

# Lithium Niobate Photonic Wafers

## Product Description

Lithium Niobate ( $\text{LiNbO}_3$ ) is an extremely versatile nonlinear crystal material. Its electro-optic and nonlinear optical coefficients are used for various photonic applications. Titanium indiffused or annealed proton exchange waveguides can be fabricated in  $\text{LiNbO}_3$  for integrated optical applications. Fast optical switches are commercially manufactured with Deltronic Crystal's lithium niobate wafers. Electro-optically controlled multiplexers and de-multiplexers can be fabricated into lithium niobate wafers. Three-inch diameter wafers are typically produced by Deltronic Crystal for integrated photonic applications.

## Applications

- EO Waveguide Phase Modulators
- EO Waveguide Amplitude Modulators
- Integrated Waveguide Photonics
- Quasi-phasematching SHG and OPO
- Waveguide Lasers

## Features

- Excellent Electro-optic and Nonlinear Optical Coefficients
- Optical Grade Grown by Czochralski Method

Figure 1.  $\text{LiNbO}_3$  Waveguide Modulator

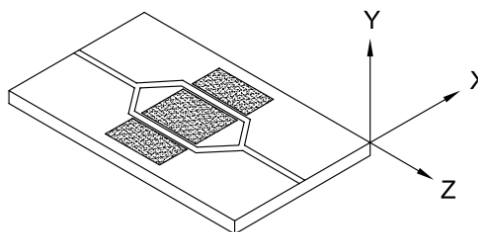
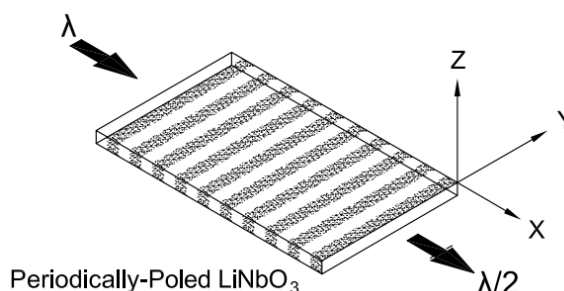


Figure 2. Quasi-Phasematching



Property at 25°C	Value
Empirical Formula	$\text{LiNbO}_3$
Congruent Melt Composition	48.6 mole % $\text{Li}_2\text{O}$
Congruent Melting Point (°C)	1253
Crystal Structure	trigonal
Bandgap (eV)	3.7
Point Group	3m
Curie Temperature (°C)	1143
Density ( $\text{g}\cdot\text{cm}^{-3}$ )	4.659
Hardness (moh)	5
Thermal Expansion Coefficient ( $^{\circ}\text{C}^{-1}$ )	$a = 16.7 \times 10^{-6}$ $c = 2.0 \times 10^{-6}$
Resistivity ( $\text{ohm}\cdot\text{cm}$ )	$> 10^{14}$ at $200^{\circ}\text{C}$
Lattice Constant (Å)	$a = 5.14829$ (hex) $c = 13.8631$ (hex)
Spontaneous Polarization ( $\text{Coul}/\text{m}^2$ )	0.71
Dielectric Constants	$\hat{a}_{33}^s = 29$ $\hat{a}_{11}^s = 44$ $\hat{a}_{33}^t = 30$ $\hat{a}_{11}^t = 84$
Refractive index, 514.5nm	$n_o = 2.2099$ , $n_e = 2.1476$
Refractive Index, 633nm	$n_o = 2.2884$ , $n_e = 2.2019$
Refractive Index, 1064nm	$n_o = 2.2340$ , $n_e = 2.1554$
Electro-optic Coefficients at 633nm [pm/V] (constant tension)	$r_{13} = 9.6$ $r_{22} = 6.8$ $r_{33} = 30.9$ $r_{51} = 32.6$ $r_c = 21.1$

<b>Crystallographic Orientations, Dimensions, and Tolerances</b>	
Orientations	X, Y or Z
Diameters	Up to 4 inches
Flatness	5 $\mu$ m
Orientation	6 minutes
Surface Quality	<10/5 $\mu$ m (scratch/dig) 1 <sup>st</sup> Surface
	20-30 2 <sup>nd</sup> Surface
Thickness Variation	<5 $\mu$ m
Index Uniformity	1 part in 10 <sup>-5</sup>
Compositional Uniformity	0.02 mole%