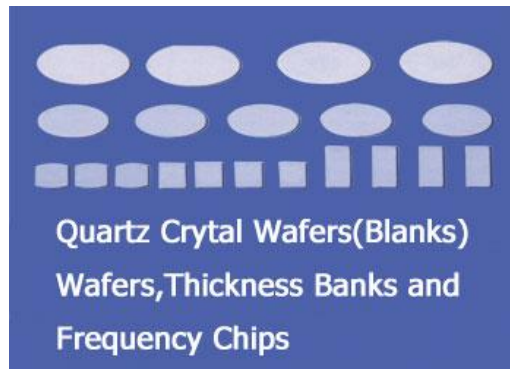
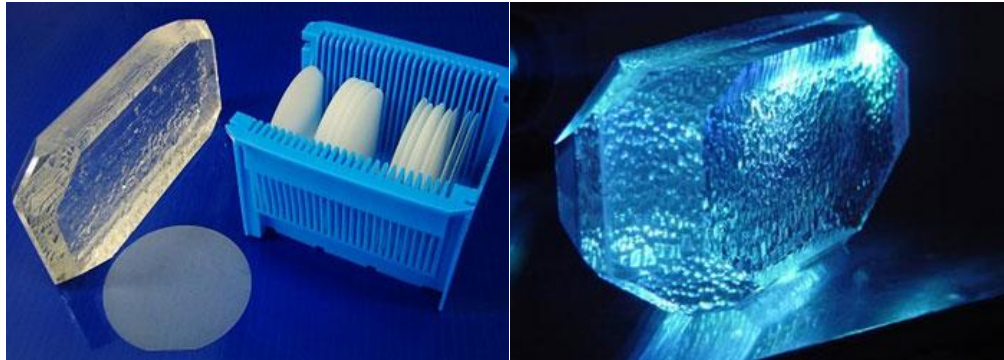


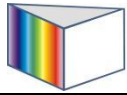
Quartz (SiO₂) Crystals and Wafers

Hangzhou Shalom EO offers the SAW grade quartz materials and wafers, advanced facilities are equipped for crystals growing, wafer cutting, wafer lapping, wafer polishing and wafer checking, all finished products are passed at Testing of curie Temp and QC inspections. The quartz crystals boules, crystals blanks, wafer blanks and polished wafers are available upon customer's request.



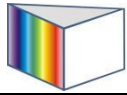
Quartz Crystals Specifications

Quartz Crystals Specifications	
Materials	both Pure Z and Y bar available
synthetic Q Value	min 1.8 , 2.4 to 3.0 mil IEC
Etch channel density	max 15/cm ² max100/cm ² ; max300/cm ²
Stress	No dark or discolored visible in polarized light
Surface finishing	#1000, #2000, #3000 , #4000, and Polished std
Angle Tolerance	ZZ': +/-15" +/-30", +/-1' +/-2'
XX'	+/-15 , +/-30'
Cut type	AT. BT. IT ,SC,.....,etc.
Frequency	1Mhz up to 50 Mhz for AT-fundamental
Size for round blank	from 3.0 to 15.0 mm dia (with flat)
Size for wafer	2.0x8.0 (mm)~ 16x16(mm)
SMD type	2.5x3.0 above at Customer option.
Flat	as request the flat shall be perpendicular to X axis within +/- 10 deg
new developed	SC-cut and LiTao3 blank & Convex blank(plano-convex) for SC-cut : theta angle: +/-30" and Phi angle : +/-3'



Specifications for 3"/4"/5"/6" quartz wafers

Specifications for 3"/4"/5"/6" quartz wafers				
Wafer Size	3"	4"	5"	6"
Diameter(mm)	76.2	100mm	125mm	150mm
Tolerance (\pm mm)	0.25	0.5	0.5	0.5
Primary reference flat (mm)	22mm or customized	32.5mm or customized	42.5mm or customized	57.5mm or customized
LTV (5x5mm) (μ m)	<2	<2	<2	<2
TTV (μ m)	<8	<10	<15	<20
Bow (μ m)	\pm 20	\pm 25	\pm 40	\pm 40
Warp(μ m)	\leq 30	\leq 40	\leq 50	\leq 50
PLTV (%) (5x5mm)	\geq 90%	\geq 90%	\geq 90%	\geq 90%
Cutting Angle	AT36/ST42.75/X/Y/Z etc.			
Orientation Flat	All available			
Surface Type	Single side polished/Double sides polished			
Polished side Ra (nm)	\leq 1			
Back Side Criteria (μ m)	General is 0.2-0.5 or as customized			
Edge Rounding	Compliant with SEMI M1.2 Standard/refer to IEC62276			
Appearance	Contamination			None
	Particles $\Phi > 0.3\mu$ m			\leq 30
	Saw Marks, striations			None
	Scratch			None
	Cracks, crowsfeet, Saw marks, strains			None



