



# Products Guide



# Company Profile

SiFusion is a leading supplier of semiconductor in the world. Committed to the developing and manufacturing of advanced silicon materials, silicon boat, precision silicon parts.

SiFusion is subsidiary company of Ferrotec Holding Corporation, registered in 2018. Currently, SiFusion have 29 patens in USA and 9 patens in China. By 2022, the patens will up to 68.

In the future, SiFusion will further consolidate its technical advantages, enhance its comprehensive strength, and create more value for customers. And strive to achieve the great goal of internationalization of China's semiconductor industry.



>80%

SiFusion products has above 80% market share in the world

NO.1

SiFusion has the world's leading and patented high-purity silicon fusion technology

# Product Introduction

## About SiFusion

SiFusion products are poly-silicon furnace ware made of ultra-pure poly-silicon materials with SiFusion patented technology, which is a breakthrough solution for the front-end thermal process.

Compared to sic, poly-silicon has been proven to reduce "slip" by **80%**

And neither quartz nor silicon carbide can achieve the purity and improved process results.

SiFusion products provide a better solution in terms of process coordination.

- Same thermal expansion coefficient as a wafer
- Same hardness as a wafer
- Completely single material
- Pore-free
- No particles, no peeling
- The purest man-made material
- Firm and stable at high temperature

## Control Your Furnace Productivity

SiFusion products provide additional benefits for capacity utilization, productivity, and output:

SiFusion poly-silicon performs far better than traditional quartz and silicon carbide products in all key performance.

### Reduce furnace downtime

Routine cleaning is not required. That means less interference with the system and increased productivity.

### Improve process stability and performance

SiFusion products can reduce the risk of human error during the frequent cleaning and replacement of traditional consumables.

### Reduce preventive maintenance

SiFusion products significantly reduces the downtime of the furnace for preventive maintenance, thereby eliminating a major source of low productivity.

### Longer effective service life

Reduces downtime for replacing component in the furnace, ensuring lower costs overall.

### Improve wafer quality

With a longer life-time and no need for routine cleaning, SiFusion products allow for longer periods of operation during fixed maintenance, thereby increasing production.

### Environmental protection

High cost cleaning process is not required to avoid the use of strong acids and harmful gases needed when cleaning the furnace.

## Silicon Injector VS Quartz Injector

| Material Property     | Unit                               | Quartz | CVD Sic | Silicon   | Silicon compared to Quartz | Silicon VS Quartz  |
|-----------------------|------------------------------------|--------|---------|-----------|----------------------------|--------------------|
| Density               | g/cc                               | 2.2    | 3.21    | 2.33      | Slightly heavier           | Much lighter       |
| Young' s Modulus      | GPa                                | 70     | 465     | 131       | More                       | Less               |
| Specific Stiffness    | Gpa/g/cm <sup>3</sup>              | 30.3   | 145     | 56.2      | Stiffer                    | Stiffer            |
| Hardness              | Kg / mm                            | 460    | 2540    | 1150      | Much harder                | Much softer        |
| Flexural Strength     | MPa                                | 80     | 324     | 300       | Much less flexible         | Same               |
| CTE (25 °C – 1000 °C) | 10 <sup>-6</sup> /K                | 0.5    | 4       | 2.49-4.44 | Expands more               | Expands less       |
| Thermal Conductivity  | W/m-K @RT                          | 1.5    | 280     | 150       | Conducts 100x more         | Conducts 2x less   |
| Thermal Diffusivity   | 10 <sup>-6</sup> m <sup>2</sup> /s | 0.77   | 119     | 89.2      | Diffuse 100x more          | Similar            |
| Thermal Shock         | Figure of merit                    | 4.8    | 110     | 41        | 10x more resistance        | 3x less resistance |

Si-Fusion

Si-Parts

## Silicon Boat 8-inch / 12-inch

Using the exclusive SiFusion patent, silicon boat can be applied in 1100-1200°C HT process and CVD-Poly deposition process

### Technical advantages

- Can be customized design, including the shape of leg, pitch, the slot quantity and tilt angle.
- Can effectively reduce the contact damage of wafers and improve the yield of the device.
- Damaged parts can be replaced so that reduce the cost of ownership.
- Have a much polysilicon deposition thicker limit, which can effectively reduce the PM frequency of the equipment and improve the production capacity.



