

## Semisera Semiconductor provides customers with large-size silicon component solutions

Provides high-purity, large-size single-crystal silicon and polycrystalline silicon precision device products, and can provide customized services such as polishing, thinning, cutting, and drilling of semiconductor silicon components

Semicera semiconductors provide customers with solutions for large-sized silicon parts. Provide high-purity, large-sized Mono silicon rods and Multi-Crystalline silicon ingot products, and can Provide single&double sided polishing, thinning, and Cutting, MEMS and other processing and customization services.

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## 硅部件的生产流程.....

## Production process of silicon parts



多晶硅原料生产  
Polycrystalline silicon production



硅棒拉晶  
Crystal pulling



硅锭生长  
Cast Ingot



硅锭切割  
Cutting



半成品检测  
Test



硅部件深加工  
Intensive processing

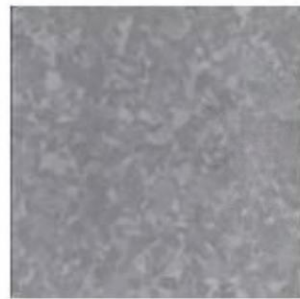
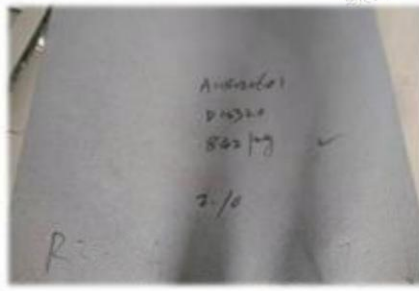


### 1、多产品技术能力，满足不同差异化需求.....

A variety of product technology reserves to meet different differentiated needs

#### ● 黑砂全熔技术

Blacksand full melting technology



- **100%完美成核**  
100% perfect nucleation
- **更均匀的晶粒**  
More uniform crystalline gra
- **1100\*1100mm 大尺寸优势**  
1100\*1100mm Large size advantage

#### ● 类单晶铸造技术

Casting Mono silicon crystal technology



- **高纯度、低位错**  
High purity, low dislocation
- **单一晶向，媲美单晶**  
Single crystal direction, comparable to Mono silicon
- **950\*950mm 大尺寸优势**  
950\*950mm Large size advantage

### 1、多产品技术能力，满足不同差异化需求.....

A variety of product technology reserves to meet different differentiated needs

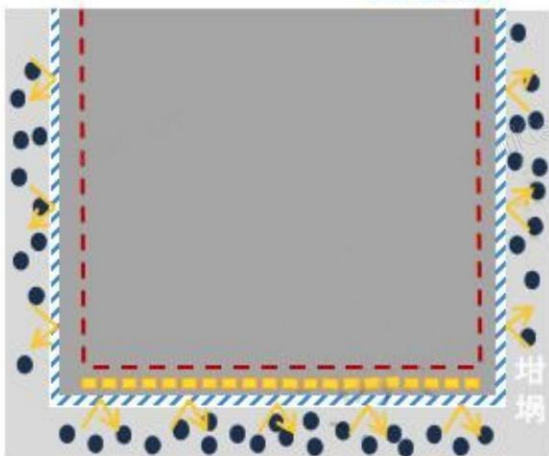
| 产品类型<br>Product type         | 生产工艺<br>Craft                    | 纯度<br>Purity | 氧含量<br>Oxygen | 碳含量<br>Carbon | 位错密度<br>Dislocations | 晶界<br>Grain boundaries   |
|------------------------------|----------------------------------|--------------|---------------|---------------|----------------------|--------------------------|
| 常规铸造多晶<br>Conventional ingot | 定向凝固法<br>Directional coagulation | > 6N         | < 10ppma      | < 10ppma      | 极高<br>Higher         | 尺寸大小不一<br>Size is uneven |
| 黑砂铸造多晶<br>Black sand ingot   | 定向凝固法<br>Directional coagulation | > 6N         | < 10ppma      | < 10ppma      | 中等<br>Medium         | 尺寸细小均匀<br>Uniform size   |
| 铸造单晶<br>Casting Mono         | 定向凝固法<br>Directional coagulation | > 6N         | < 8ppma       | < 8ppma       | 低<br>Low             | 单一晶向<br>Mono             |
| 直拉多晶<br>CZ Polysilicon       | 直拉法<br>CZ                        | > 7N         | < 16ppma      | < 3ppma       | 中等<br>Medium         | 尺寸大小不一<br>Size is uneven |
| 直拉单晶<br>CZ Mono              | 直拉法<br>CZ                        | > 7N         | < 16ppma      | < 1ppma       | 极低<br>Lower          | 单一晶向<br>Mono             |

