

# Nonlinear and Electro-Optical Products

## **Product Description**

Lithium Niobate is a noncentrosymmetric large band-gap ferroelectric oxide crystal. It has nonlinear optical applications in harmonic generation, optical parametric oscillation and electro-optic modulation. It offers excellent transmission properties coupled with a high extinction ratio and low half-wave voltage. Deltronic Crystal grows large diameter high quality optical crystals from a congruent melt, using the Czochralski method.

## **Applications**

- Electro-optic Amplitude Modulators
- Electro-optic Phase Modulators
- Electro-optic Q-switches
- BPM Optical Parametric Conversion
- Binary Optics

## **Features**

- Excellent Transmission Properties
- High Extinction Ratio
- Grown by Czochralski Method

Figure 1. Type I Phasemaching Angle and Effective Second-Order Nonlinear Susceptibility

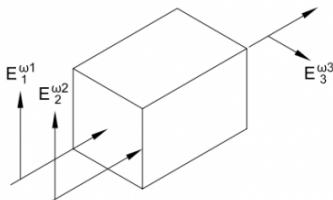


Figure 2. Type II Phasemaching Angle and Effective Second-Order Nonlinear Susceptibility

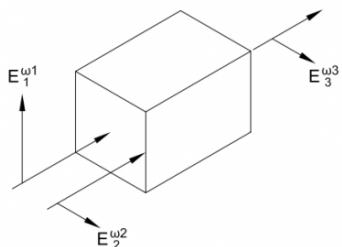
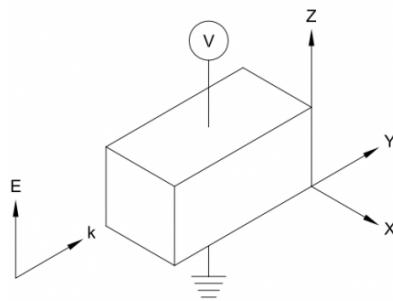


Figure 3. Transverse Electro-optic Modulator



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
Space Group	R3c
Point Group	3m
Curie Temperature (°C)	1143
Density (g·cm <sup>-3</sup> )	4.612
Hardness (moh)	5
Thermal Expansion Coefficient (°C <sup>-1</sup> )	$a = 16.7 \times 10^{-6}$ $c = 2.0 \times 10^{-6}$
Resistivity (ohm·cm)	$> 10^{14}$ at 200°C
Bandgap (eV)	3.7
Lattice Constant (Å)	$a = 5.14829$ (hex) $c = 13.8631$ (hex)
Spontaneous Polarization (Coul/m <sup>2</sup> )	0.71
Dielectric Constants	$\hat{\alpha}_{33}^s = 29$ $\hat{\alpha}_{11}^s = 44$ $\hat{\alpha}_{33}^s = 30$ $\hat{\alpha}_{11}^T = 84$
NLO Coefficients at 1064nm (pm/V)	$d_{31} = -1.4$ $d_{33} = -2.1$ $d_{22} = 2.2$
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>	
Standard Sizes	To customer specifications
Dimension Tolerances	$\pm 0.25\text{mm}$ on polished faces
Orientations	To customer specifications (X-ray oriented to $\pm 0.2$ degrees)
Flatness	$<\lambda/10$ at 633nm
Surface Quality	$<10/5$ (scratch/dig)
Transmitted Wavefront	$<\lambda/10$ at 633nm
Edges	0.1 to 0.15mm chamfer at $45^\circ$
Dopants	To customer specification
Anti-reflection Coating	Specify wavelength of operation