

Specification of $\text{Li}_2\text{B}_4\text{O}_7$ Substrates for SAW/BAW Devices

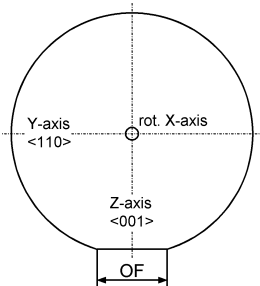
(Version: 1.0)

Basic Material Properties

Commodity:	Lithium Tetraborate ($\text{Li}_2\text{B}_4\text{O}_7$)
Composition:	$\text{Li}_2\text{O}:\text{B}_2\text{O}_3 = 1:2 \pm 0.02$
Growth Method:	modified Brigman
Purity/Grade:	SAW
Lattice Constant:	$a=9.479\text{\AA}$, $c=10.280\text{\AA}$
Melting Point:	917 °C
Density:	2.45g/cm ³
Hardness:	6 (Mohs)
Relative Dielectric Constant:	$\epsilon_{11}^T/\epsilon_0=8.5$, $\epsilon_{33}^T/\epsilon_0=8.2$
Elastic Stiffness Coefficient ($\times 10^{10}\text{N/m}^2$):	$c_{11}^E=13.5$, $c_{12}^E=0.357$, $c_{13}^E=3.35$, $c_{33}^E=5.68$, $c_{44}^E=5.85$, $c_{66}^E=4.67$
Piezoelectric Strain Constant (C/m^2):	$e_{15}=0.472$, $e_{31}=0.290$, $e_{33}=0.928$
Thermal Expansion Coefficient ($\times 10^{-6}/^\circ\text{C}$):	$a_{11}=11.1$, $a_{33}=3.74$
Pyro. Constant:	$3.0 \times 10^{-5}\text{C/m}^2\cdot\text{K}$
Poling:	no
Curie Temperature (T_c):	none

Basic SAW Properties (45° rotated X-cut)

Propagation Direction:	Z-axis
El.-Mech. Coupling Coefficient (k^2):	1.0%
Surface Wave Velocity:	3401m/s
Group Delay Time Temp. Coefficient:	0ppm/°C

Specification Item	Value	Tolerance
	Orientation	45° rotated X-cut
	Orientation Flat	perpendicular to Z-axis
	Orientation Flat Length	32.0mm
	Secondary Flat Position	none / on request
	Secondary Flat Length	none / on request
Diameter	100.00mm	± 0.50mm
Thickness (center point)	350μm ~ 500μm	± 30μm
Total Thickness Variation (TTV)	≤ 12μm	
Local Thickness Variation (LTV) within 5mm x 5mm	≤ 1.5μm	95% (PLTV)
Bow	-30μm ≤ bow ≤ +30μm	
Warp	≤ 60μm	
Front Surface Roughness (Ra)	≤ 7Å	(mirror polished)
Backside Surface Roughness (Ra)	0.2μm ~ 0.5μm	(GC# 1200 lapped)

Other specifications are available on request.