

Shin-Etsu Synthetic Quartz

Synthetic Quartz Glass Substrates

VIOSIL-SQ (For General Application)

VIOSIL-SX (For High Temperature Application)

ShinEtsu’s VIOSIL Quartz Glass products have many advantageous characteristics as described below. Applications include photomask substrates in the semiconductor industry, poly-Si-TFT substrates for LCDs, micro lens substrates for LCDs and fiber optics, substrates for high frequency (RF) applications, microfluidic substrates, Nano-Imprint Templates, and DNA chip substrates. VIOSIL-SQ is made of a standard grade material, while VIOSIL-SX is made of a material with higher heat resistance.



Contents

1 Features	2
2 Physical Characteristic	2 • 3
3 Miscellaneous Properties	3
4 Surface Roughness	3
5 Size List	4 • 5 • 6

1 Features

- Purity: high purity completely eliminates contamination.
- Chemical resistance: high stability against a variety of solvents.
- Heat resistance: high dimensional stability over a wide temperature range.
- Transparency: high transmissivity over a wide range of wavelengths from UV to IR.
- Fluorescence: no fluorescence over a wide range of wavelengths from UV to IR.
- Dielectric properties: low dielectric loss even at GHz frequencies.
- Surface: high flatness, high uniformity of thickness and smooth surface, thanks to techniques developed for photomask substrates used in LSI manufacturing.

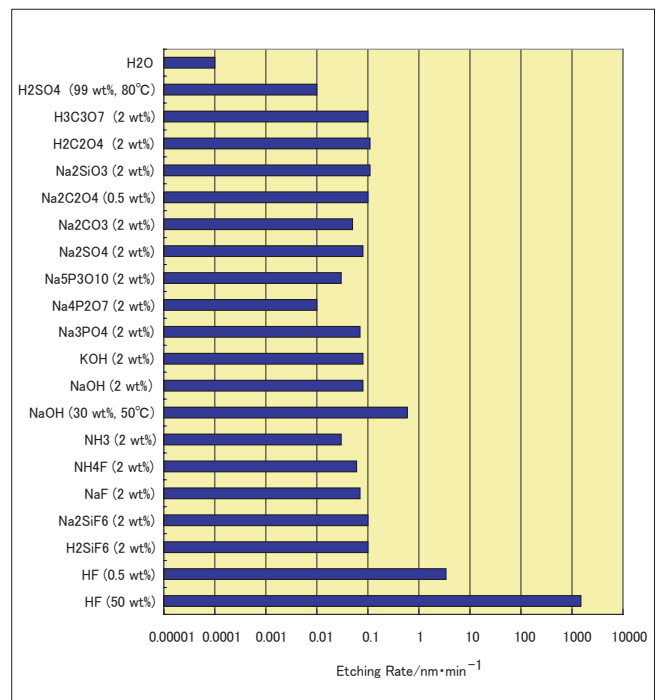
2 Physical Characteristic

Purity

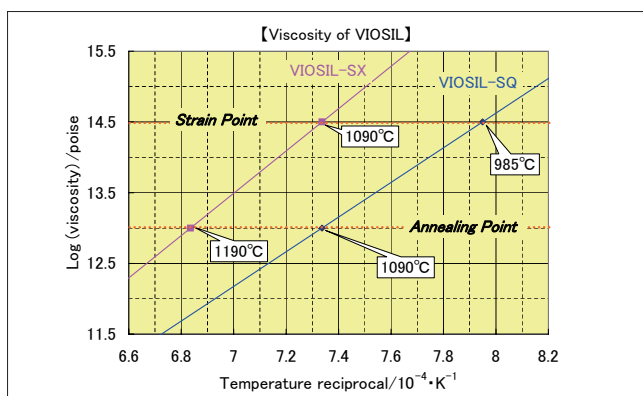
Elements	Impurities/ppb			Method of analysis
	SQ	SX	Fused quartz (natural)	
Li	< 1	< 1	700	A
Na	< 1	< 1	1000	A
Mg	< 1	< 1	200	A
Al	< 1	< 1	18000	A
K	< 1	< 1	800	A
Ca	< 1	< 1	800	A
Ti	< 1	< 1	800	A
V	< 1	< 1		A
Cr	< 1	< 1	1000	A
Mn	< 1	< 1		A
Fe	< 1	< 1	800	A
Co	< 1	< 1		A
Ni	< 1	< 1	100	A
Cu	< 1	< 1	70	A
Zn	< 1	< 1		A
Ge	< 1	< 1		A
As	< 0.1	< 0.1	0.2	C
Zr	< 1	< 1		A
Mo	< 1	< 1		A
Cd	< 1	< 1		A
Sn	< 1	< 1		A
Sb	< 1	< 1		A
Pb	< 1	< 1		A
B	< 1	< 1	100	B
P	< 1	< 1	100	B
U	< 0.1	< 0.1	0.3	C