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Si-Parts

## Silicon Injector

Poly silicon injector is processed by mechanical drilling, the maximum length can reach 1300mm, the processing range of the inner diameter of the injector is over  $\phi 4$ mm, and it is widely used in CVD process

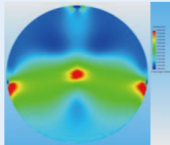
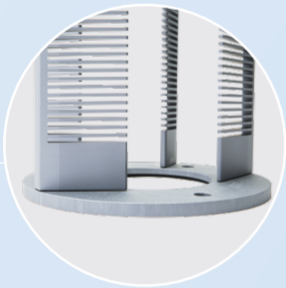
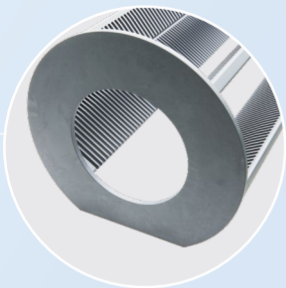
### Technical advantages

- Reduces the risk of particle contamination in the process
- Thicker deposition limit (>100 $\mu$ m)
- Effectively reduces the PM frequency of the equipment and improves productivity.

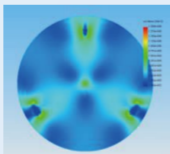
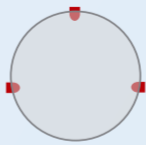




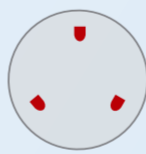
# Finger shape optimization



5.25 E06 N/m2

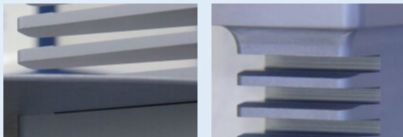
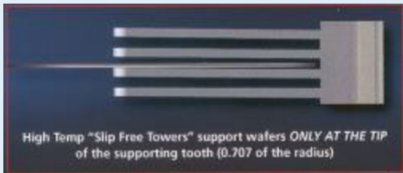


1.28 E06 N/m2



Stress modeling showing the advantages of supporting at about

**70%**  
of the diameter



|                                  |                              |
|----------------------------------|------------------------------|
| Operating Temperature            | 1,250 °C                     |
| Coefficient of Thermal Expansion | 3.8 E-06 /K (same as wafers) |
| Trace Metal Concentration        | 1 E10 atoms/cm2 or better    |
| Bulk Material Purity             | 99.99999999% Si              |
| Wafer Size Supported             | 200mm , 300mm                |

Si-Fusion

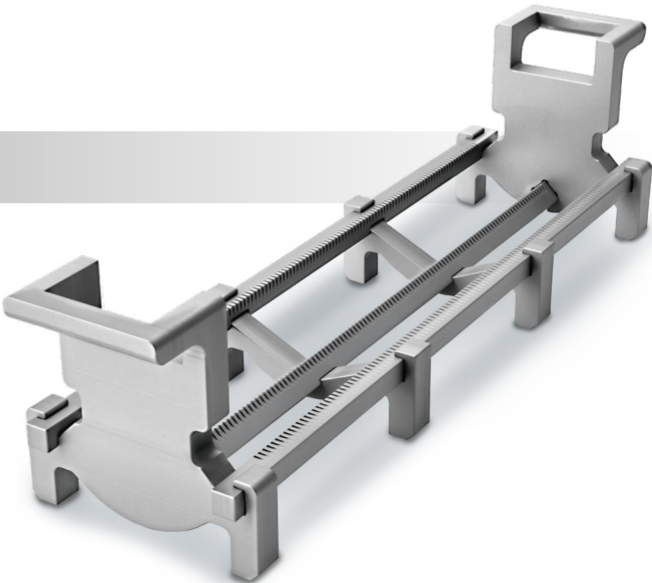
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## Mother Boat

