

LiNbO₃ Crystal

Introduction

LiNbO₃ is widely used as electro-optic modulators and Q-switches for Nd:YAG, Nd:YLF and Ti:Sapphire lasers as well as modulators for fiber optics. The following table list the specifications of a typical LiNbO₃ crystal used as Q-switch with transverse E-O modulation. The light propagates in z-axis and electric field applies to x-axis. The electro-optic coefficients of LiNbO₃ are: $r_{33} = 32$ pm/V, $r_{31} = 10$ pm/V, $r_{22} = 6.8$ pm/V at low frequency and $r_{33} = 31$ pm/V, $r_{31} = 8.6$ pm/V, $r_{22} = 3.4$ pm/V at high electric frequency. The half-wave voltage: $V_{\pi} = \lambda d/n_o^3 \gamma_c$, $\gamma_c = (n_e/n_o)^3 \gamma_{33} - \gamma_{13}$.

LiNbO₃ Q-Switch Specifications

Size	9 X 9 X 25 mm ³ or 4 X 4 X 15 mm ³
	Other size is available upon request
Tolerance of size	Z-axis: ± 0.2 mm
	X-axis and Y-axis: ± 0.1 mm
Chamfer	less than 0.5 mm at 45°
Accuracy of orientation	Z-axis: $< \pm 5'$, X-axis and Y-axis: $< \pm 10'$
Parallelism	$< 20''$
Finish	10/5 scratch/dig
Flatness	$\lambda / 8$ at 633 nm
AR-coating	R $< 0.2\%$ @ 1064 nm
Electrodes	Gold/Chrome plated on X-faces
Wavefront distortion	$< \lambda / 4$ @ 633 nm
Extinction ratio	$> 400:1$ @ 633 nm, $\phi 6$ mm beam

LiNbO₃ is also a good acousto-optic crystal and used for surface acoustic wave (SAW) wafer and A-O modulators. CASTECH provides acoustic (SAW) grade LiNbO₃ crystals in wafers, as-cut boules, finished components and custom fabricated elements.

Typical SAW Properties

Cut Type	SAW Velocity v_s (m/s)	Electromechanical Coupling Factor κ_s^2 (%)	Temperature Coefficient of Velocity TCV ($10^{-6}/^{\circ}\text{C}$)	Temperature Coefficient of Delay TCD ($10^{-6}/^{\circ}\text{C}$)
127.86° Y-X	3970	5.5	-60	78
Y-X	3485	4.3	-85	95

Typical Specifications

Specifications	Type	Boule		Wafer	
	Diameter		φ3"	φ4"	φ3"
Length or Thickness (mm)		≤ 100	≤ 50	0.35-0.5	
Orientation		127.86°Y, 64°Y, 135°Y, X, Y, Z, and other cut			
Ref. Flat Orientation		X, Y			
Ref. Flat Length		22±2mm	32±2mm	22±2mm	32±2mm
Front Side Polishing				Mirror polished 5-15 Å	
Back Side Lapping				0.3-1.0 μm	
Flatness (μm)				≤ 15	
Bow (μm)				≤ 25	

CASTECH can offer other sizes and specifications of wafers upon request.