A : Induced coupled plasma mass spectroscopy
 B : Induced coupled plasma emission spectroscopy
 C : Radioactive analysis

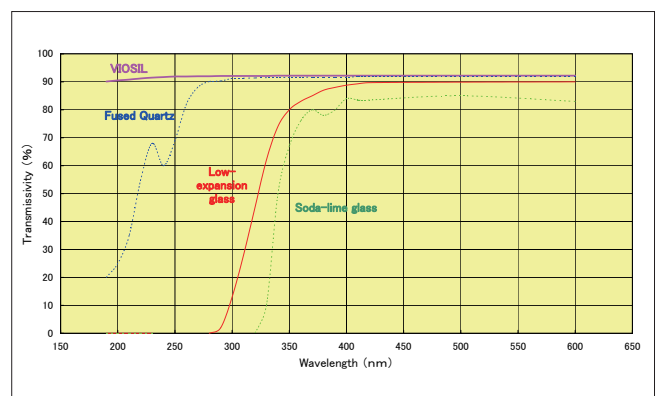
Chemical Durability



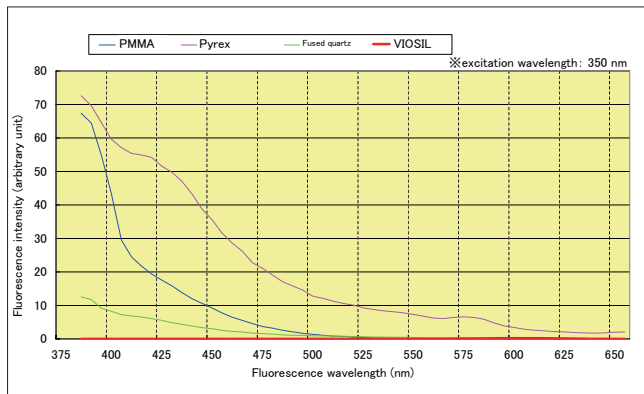
Heat Resistance



Optical Transmission



Fluorescent Intensity



Dielectric Properties

【Dielectric Properties of synthetic quartz glass VIOSIL】

(20°C)

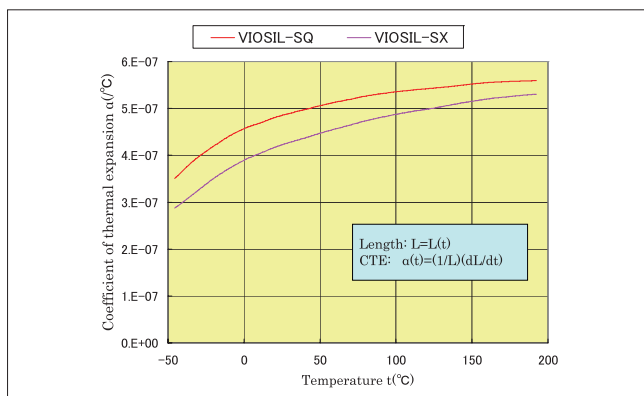
Frequency	1 MHz	100 MHz	1 GHz	30 GHz	60 GHz
Dielectric constant (ϵ_r)	3.9	3.9	3.9	3.9	3.9
Dielectric loss ($\tan \delta$)	$< 1 \times 10^{-4}$	$< 1 \times 10^{-4}$	$< 1 \times 10^{-4}$	4×10^{-4}	7×10^{-4}

