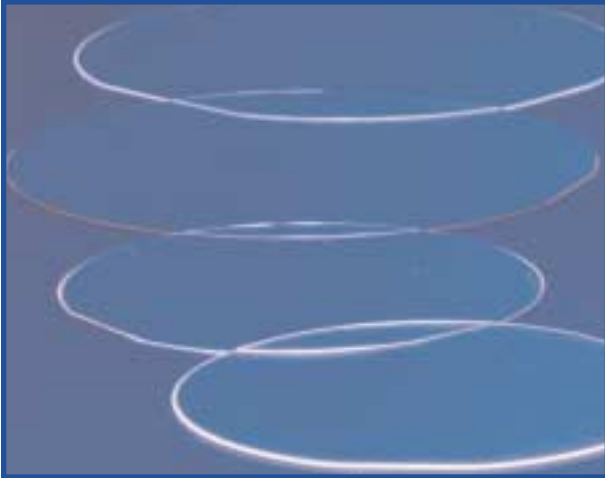


# LITHIUM NIOBATE, PHOTONIC WAFER APPLICATIONS



## 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.

## FEATURES

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

## APPLICATIONS

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

60 Harding Avenue  
Dover, NJ 07801  
t 973.361.2222  
f 973.361.0722

## DRAWINGS

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

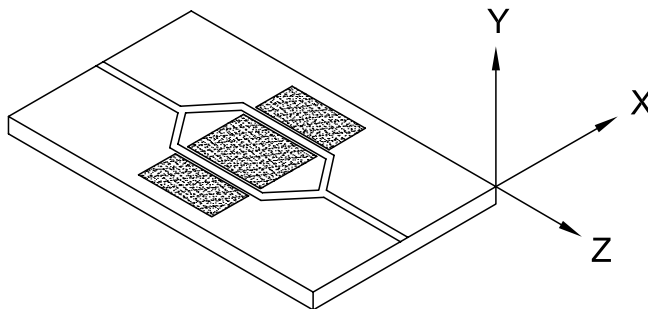
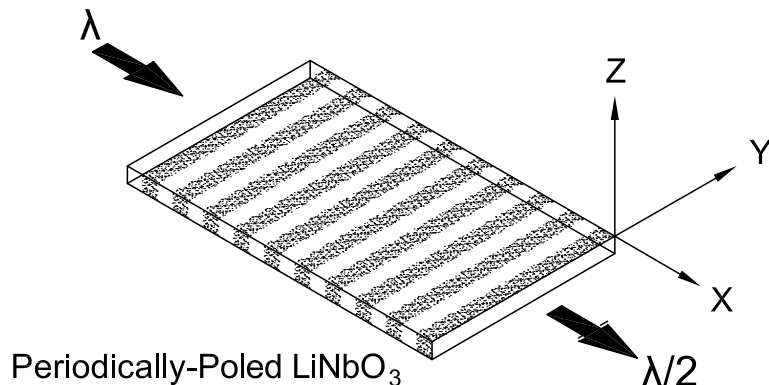


Figure 2. Quasi-Phasematching



## PROPERTIES

Property at 25°C	Value
Empirical Formula	LiNbO <sub>3</sub>
Congruent Melt Composition	48.6 mole%Li <sub>2</sub> O
Congruent Melting Point (°C)	1253
Crystal Structure	trigonal
Bandgap (eV)	3.7
Point Group	3m
Curie Temperature (°C)	1143
Density (g-cm <sup>-3</sup> )	4.659
Hardness (moh)	5
Thermal Expansion Coefficient (°C <sup>-1</sup> )	a=16.7x10 <sup>-6</sup> , c=2.0 x 10 <sup>-6</sup>
Resistivity (ohm-cm)	>1014 at 200°C
Lattice Constant (Å)	a=5.14829 (hex) c=13.8631 (hex)
Spontaneous Polarization (Coul/m <sup>2</sup> )	0.71
Dielectric Constants	$\hat{a}_{33}^s=29$ , $\hat{a}_{11}^s=44$ $\hat{a}_{33}^s=30\hat{a}_{11}^T=84$
Refractive index, 514.5nm	n <sub>o</sub> =2.2099, n <sub>e</sub> =2.1476
Refractive Index, 633nm	n <sub>o</sub> =2.2884, n <sub>e</sub> =2.2019
Refractive Index, 1064nm	n <sub>o</sub> =2.2340, n <sub>e</sub> =2.1554
Electro-optic Coefficients at 633nm [pm/V] (constant tension)	r <sub>13</sub> =9.6, r <sub>22</sub> =6.8, r <sub>33</sub> =30.9 r <sub>51</sub> =32.6, r <sub>c</sub> =21.1

## SPECIFICATIONS

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