Mono or poly silicon boat using mechanical splicing, mainly used in 4-8 inch HT process

### Technical advantages

- Damaged parts are replacad
- Low cost of ownership



Si-Fusion

Si-Parts

## Cassette Boat 5-inch / 6-inch

Cassette boat is a small one-piece silicon boat, mainly used in 4" to 6" horizontal HT furnace, suitable for the process below 1250°C

### Technical advantages

- High purity, no surface sediment layer
- No deformation and surface material peeling off after a long time production
- Keep away from pollution in a long term way



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## Scewed Pedestal

There are two kinds: one-piece pedestal and fused pedestal, which are used in the vertical furnace equipment to stabilize the processing atmosphere of the hot zone

### Technical advantages

- High purity, can be customized design
- Not easy to deform, long reusable life



Si-Fusion

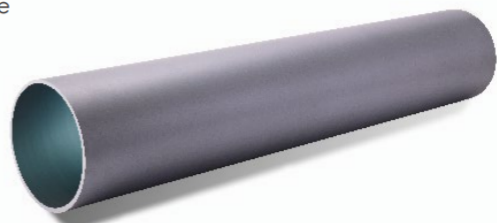
Si-Parts

## Silicon inner tube

Silicon inner tube, used between quartz tube and boat in a vertical furnace

### Technical advantages

- High-purity mono-crystal silicon
- Mature processing and cleaning technology



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Si-Parts

# Silicon Ring

Large diameter rings (450mm or above) are made from large mono-silicon materials with a maximum diameter of 600mm, which can be used for electrodes or shroud rings in chip etchers. Conventional 12-inch rings are made from single crystal or polycrystal materials, which can be used in 12-inch chip etchers



### Technical advantages

- Silicon ingot pulling capability
- Massive production experience
- Understand the customers requinemant

Si-Fusion

Si-Parts

# Shower Head 12-inch



Mono silicon or poly silicon electrode, the application in a 12 inch etcher

### Technical advantages

- Chip-free driling capability
- No sub-surface damage in the inner wall of holes after processing
- The minimum machining hole ID is 0.2mm
- Supec clean and etching process

Si-Fusion

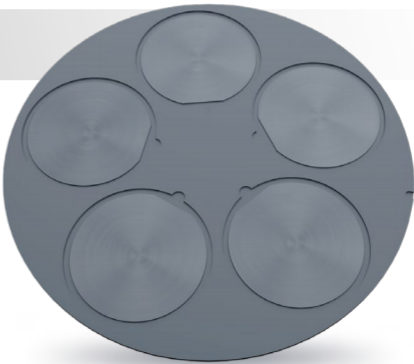
Si-Parts

# Tray

Tray supporting wafer in CVD machine

### Technical advantages

- Minimum processing thickness of 1mm
- High purity, recycable



# Production Process

Yinchuan Factory

Ningxia

## Silicon Growth

In FTSN production

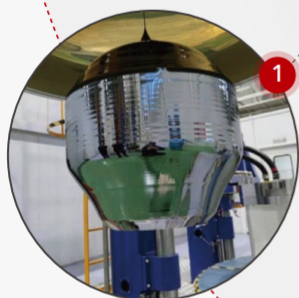
The world's first supplier capable of producing OD620mm slip-free