【Dielectric Properties of other materials (examples)】

Material	Sodalime glass	Pyrex	Mica
Frequency	100 Hz	100 Hz	1 MHz
Dielectric constant (ϵ_r)	8.3	4.8	4.6
Dielectric loss ($\tan \delta$)	7.8×10^{-2}	1.0×10^{-2}	1.3×10^{-2}

3 Miscellaneous Properties

Thermal Expansion

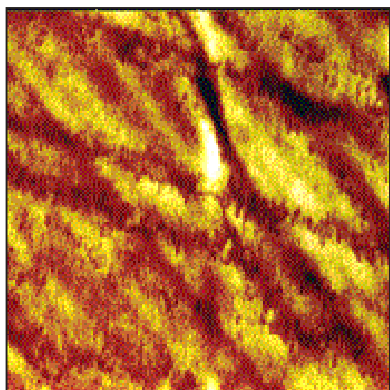


Mechanical Properties

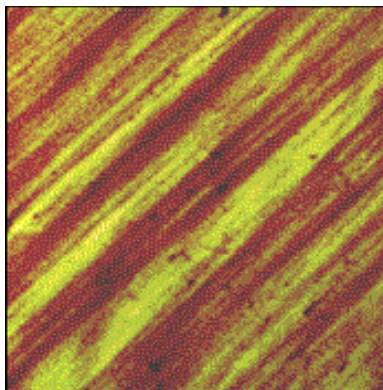
Mechanical Properties	unit	VIOSIL
specific gravity (ρ)	g/cm^3	2.202
Poisson's ratio (σ)		0.17
Young's modulus (E)	kgw/mm^2	7380
shear modulus (G)	kgw/mm^2	3150
Vicker's hardness (Hv)	kgw/mm^2	784

4 Surface Roughness

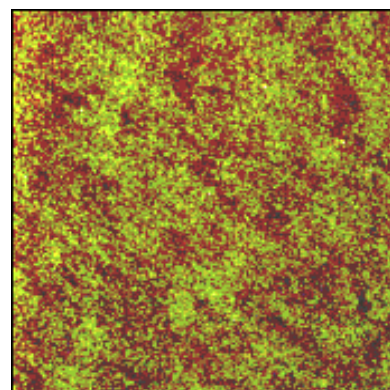
P-Grade ($R_a \leq 1.0 \text{ nm}$)



W,M-Grade ($R_a \leq 0.3 \text{ nm}$)



S-Grade ($R_a \leq 0.2 \text{ nm}$)



Measured with AFM (Atomic Force Microscope), Size : $1 \mu\text{m}^2$ area.

5 Size List

Our integrated production line incorporates all steps from the production of synthetic quartz to cutting and polishing of substrates. We can also provide substrates in sizes and specifications other than those listed below. Feel free to contact us with any requests.

1. Slide Glass Size/Square Type

Material	Product Name	Diameter (mm)	Thickness (mm)
SQ or SX	VIOSIL-SG1A	$(25.4 \times 76.2) \pm 0.1$	1.0 ± 0.02
SQ or SX	VIOSIL-SG1B	$(25.4 \times 76.2) \pm 0.1$	0.6 ± 0.02
SQ or SX	VIOSIL-SG1C	$(25.4 \times 76.2) \pm 0.1$	0.2 ± 0.02
SQ or SX	VIOSIL-SG2A	$(25.0 \times 75.0) \pm 0.1$	1.0 ± 0.02
SQ or SX	VIOSIL-SG2B	$(25.0 \times 75.0) \pm 0.1$	0.6 ± 0.02
SQ or SX	VIOSIL-SG2C	$(25.0 \times 75.0) \pm 0.1$	0.2 ± 0.02