### 2、除杂提纯技术..... Purification technology

- **独家热场优化技术，通过热通道充分对流，让金属杂质以及氮、氧、碳充分排出，实现硅材料的更高纯度。**  
The unique thermal field optimization technology allows nitrogen, oxygen, carbon and metal impurities to be fully discharged through the hot aisle to achieve high purity of silicon materials

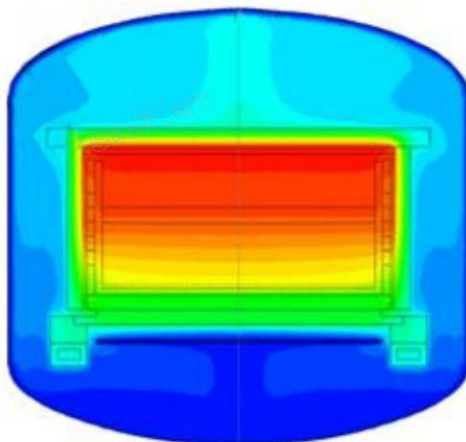
**优势①：降O坩埚涂层技术**  
Advantage①: Reducing O crucible coating technology

高纯涂层



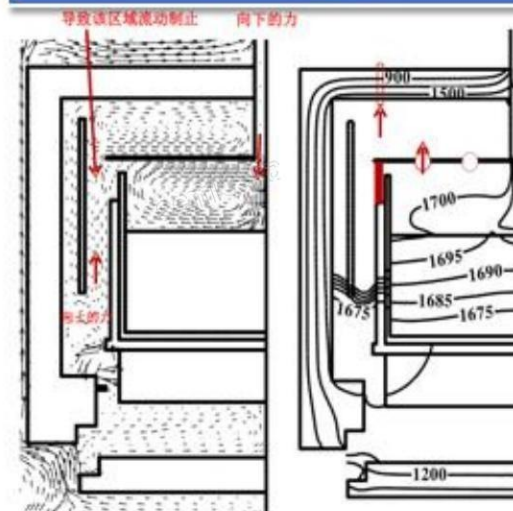
- **高纯层阻隔杂质扩散**  
The high-purity layer blocks the diffusion of impurities

**优势②：独家的热场设计**  
Advantage ②: Exclusive thermal field design



- **热场温度独立控制**  
The thermal field temperature is controlled independently

**优势③：强对流技术**  
Advantage ③ Strong convection technology



- **打开热通道，充分对流**
- **搅动硅液面，充分排杂**  
Open the hot aisle and fully convection

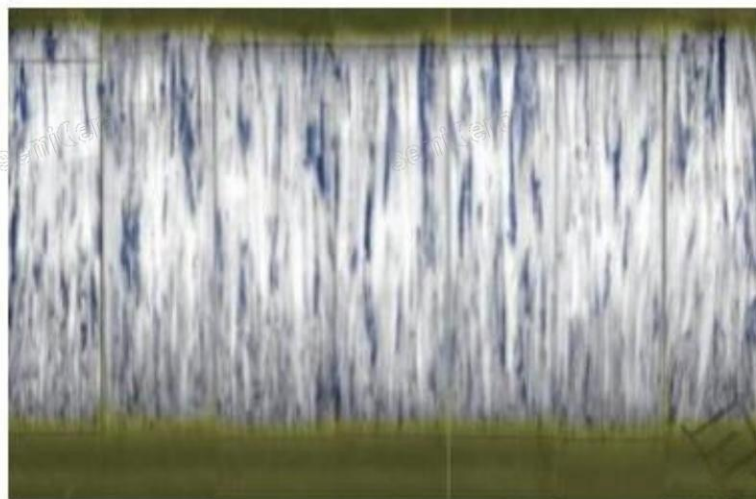
### 2、除杂提纯技术..... Purification technology

