

# Quartz glass products and Materials for quartz glass products

Using quartz glass products is essential in the semiconductor manufacturing process. Accompanying the increasing integration level of semiconductor devices due to miniaturization, there is a need for higher levels of purity and precision with regard to quartz glass. Since its establishment, we at Shin-Etsu Quartz have been developing products that meet the cutting-edge requirements of the semiconductor industry, and have been manufacturing and selling outstanding processing technologies.



## Introduction of product types

In the area of transparent quartz glass, we at Shin-Etsu Quartz offer items ranging from general-purpose products to ultra-high purity synthetic quartz glass products, as well as specially treated products with enhanced functionality, including increased heat resistance and reduced particle generation. Furthermore, we offer a full lineup of raw materials in accordance with a wide range of user applications and preferences, such as opaque quartz glass products with heat insulation properties. In the field of natural quartz glass, we have products made by electrical fusing that have high viscosity, and products made by oxyhydrogen flame fusing that have almost no bubbles, and offer general-purpose products and ultra-high purity products in both these areas. We also have synthetic quartz glass products that feature extremely high purity.

#### ■List of product types

Main product types		Material name	Characteristics	Material shape
Natural quartz glass	Oxyhydrogen	TSC-3	Standard grade; Normally used for single-wafer processes.	Ring, Plate, Ingot
	material	TSC-4	High purity grade; Contamination risk has been reduced with particularly low Al and low alkalinity metals.	Ring, Plate, Ingot
	Electrically fused materials	HERALUX-E	High heat-resistance grade; lowOH and optimal for high temperature processes.	Tube, Rod, Plate
		HERALUX-E-LA	Ultra-high purity, high heat-resistance grade; heat resistant product in which metal impurities (especially alkaline metals) have been eliminated through special treatment.	Tube, Rod, Plate
		HSQ330	Material that has outstanding cost performance while maintaining high purity, and high heat resistance.	Tube, Rod, Plate
		HSQ130	High purity grade; It is a large block with a size of 1,800 mm. It is optimal as a material for large size products.	Block
		HSQ135	Standard grade; It is a large block with a size of 1,800 mm. It is optimal as a material for large size products.	Block
	Opaque products	OM-100	High-purity opaque grade manufactured with our company's unique technologies; It has high heat resistance and high density as the result of a special microstructure.	(Molding form)
Synthetic quartz glass	Synthetic products	SH110	Standard grade; Synthetic quartz glass with high purity and no bubbles.	Tube, Rod, Plate
		SH100	Low OH grade; Synthetic quartz glass with increased heat resistance compared to conventional synthetic quartz glass, and OH free.	Tube, Rod, Plate
		SH200	High OH grade; Contains high OH of around 800 ppm and has high omogeneity.	Plate
		SH120	High viscosity grade; Synthetic quartz glass which heat resistance is similar to natural quartz by special treatment.	Internal use
		SPECTROSIL	Cl free grade; Synthetic quartz glass with no impurities and bubbles, etc., that has been made with a chlorine-free process.	Tube, Plate

\* In addition to the above-mentioned product types, among oxyhydrogen flame fusing products and electrical fusing products,

we can also provide st processing products with increased heat-resistance stability. For information on st processing, please see page 4.

#### • Oxyhydrogen flame fused material

Manufactured by flame fusion that contains hydrogen and oxygen, so the fused glass contains high OH content.

#### • Electrically fused materials

Manufactured by electric furnace, so the fused glass is low OH content.

#### • Synthetic quartz materials

Synthetic quartz materials are few impurities and bubble free with high hohogeneity compared to metal impurities and high homogeneity compared to natural quartz products.



Matarial name			Viscosity							
	Na	к	Li	Mg	Cu	Fe	Ca	AI	OH base	(log ŋ)
TSC-3	0.3	0.2	0.2	<0.05	<0.05	0.05	0.4	15	170	12
TSC-4	0.2	0.08	<0.05	<0.05	<0.05	0.1	<0.05	8	170	12
HERALUX-E	0.3	0.4	0.6	0.05	<0.05	0.1	0.5	15	20	12.5
HERALUX-E-LA	0.05	0.1	0.05	0.05	<0.05	0.1	0.5	15	20	12.5
HSQ330	0.1	0.3	0.6	<0.05	<0.05	0.1	0.5	15	20	12.5
HSQ130	0.1	0.3	0.6	<0.05	<0.05	0.1	0.5	15	<10	12.5
HSQ135	0.9	0.7	0.6	<0.05	<0.05	0.3	0.5	15	<10	12.5
OM-100	0.2	0.4	0.6	0.05	<0.05	<0.2	1.2	15	_	_
SH110	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	250	11.5
SH100	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1	11.7
SH200	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	800	_
SH120	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1	12.1
SPECTROSIL	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1,200	_

#### ■Purity analysis values by material

Values shown in this table are typical (not guaranteed) values.

