

Laser Crystals

NLO Crystals

Birefringent Crystals

AO and EO Crystals

## Lithium Niobate Crystal (LiNbO<sub>3</sub>)

### Introductions



LiNbO<sub>3</sub> Crystal is widely used as frequency doublers for wavelength > 1μm and optical parametric oscillators (OPOs) pumped at 1064 nm as well as quasi-phase-matched (QPM) devices. Additionally due to its large Electro-Optic(E-O) and Acousto-Optic(A-O) coefficients, LiNbO<sub>3</sub> crystal is the most commonly used material for Pockel Cells, Q-switches and phase modulators, waveguide substrate, and surface acoustic wave(SAW) wafers, etc.

### Basic Properties

Items	Specifications
Crystal Structure	Trigonal, Space group R <sub>3C</sub> , Point group 3m
Cell Parameters	a=5.148Å, c=13.863 Å
Melting Point	1253°C
Curie Temperature	1140°C
Mohs Hardness	5
Density	4.64 g/cm <sup>3</sup>
Elastic Stiffness Coefficients	CE11 2.33(× 10 <sup>11</sup> N/m <sup>2</sup> ) CE33 2.77(× 10 <sup>11</sup> N/m <sup>2</sup> )
Transparency Range	420-5200nm
Optical Homogeneity	~ 5 x 10 <sup>-5</sup> /cm
Refractive indices at 1064nm	n <sub>e</sub> = 2.146, n <sub>o</sub> = 2.220 @ 1300 nm n <sub>e</sub> = 2.156, n <sub>o</sub> = 2.232 @ 1064 nm n <sub>e</sub> = 2.203, n <sub>o</sub> = 2.286 @ 632.8 nm
NLO Coefficients	d <sub>33</sub> = 86 x d <sub>36</sub> (KDP) d <sub>31</sub> = 11.6 x d <sub>36</sub> (KDP) d <sub>22</sub> = 5.6 x d <sub>36</sub> (KDP)
Effective NLO Coefficients	d <sub>eff</sub> (I)=d <sub>31</sub> sinθ-d <sub>22</sub> cos <sup>2</sup> θcos3φ d <sub>eff</sub> (II)=d <sub>22</sub> cos <sup>2</sup> θcos3φ
Electro-Optic Coefficients	γ <sup>T</sup> <sub>33</sub> = 32 pm/V, γ <sup>S</sup> <sub>33</sub> = 31 pm/V, γ <sup>T</sup> <sub>31</sub> = 10 pm/V, γ <sup>S</sup> <sub>31</sub> = 8.6 pm/V, γ <sup>T</sup> <sub>22</sub> = 6.8 pm/V, γ <sup>S</sup> <sub>22</sub> = 3.4 pm/V,
Half-Wave Voltage, DC Electrical field // z, light ⊥ z: Electrical field // x or y, light // z	3.03 KV 4.02 KV
Damage Threshold	100 MW/cm <sup>2</sup> (10 ns, 1064nm)

LiNbO<sub>3</sub>

Crystal

LiNbO<sub>3</sub> 01

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**Lithium Niobate Crystal (LiNbO<sub>3</sub>)**
**Basic Properties**

Items	Specifications
Melting Point	1250°C
Curie Temperature	1140°C
Thermal Conductivity	38W/m/K@25°C
Thermal Expansion Coefficients(at 25°C)	//a, 2.0 × 10 <sup>-6</sup> /K //c, 2.2 × 10 <sup>-6</sup> /K
Resistivity	2 × 10 <sup>-6</sup> Ω · cm@200°C
Dielectric Constants	ε <sub>S11</sub> / ε <sub>0</sub> -43                      ε <sub>T11</sub> / ε <sub>0</sub> -78
	ε <sub>S11</sub> / ε <sub>0</sub> -28                      ε <sub>T33</sub> / ε <sub>0</sub> -32
Piezoelectric Strain Constant	d <sub>22</sub> 2.04(× 10 <sup>-11</sup> C/N )
	d <sub>33</sub> 19.22 (× 10 <sup>-11</sup> C/N )

**The Sellmeier equations (λ in μm)**

$$n_o^2 = 4.9048 + 0.11768 / (\lambda^2 - 0.04750) - 0.027169\lambda^2$$

$$n_e^2 = 4.5820 + 0.099169 / (\lambda^2 - 0.04443) - 0.02195\lambda^2$$

**Specifications**

Items	Specifications
Transmitting wavefront distortion	< λ/4 @ 633 nm
Dimension tolerance	(W ± 0.1 mm) x (H ± 0.1 mm) x (L ± 0.2mm)
Clear aperture	> 90% central area
Flatness	λ/8 @ 633 nm
Surface Quality	Scratch and dig 20-10
Parallelism	< 20 arc seconds
Perpendicularity	5 arc minutes
Angle tolerance	< 0.5°
AR coating	dual wave band AR coating at 1064/532 nm on both surfaces, with R < 0.2% at 1064 nm and R < 0.5% at 532 nm per surface Other coatings are available upon request

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