Hangzhou Dunyuan Juxin Semiconductor Technology

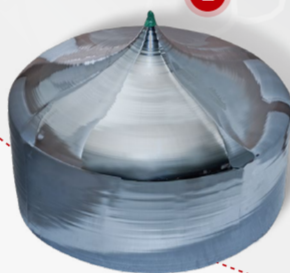
Zhejiang

## Silicon cutting

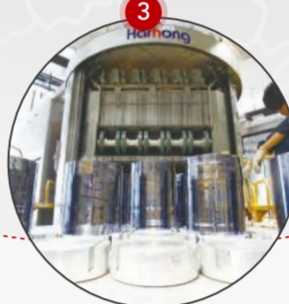
Hangzhou factory for cutting



1



2



3



4



5



6



7

## Product Assembling

At Hangzhou factory

## Department of product processing

Hangzhou factory for processing

## Purity detection

Total element analysis

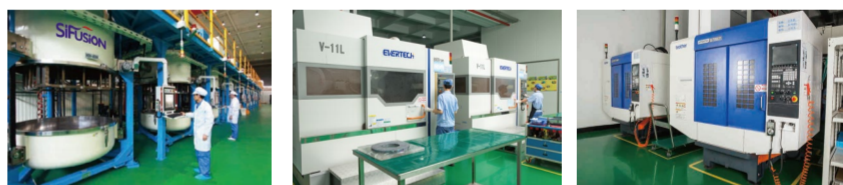
## Size detection

Hangzhou factory for inspection



# Production Base

The largest **200kg** mono-Silicon ingot and **800kg** poly-silicon ingot in China, as well as a full set of advanced inspection equipment. Meanwhile, we are also committed to semiconducting grade silicon ingot drawing and can provide mono/poly silicon ingot with diameter of **300-620mm** and **12-inch** silicon parts to well-known semiconductor equipment manufacturers at domestic and abroad. Our product quality is in line with SEMI and international standards, and has been recognized and praised by many international listed companies.



## Key Equipment List and function

| SN | Equipment           | Process          |
|----|---------------------|------------------|
| 1  | Wiresaw             | Ingot Cutting    |
| 2  | Horizontal Grinder  | Grinding         |
| 3  | Grinding Rotator    | Round Edge       |
| 4  | Tapping Center      | Hole Drilling    |
| 5  | Machine Center      | Machining        |
| 6  | Dewax Tank          | Dewaxing         |
| 7  | General Baker       | Baking Parts     |
| 8  | Cleanroom Baker     | Baking Parts     |
| 9  | Polishing Machine   | Polishing        |
| 10 | 22B Lapping Machine | Lapping          |
| 11 | Single-sider Polish | Polishing        |
| 12 | CMM                 | Inspection       |
| 13 | Ultrasonic Tank     | Ultrasonic Clean |
| 14 | Horizontal Lathe    | Rings Machining  |
| 15 | CCD                 | Holes Inspection |

## Conventional materials of FTSN

|                   | Resistance   | Slip | Crystal | Type |
|-------------------|--------------|------|---------|------|
| Low Resistance    | <0.01 ohm-cm | Free | 100     | P    |
| Normal Resistance | 1-5 ohm-cm   | Free | 100     | P    |
| High Resistance   | 65-85 ohm-cm | Free | 100     | P    |

FTNC can produce material according to customer's specific requirements.

# Development History of SiFusion

## 2020

In 2020, FTSN was renamed FTNC with large-scale additional investment. FTNC successfully pulled a **620mm** (24-inch) mono-silicon ingot, which is the largest semi-grade single-silicon ingot in the world. The annual production capacity can reach 800 million RMB. In addition, products such as Si boats and SiParts series from SiFusion have been recognized and used by many large semiconductor manufacturers at domestic and abroad.

## 2018

In 2018, SiFusion formally got independent in response to the national call to realize the localization of the semiconductor industry.

## 2015

In 2015, with large-scale additional investment in SiParts, the factory space was expanded from 1000 square meters to **5000** square meters. Yinchuan silicon material production base( FTSN) began to develop and pull semi-grade poly-silicon ingots and single-silicon ingots

## 2011

In 2011, Hangzhou production base began mass production of **12**-inch poly-silicon boats, showerhead and other products.