2. Wafer Size/Circle Type

Material	Product Name	Diameter (mm)	Thickness (mm)	OF or Notch (mm)	Edge (mm)
SQ or SX	3W525WR/SX3W525WE	76.20 ± 0.25	0.525 ± 0.020	22.5 ± 2.0	0.35 ± 0.10
SQ or SX	3W1000WR/SX3W1000WR	76.20 ± 0.25	1.000 ± 0.020	22.5 ± 2.0	0.80 ± 0.10
SQ or SX	4W525WR/SX4W525WE	100.00 ± 0.25	0.525 ± 0.020	32.5 ± 2.0	0.35 ± 0.10
SQ or SX	4W1000WR/SX4W1000WE	100.00 ± 0.25	1.000 ± 0.020	32.5 ± 2.0	0.80 ± 0.10
SQ	5W550WR	125.00 ± 0.25	0.550 ± 0.020	42.5 ± 2.0	0.35 ± 0.10
SQ	5W625WR	125.00 ± 0.25	0.625 ± 0.020	42.5 ± 2.0	0.35 ± 0.10
SQ or SX	6W625WE/SX6W625WE	150.00 ± 0.25	0.625 ± 0.020	47.5 ± 2.0	0.35 ± 0.10
SQ or SX	6W675WE/SX6W675WE	150.00 ± 0.25	0.675 ± 0.020	57.5 ± 2.0	0.35 ± 0.10
SX	SX6W800WE	150.00 ± 0.25	0.800 ± 0.020	47.5 ± 2.0	0.35 ± 0.10
SQ	6W1100WR	150.00 ± 0.25	1.100 ± 0.020	47.5 ± 2.0	0.80 ± 0.10
SQ or SX	8W725WEY/SX8W725WEY	200.00 ± 0.25	0.725 ± 0.020	Notch	0.50 ± 0.10
SQ or SX	8W800WE/SX8W800WE	200.00 ± 0.25	0.800 ± 0.020	57.5 ± 2.0	0.50 ± 0.10
SQ or SX	12W1200WE/SX12W1200WE	300.00 ± 0.25	1.200 ± 0.020	Notch	0.85 ± 0.10

Notch = Angle : $90^\circ + 5^\circ - 1^\circ$, Depth : $1\text{mm} + 0.25, -0.00\text{mm}$ (Based on SEMI standard).

3. Size of Synthetic Quartz Glass for LSI Photomask Substrates

Product Name	Diameter		Thickness		Flatness
	Size	Tolerance	Size	Tolerance	Front Side
	mm	mm	mm	mm	um
SMS2506E5	63.1×63.1	±0.2	1.50	±0.10	5
SMS3006E5	75.8×75.8	±0.2	1.50	±0.10	5
SMS4006E2C	101.2×101.2	±0.2	1.50	±0.10	2
SMS4009E2C	101.2×101.2	±0.2	2.30	±0.10	2
SMS5009E5	126.6×126.6	±0.2	2.30	±0.10	5
SMS6009E5	152.0×152.0	±0.2	2.30	±0.10	5
SMS6012E2C	152.0×152.0	±0.2	3.05	±0.10	2
SMS6015E2C	152.0×152.0	±0.2	3.80	±0.10	2
SMS6025E2	152.0×152.0	±0.2	6.35	±0.10	2
SMS7012E2C	177.4×177.4	±0.2	3.05	±0.10	2
SMS7015E2C	177.4×177.4	±0.2	3.80	±0.10	2
SMS7Q15E2	184.15×184.15	±0.2	3.80	±0.10	2
SMS8009E10	200.0×200.0	±0.2	2.30	±0.10	10
SMS8012E10	200.0×200.0	±0.2	3.05	±0.10	10
SMS9025E10	228.2×228.2	±0.2	6.35	±0.10	10
SMS1420E10	355.2×355.2	±0.2	5.10	±0.10	10
SZS5009E5	126.6×126.6	±0.2	2.30	±0.10	5
SZS5018E5	126.6×126.6	±0.2	4.60	±0.10	5
SZS6025E2	152.0×152.0	±0.2	6.35	±0.10	2
SZS7012E10	177.4×177.4	±0.2	3.05	±0.10	10
SZS8009E10	200.0×200.0	±0.2	2.30	±0.10	10
SZS8012E10	200.0×200.0	±0.2	3.05	±0.10	10