- 第三方GDMS法检测73种金属杂质含量 < 2ppmw，我们通过ICPMS法实测12种常见金属杂质含量，**单晶硅产品 < 5ppbw，多晶硅产品 < 20ppbw**。The third-party GDMS method detected 73 kinds of metal impurities with a content of < 2ppmw, and we measured the content of 12 common metal impurities by ICPMS method: monocrystalline silicon products < 5ppbw, and polysilicon products < 20ppbw.

| 杂质元素 | 行业标准 (ppmw) | 单晶硅产品 (ppmw) | 多晶硅产品 (ppmw) |
|------|-------------|--------------|--------------|
| Na   | <0.01       | 0.00016      | 0.00026      |
| Al   | <0.01       | 0.00038      | 0.00017      |
| K    | <0.05       | 0.00016      | 0.00042      |
| Ti   | <0.005      | 0.00005      | 0.00018      |
| Cr   | <0.01       | 0.00014      | 0.00019      |
| Fe   | <0.01       | 0.00024      | 0.00053      |
| Co   | <0.005      | 0.00002      | 0.00002      |
| Ni   | <0.01       | 0.00007      | 0.00006      |
| Cu   | <0.01       | 0.00026      | 0.00153      |
| Zn   | <0.05       | 0.00006      | 0.00022      |
| Mo   | <0.05       | 0.00002      | 0.00006      |
| Ru   | <0.05       | 0.00004      | 0.00007      |

### 3、技术优势：低位错、低应力、高光洁度.....

Technical advantages: Low dislocation, low stress, high finish



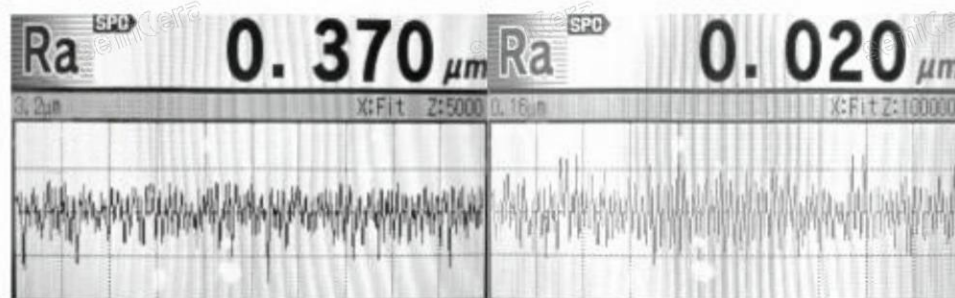
**独有的长晶工艺，保证更低位错密度和杂质含量，充分释放硅内部应力。**

Exclusive technical process to ensure lower impurity content and dislocation density, fully release the internal stress of silicon.

- 掺杂技术精准调控电阻率范围 Doping technology precisely regulates the resistivity
- 退火技术充分释放内部应力 Annealing technology fully relieves internal stress
- 低位错、易加工、不易损 Low dislocation, easy to process, not easily damaged