## Finished quartz glass products

Our quartz glass products are manufactured using the optimal materials selected from among of product types, based on the drawings and other specifications sheet of users. For more detailed information regarding our delivery times, specifications, and so on, please contact one of our sales offices or Base Materials & Fabrication Division of our Head Office.

### Parts for oxidation/diffusion and CVD/ALD processes

In the case of tubes and boats that are used in oxide/diffusion process and CVD/ALD processes, focus is placed on high purity and high heat resistance. Requitment of high purity and high heat resistance for vertical tubes and boats are emphasized. In particularly, requirement of high quality products especially for vertical furnace has been much stronger.



### Cleaning process parts

Semiconductor processes include many cleaning processes such as chemical treatments and ultra-pure water treatments, and quartz glass products are often used for related cleaning containers and other types of jigs in order to prevent pollution contamination.

#### ■ Parts for etching/ashing processes

Single-wafer processing equipment is normally used for dry etching, plasma CVD/ALD, and ashing processes, and the quartz glass jigs that are used for this have a variety of shapes, including chambers, rings, and plates.



### Other processed products

The utilization of quartz glass products does not end at semiconductor and liquid crystal Display process applications. Quartz burners and quartz tube products are used for quartz optical fiber vitrification and preform manufacturing. A lot of the physics and chemistry equipment that is used at universities, research institutions, and so on consists of quartz glass items. In addition, quartz glass products are used in a wide range of industrial fields such as chemicals, pharmaceuticals, and food products, and we manufacture these in accordance with the preferences of users.



## Materials for quartz glass products

We at Shin-Etsu Quartz also sales materials into outside market.

#### Characteristics of Shin-Etsu Quartz materials for quartz glass products

- We are able to offer materials with high quality and highly accurate dimensions that have garnered high ratings from users in Japan and overseas.
- In the case of natural quartz glass, we use raw materials (cylinders, ingots, blocks) that are mainly steadily supplied by Heraeus of Germany, and we process these into tubes, rods, and plates in Japan so are able to make quick deliveries. Also, in the case almost of synthetic quartz glass materials, we carry out production only inside of Japan.
- We are able to handle a variety of sizes in accordance with the preferences of users.

## Special technology for improvement of function

We are able to offer materials and products with enhanced functionality as the result of adding special processing in material manufacturing processes and processing processes.

#### Special surface treatment (SST)

SST is a special technique for making uneven forms on the surface of quartz glass with chemical treatment. The uneven surfaces that are obtained through SST have the effect of reducing the difference in coefficient of thermal expansion between thin film and quartz glass, so in the case of use in CVD/ALD processes, micro-cracks not to be generated in the thin film. This increases the lifetime of products and significantly reduces the generation of particles.



This is nitride film (thick film of 10  $\mu m)$  on quartz glass that has undergone SST processing. Micro-cracks have not been generated.

#### St treatment (tubes)

In the case of diffusion processes related to semiconductor manufacturing process, there is generally heating up at high temperatures.

As such, the quartz glass tubes that are used for furnace tubes need to have a high level of heat resistance. St treatment is a heat stabilization processing technology that improve the heat resistance of quartz glass tubes. Stabilization processing is a type of processing in which the nucleation element AI is uniformly and thinly doped in order to generate a crystal layer on the glass tube's outer surface. When the stabilization glass tube is heated, a crystal layer called cristobalite is generated on the outer surface, and its heat resistance becomes improved. Also, to keep its shape better compared to normal materials when used over long periods of time so another effect is an increased product lifetime .

St treatment can be carried out with regard to both of oxyhydrogen melting products and electrical melting products.





## Shin-Etsu Quartz Products Co., Ltd.

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