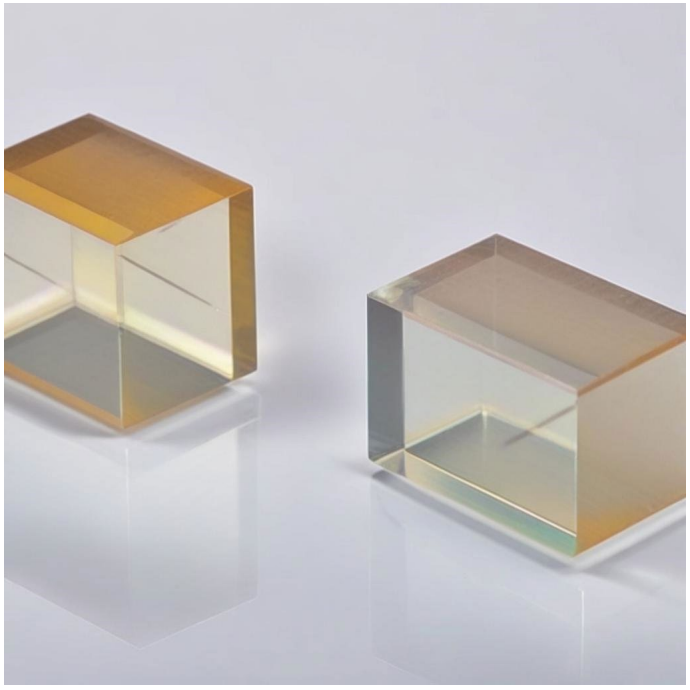
Photonics On Crystals

POC-OC-122410-LN Crystal Datasheet

1. Main Features

- Broad transparency range: 420 nm to 5200 nm.
- High electro-optic (E-O) and acousto-optic (A-O) coefficients.
- Non-hygroscopic, mechanically, and chemically stable.
- Exceptional optical homogeneity (~5 x 10^{-5} cm).
- Compatible with high-power laser systems for SHG and E-O modulation.



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2. Material General Description

Lithium Niobate ($LiNbO_3$ or LN Crystal) is a highly versatile nonlinear optical material widely utilized in photonics for its remarkable electro-optic (E-O) and acousto-optic (A-O) properties. It is frequently used in frequency doubling (SHG) applications for infrared lasers beyond 1 µm, optical parametric oscillators (OPOs), and quasi-phase-matched (QPM) devices. With a high optical damage threshold, excellent optical homogeneity, and mechanical robustness, LN Crystals are indispensable for applications such as Pockel cells, Q-switches, phase modulators, and surface acoustic wave (SAW) wafers. The crystal is non-hygroscopic, ensuring stability even under high-power operational conditions. Its thermal and electrical properties make it a preferred choice for advanced photonic systems.

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3. General Applications and Examples

LN Crystals are widely used in the following applications:

1. **Frequency Doubling (SHG)**: Ideal for frequency conversion of Nd:YAG and Nd:YVO_4 lasers to visible wavelengths, e.g., 532 nm green light.
2. **Optical Parametric Oscillators (OPOs)**: Enables tunable mid-infrared light generation for spectroscopy, biomedical imaging, and remote sensing.
3. **Quasi-Phase-Matched Devices (QPM)**: Boosts wavelength conversion efficiency in periodically poled $LiNbO_3$ (PPLN) devices.
4. **Electro-Optic Modulation (EOMs)**: LN's high E-O coefficients make it suitable for Pockel cells, phase modulators, and Q-switches in communication and laser modulation systems.
5. **Surface Acoustic Wave (SAW) Devices**: A critical material for high-frequency waveguides in modern telecommunications.

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4. Chemical and Physical Properties

Table 1. Chemical and Physical Properties

Property	**Value**
Crystal Structure	Trigonal, Space Group R3c
Lattice Parameter	a = 5.148 Å, c = 13.863 Å
Melting Point	1253°C
Curie Temperature	1140°C
Mohs Hardness	5
Density	4.64 g/cm³
Elastic Stiffness Coefficients	$C_{11} = 2.33 \times 10^{11}$ N/m²
	$C_{12} = 2.77 \times 10^{11}$ N/m²

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5. Optical and Nonlinear Optical Properties

Table 2. Optical and Nonlinear Optical Properties

Property	**Value**
Transparency Range	420 - 5200 nm
Optical Homogeneity	~5 x 10^{-5} cm
Refractive Indices	$n_e = 2.156$, $n_o = 2.232$ at 1064 nm
	$n_e = 2.146$, $n_o = 2.220$ at 1300 nm
NLO Coefficients	$d_{31} = 86 \times d_x$ (KDP)
	$d_{33} = 37.84$ pm/V

Effective NLO Coefficients	$d_eff = d_{11}\cos\theta\cos^2\varphi\cos3\phi$
Damage Threshold	100 MW/cm² (1064 nm, 10 ns)

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6. Spectrum Transmission Curves

The LN Crystal exhibits transparency across the 420–5200 nm range, making it suitable for tunable laser systems.

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7. Coating Specification

- **Dual Band AR Coating (DBAR):** Low reflectance (R < 0.2% @ 1064 nm, R < 0.5% @ 532 nm).
- **Custom Coatings:** Available upon request for electro-optic (E-O) or acousto-optic (A-O) applications.
- **Gold/Chrome Plating:** For specific high-durability and high-power applications.

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8. Standard Fabrication Specifications

Table 3. Standard Fabrication Specifications

Property	**Specification**
Dimension Tolerance	(W ± 0.1 mm) x (H ± 0.1 mm) x (L ± 0.2 mm)
Angle Tolerance	$\Delta\theta \leq 0.25°$, $\Delta\phi \leq 0.25°$
Parallelism	< 20 arc seconds
Perpendicularity	< 5 arc minutes
Surface Quality (Scratch/Dig)	20/10 to MIL-PRF-13830B
Surface Flatness	λ/8 @ 633 nm
Wavefront Distortion	λ/8 @ 633 nm
Damage Threshold	100 MW/cm² @ 1064 nm (10 ns)

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9. POC Strength and Capabilities

- High monthly production capacity: 50,000 to 100,000 pcs/month for Pockel cells and SAW wafers.
- Precision testing for quality control.
- Rapid delivery with standard lead times of 15 working days.
- Technical support for custom applications.
- Scalable pricing based on volume.

10. Standard Products

Table 4. Standard Products

Product Code	Dimensions (mm)	Coating Type	Application	Price (USD)
LN-C1	10 x 10 x 10	AR @ 1064/532 nm	SHG/OPO	$150
LN-C2	15 x 15 x 20	DBAR @ 1064/532 nm	Electro-Optic Modulation	$200
LN-Custom	Custom Dimensions	Custom Coatings	Tailored Applications	On Request