#### ● 更均匀的表面粗糙度，光洁度高

More uniform surface roughness and high smoothness

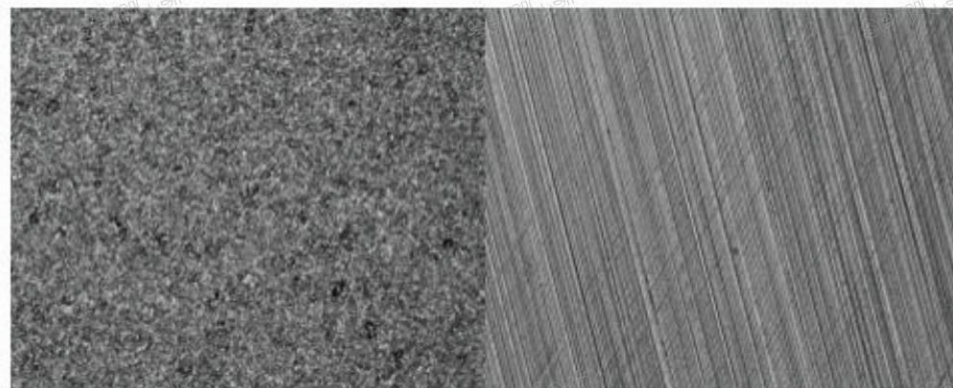


磨片后粗糙度图

Roughness map after coarse grinding

磨片后粗糙度图

Roughness map after fine grinding



磨片后显微镜图

Microscopic image after coarse grinding

磨片后显微镜图

Microscopic image after fine grinding

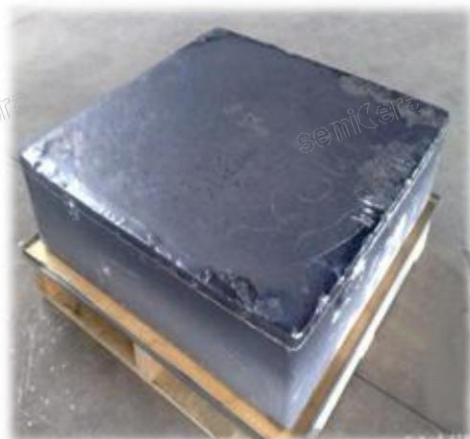
## 1、把控硅料质量、实现源头控制.....

Control the quality of polysilicon and achieve source control



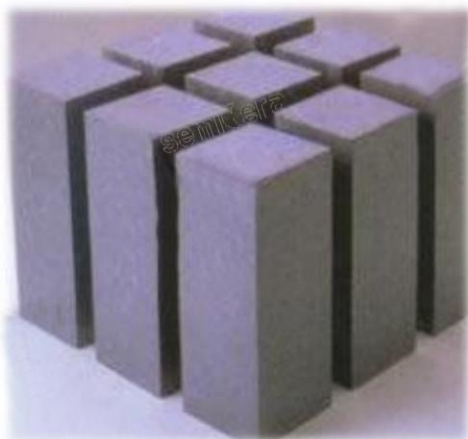
原生碎多晶

Crushed polycrystalline



定向凝固提纯

Ingot purification



提纯硅料

Purification of silica



拉晶

Crystal pulling

- 原生碎多晶经过定向凝固提纯，检测合格后方可用于拉晶生产的原料；有效规避原料质量不可控和检测结果不具有代表性的问题；The primary crushed polycrystalline is purified by directional solidification, and can be used as a raw material for crystal pulling production after passing the test; Effectively avoid the problems of uncontrollable raw material quality and unrepresentative test results;
- 独特稳定产品质量的技术路线， The unique technical route of stable product quality,



## 2、重视产品研发、严格按照质量管理体系全过程质量控制.....

Pay attention to product research and development, the whole process of quality control