1. Physical properties of synthetic crystal quartz

Physical properties of synthetic crystal quartz	
Density, g/cm ³	2.65
Melting point, °C	1467
Thermal conductivity, W/(m x K) (T = 25°C)	10.7 (parallel to axis Z) 6.2 (perpendicular to axis Z)
Thermal conductivity, W/(m x K) (T = 25°C)	7.1 × 10 ⁻⁶ (parallel to axis Z) 13.2 × 10 ⁻⁶ (perpendicular to axis Z)
Hardness (Mohs)	7
Specific heat capacity, J/(kg x K) (T = 25°C)	710
Specific heat capacity, J/(kg x K) (T = 25°C)	4.34 (parallel to axis Z) 4.27 (perpendicular to axis Z)
Young's modulus (E), GPa	4.34 (parallel to axis Z) 4.27 (perpendicular to axis Z)
Shear modulus (G), GPa	31.14
Bulk modulus (K), GPa	36.4
Chemical stability	insoluble in water
Elastic coefficients	C11=87 C12=7 C44=58 C13=13 C14=18 C33=106

2. Synthetic crystal quartz refractive index vs wavelength

Synthetic crystal quartz refractive index vs wavelength								
λ, μm	n ₀	n _e	λ, μm	n ₀	n _e	λ, μm	n ₀	n _e
0.185	1.676	1.690	0.243	1.605	1.617	0.589	1.544	1.553
0.194	1.660	1.673	0.263	1.593	1.604	1.083	1.534	1.543
0.204	1.643	1.656	0.291	1.581	1.591	1.800	1.524	1.532
0.219	1.625	1.637	0.340	1.567	1.577	2.500	1.512	1.520
0.231	1.614	1.626	0.405	1.557	1.567	3.000	1.500	1.507

1. Materials

This material consists of single-crystal right-handed α -quartz artificially grown bars which is intended for use in fabrication of piezoelectric for such as timing freq control and frequency selection under hydro-thermal condition on a seed with its length along the Y axis. This cultured quartz crystal shall have nominal Q specification defined by followed grade: Grade Q-VALUE : Specification of the synthetic quartz crystal:

Specification of quartz crystal				
Infrared absorption α 3585	≤ 0.024	≤ 0.024	≤ 0.05	≤ 0.05
Q x10 6	3.0	3.0	2.4	2.4
Inclusions density	I	I	I	I or II
Etch channel density (strips/cm ²)	≤ 10	≤ 30	≤ 100	≤ 100

2. Quality evaluation of synthetic quartz crystal

2.1 The amount of crystal defect and impurity in synthetic quartz crystal depends on growth rate, mineralizer and raw material. The growth rate affects greatly to the important properties such as infra-red absorption coefficient α , which correlates to Q value, and frequency-temperature characteristics. The larger growth rate causes increase in α , decrease in Q value, and dispersion in frequency-temperature characteristics.

2.2 The quality index of synthetic quartz crystal was originally a Q value, and a 5 MHz quartz crystal unit operated in 5th overtone mode was used to obtain the Q value. But it required laborious work to fabricate the 5 MHz crystal unit, so the index had been changed to the coefficient α instead of the Q value

3. Standard specification for synthetic quartz crystal

3.1 Twinning: There shall be no electrical or optical twinning in the usable region.

3.2 Strain: There shall be no strain contained both inside and surface of seed crystal as well as in a grown quartz crystal.

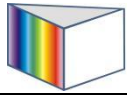
3.3 Cracks and fractures: There shall be no cracks, chippings or fractures in the usable region.

3.4 Inclusion density: The specification is in accordance with the IEC 60758.

Size range (μm) Grade	Q'ty per cm ³			
	10 to 30	30 to 70	70 to 100	>100
Ia	2	1	0	0
Ib	3	2	1	1
I	6	4	2	2
II	9	5	4	3
III	12	8	6	4

3.5 Infra-red quality indication: The specification is in accordance with the IEC 60758.

Grade	Max. α 3585	Estimated Q values (x 106)
A	0.015	3.8
A	0.024	3.0
B	0.050	2.4
C	0.069	1.8
D	0.100	1.4



3.6 Etch channel density: The specification is in accordance with the IEC 60758.

Grade	Max. number per cm ³
1	10
2	30
3	100
4	300
5	600

4. Specification for lumbered quartz crystal:

4.1 Angles:

5.1.1 Rotation angle of X-surface around Y-axis: $00^{\circ}00' \pm 15'$

5.1.2 Rotation angle of X-surface around Z-axis: $00^{\circ}00' \pm 15'$

4.2 Dimensional tolerance:

5.2.1 along X or Z axis: ± 0.1 mm

5.2.2 along Yaxis: ± 10 mm

4.3 Surface roughness: as customized ,lapped and polished are both available.

