling and Maintenance Handling

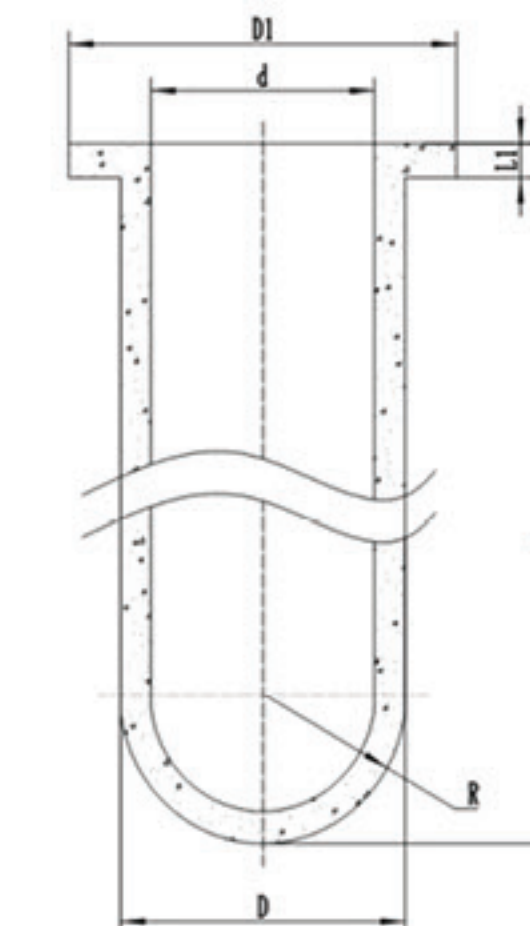
Follow our procedures in the instruction manual for first time use
Avoid severe mechanical impact
Avoid rapid cooling over a wide temp range
Assemble and install only in moisture free conditions

Maintenance

Remove slag deposits before solidification from heater protection tube weekly

Si3N4/Sialon/Syalon Heater Protection Tube

Shape and Sizes



Standard Sizes(mm)

Inner Dia.	Outer Dia.
65	85
70	90
80	100
85	105
100	120
125	145
135	155
150	170
165	185
210	230