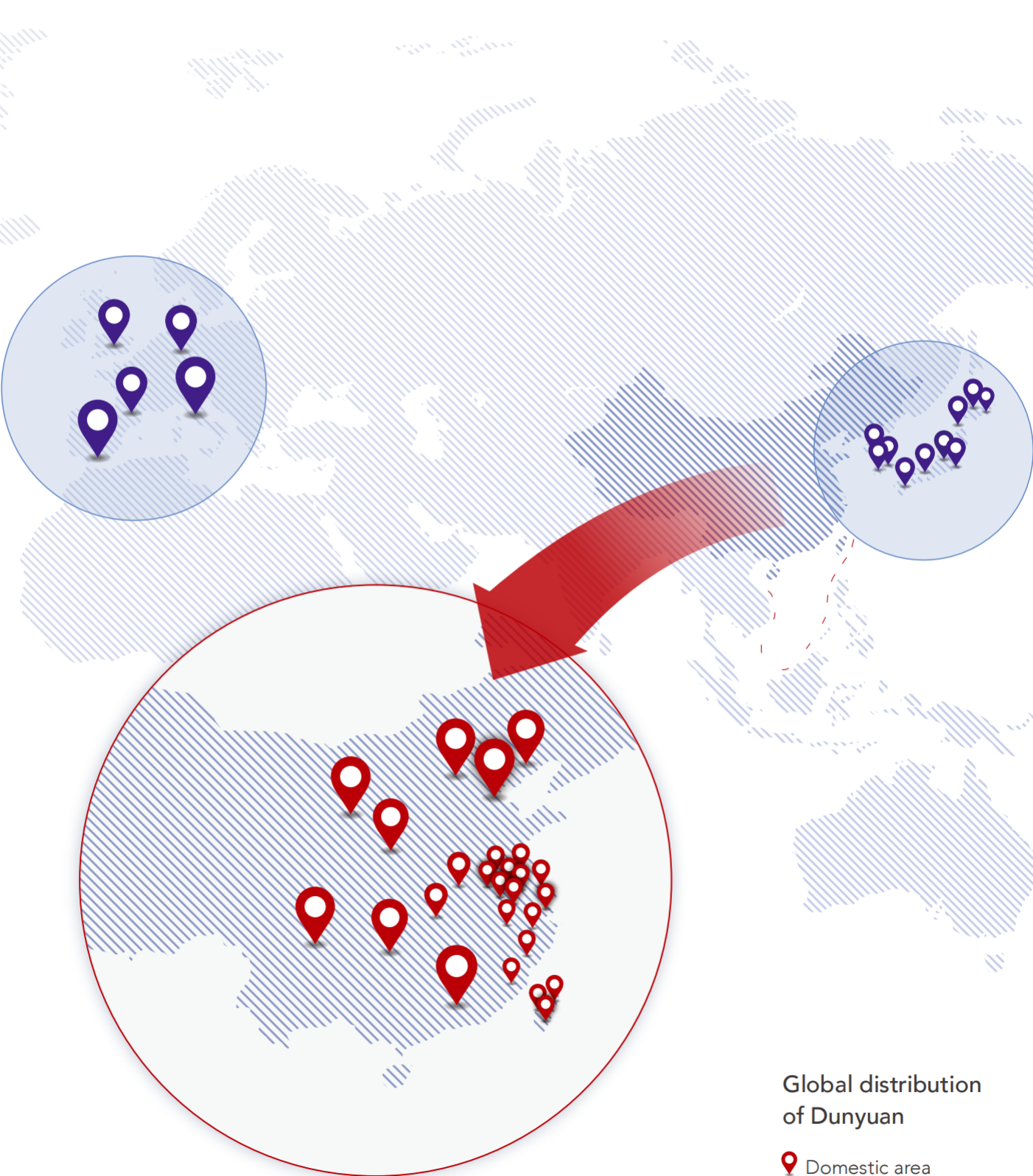
## 2010

In 2010, IMI was wholly acquired by FerroTec and the manufacturing base moved to Hangzhou.



## 1998

In 1988, IMI was founded in Silicon Valley to provide semiconductor silicon products.





**Global distribution of Dunyuan**

-  Domestic area
-  Foreign regions

ADD

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official account

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