### 产品特性：物理性质、技术指标.....

Product characteristics: physical properties, technical indicators

**多晶硅硅部件性能参数表**  
Multi-Crystalline parts of silicon components

| 物理性质 Physical property  |                            | 技术指标 Specification            |                        |
|-------------------------|----------------------------|-------------------------------|------------------------|
| 产品名称<br>Product name    | 硅<br>Silicon               | 纯度<br>Purity                  | > 6N<br>(99.9999%)     |
| 元素符号<br>Element symbols | Si                         | 相对密度<br>Relative Density      | > 99.9%                |
| 颜色<br>Colour            | 灰色<br>Grey                 | 导电类型<br>Conduction Type       | P型/N型                  |
| 密度<br>Density           | 2.33g/cm <sup>3</sup>      | 电阻率<br>Resistivity            | 0.005~80Ω*cm<br>可定制    |
| 熔点<br>Melting point     | 1410°C                     | 金属杂质含量<br>Metallic Impurities | < 2ppmw                |
| 沸点<br>Boiling point     | 2900°C                     | 尺寸<br>Size                    | 根据客户定制<br>Customizable |
| 分子量<br>Molecular weight | 28.0855                    | 表面粗糙度<br>Surface Roughness    | < Ra 0.8               |
| 溶解性<br>Solubility       | 不溶于水、硝酸和盐酸，溶于氢氟酸和碱液。有金属光泽。 | 氧含量<br>Oxygen                 | ≤24ppma                |
|                         |                            | 碳含量<br>Carbon                 | ≤1ppma                 |

### 相较于碳化硅，多晶硅被证实可以减少 80% 的晶粒位错

Compared to silicon carbide, Multi-Crystalline silicon has been proven to reduce grain dislocations by 80%

不论是石英或者是碳化硅皆无法达到多晶硅制品相当的纯度和改善制程结果。

Neither quartz nor silicon carbide can achieve the same purity and improve process results as Multi-Crystalline silicon products.

- 热膨胀系数与晶圆片相同 The same thermal expansion coefficient
- 硬度与晶圆片相同 The same hardness
- 完全单一材质 100% single material
- 无孔隙 No holes
- 无粒子，不剥落 No particles, no peeling
- 最纯净的人造材料 The purest artificial materials
- 高温下坚硬且稳定 Hard and stable at high temperatures

产品系列：硅棒、硅片、硅锭、硅部件.....  
Product Series: Silicon rods, ingots, and parts



板材/Plate



籽晶/Seed



硅管/Pipe



硅片/wafer



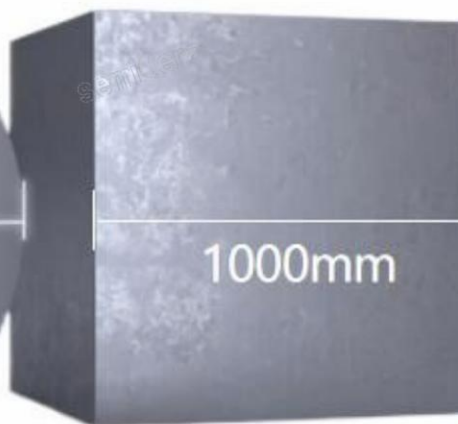
环类/loops



片材/Sheet



620mm



1000mm



异型/Shaped

我司采用直拉晶体生长技术及定向凝固技术制造单晶，多晶硅部件，晶粒均匀，最大直径可以达到 1000mm，可以加工成长方形，圆形等各种形状，还可以根据用户图纸加工特殊尺寸要求的硅部件。

Our company adopts Czochralski crystal growth technology and directional solidification technology to manufacture single crystal and Multi-Crystalline silicon parts, with uniform grains and a maximum diameter of 1000mm. We can process various shapes such as long squares and circles, and also process silicon parts with special size requirements according to user drawings.



硅环和硅圆：最大直径600 mm | Silicon rings and circles: Diameter 600 mm



环型硅靶 | Ring-shaped silicon targets



圆柱硅锭 | Cylindrical silicon ingots



椭圆硅靶 | Elliptical silicon targets



硅管 | Silicon tubes

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semiCera

semiCera

semiCera

semiCera

semiCera



拼接椭圆硅靶 | Splicing silicon target



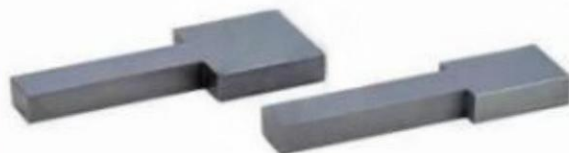
硅锭 | Silicon ingots



拼接斜角硅靶 | Splicing silicon target

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异型硅靶 | Shaped silicon targets

semiCera

semiCera



长方形硅靶 | Rectangular targets

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硅窗口片 | Silicon windows

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# Semicera Semiconductor

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Provides high-end silicon material solutions

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