4. Size of Synthetic Quartz Glass for LCD Photomask Substrates

Product Name	Diameter		Thickness		Flatness
	Size	Tolerance	Size	Tolerance	Front Side
	mm	mm	mm	mm	um
M228228Z20	228.6×228.6	±0.3	3	±0.2	20
M228228A20	228.6×228.6	±0.3	5	±0.2	10
M3345A10 or S3345A10	330×450	±0.3	5	±0.2	10
M3745A10 or S3745A10	370×450	±0.3	5	±0.2	10
M3961B20 or S3961B20	390×610	±0.3	6	±0.2	20
M4252A20 or S4252A20	420×520	±0.3	5	±0.2	20
M4253A20 or S4253A20	420×530	±0.3	5	±0.2	20
M4353A20 or S4353A20	430×530	±0.3	5	±0.2	20
M4452A20 or S4452A20	440×520	±0.3	5	±0.2	20
M4555A20 or S4555A20	450×550	±0.3	5	±0.2	20
M450554A20 or S450554A20	450×554	±0.3	5	±0.2	20
M4657A20 or S4657A20	460×570	±0.3	5	±0.2	20
M4757A20 or S4757A20	470×570	±0.3	5	±0.2	20
M4959A20 or S4959A20	490×590	±0.3	5	±0.2	20
M508609A30 or S508609A30	508×609	±0.3	5	±0.2	30
M5075D20 or S5075D20	500×750	±0.3	8	±0.2	20
M5261F20P or S5261F20P	520×610	±0.3	10	±0.2	20
M5280F10P or S5280F10P	520×800	±0.3	10	±0.2	10
M6272D30P or S6272D30P	620×720	±0.3	8	±0.2	30
M6575D30P or S6575D30P	650×750	±0.3	8	±0.2	30
M7080D30P or S7080D30P	700×800	±0.3	8	±0.2	30
MLC7080D30 or SLC7080D30	700×800	±0.3	8	±0.2	30
M8092D30P or S8092D30P	800×920	±0.3	8	±0.2	30
MLC8092D30 or SLC8092D30	800×920	±0.3	8	±0.2	30
MLC8092F30 or SLC8092F30	800×920	±0.3	10	±0.2	30
M8092F20/L10 or S8092F20/L10	800×920	±0.3	10	±0.2	20
M8096D30P or S8096D30P	800×960	±0.3	8	±0.2	30
M70110F30P or S70110F30P	700×1100	±0.4	10	±0.2	30
M85100F20P or S85100F20P	850×1000	±0.3	10	±0.2	20
MLC85100F30 or SLC85100F30	850×1000	±0.3	10	±0.2	30
M85120F20P or S85120F20P	850×1200	±0.3	10	±0.2	20
MLC85120F30 or SLC85120F30	850×1200	±0.3	10	±0.2	30
M85135E20/L10 or S85135E20/L10	850×1350	±0.3	9	±0.2	20
M85140F20P or S85140F20P	850×1400	±0.3	10	±0.2	20
MLC85140F30 or SLC85140F30	850×1400	±0.3	10	±0.2	30
M122140J20/L10 or S122140J20/L10	1220×1400	±0.3	13	±0.2	20
MLC122140J30 or SLC122140J30	1220×1400	±0.3	13	±0.2	30



Shin-Etsu Chemical Co., Ltd.

Advanced Materials Division

6-1 Ohtemachi 2-chome, Chiyoda-ku, Tokyo, Japan

TEL.+81-(0)3-3246-5222 FAX.+81-(0)3-3246-6839 E-mail: r_nakata@shinetsu.jp