

LiNbO₃

Potassium niobate possesses the largest nonlinear coefficients for wavelength conversion of all commercially available inorganic materials. Strong, natural birefringence ($n_e - n_o = 0.22$) combined with high nonlinearity make potassium niobate one of the most versatile materials for SHG, SFM and OPO nonlinear conversion.

- PZOptics produces a wide variety of finished KNbO₃, our general production capabilities include:
- 1) Aperture: 2 ~ 10mm
 - 2) Length: 0.3 ~ 20mm
 - 3) Configuration: Flat, spherical, parallel and wedged
 - 4) Coating: Antireflective and reflective etc upon customer request

Physical and Optical Properties

Symmetry	orthorhombic
Point Group	mm2 (at temperature from -50 °C to 222±4 °C)
Lattice Parameters	a = 5.68961Å, b = 3.9692Å, c = 5.7256Å
Thermal Expansion	a a = 5.010x10 ⁻⁶ / °C a b = 1.410x10 ⁻⁵ / °C a c = 5.010x10 ⁻⁷ / °C
Density	4.62g/cm ³
Hardness	Mohs 5
Phase Transition Temperature	-50 °C ; 220 °C ; 430 °C

Transparent Range	400 - 4500 nm
Absorption Loss	<=1%/cm at 1064nm
Damage Threshold	>=4J/cm ² at 527nm (500ps) >= 6J/cm ² at 1054nm (700ps)
Sellmeier equations: (λ in μm)	n _x ² = 4.4208 + 0.10044/(λ ² - 0.054084) - 0.019592 λ ² n _y ² = 4.8355 + 0.12839/(λ ² - 0.056342) - 0.025379 λ ² n _z ² = 4.9873 + 0.15149/(λ ² - 0.064143) - 0.028775 λ ²

Typical Specification and Tolerance:

- 1) Lateral dimension tolerance: +/-0.2mm
- 2) Length tolerance: +/-0.2mm
- 3) Perpendicularity of polished face to sides: 30 arc minutes
- 4) Parallelism: 15 arc minutes
- 5) Surface quality : Better than 20/10
- 6) Surface flatness : λ/4 @ 632.8nm
- 7) Clear aperture : Central 80%

LiNbO₃ Crystal is widely used as frequency doublers for wavelength > 1 μm and optical parametric oscillators (OPOs) pumped at 1064 nm as well as quasi-phase-matched (QPM) devices. Due to its large Electro-Optic (E-O) and Acousto-Optic (A-O) coefficients.

PZOptics provides high quality and large size LiNbO₃ crystals for laser frequency doublers, OPOs and quasi-phase-matched doublers, as well as waveguide substrate and SAW wafers. High quality LiNbO₃ finished components with aperture of (2 - 15) x (2 - 15) mm² and length up to 50 mm for frequency doublers and optical parametric oscillators (OPOs), 50x50x1 mm³ or Dia. 3" x 1 mm LiNbO₃ substrate for waveguide optics, and Dia. 3" SAW wafers are available with high volume and at low price.

Physical and Optical Properties

Crystal Structure	Trigonal, space group R 3c
Cell Parameters	a = 0.515, c = 13.863, Z = 6
Melting Point	1255 +/-5°C
Curie Point	1140 +/-5°C
Mohs Hardness	5
Density	4.64 g/cm ³
Absorption Coefficient	~ 0.1%/cm @ 1064 nm
Solubility:	insoluble in H ₂ O
Relative Dielectric Constant	e _{T11} /e ₀ : 85 e _{T33} /e ₀ : 29.5
Thermal Expansion Coefficients at 25°C	a, 2.0 x 10 ⁻⁶ /K @ 25°C c, 2.2 x 10 ⁻⁶ /K @ 25°C
Thermal Conductivity	38 W /m /K @ 25°C

Transparency Range	420 - 5200 nm
Refractive Indices	n _e = 2.146, n _o = 2.220 @ 1300 nm n _e = 2.156, n _o = 2.322 @ 1064 nm n _e = 2.203, n _o = 2.286 @ 632.8 nm
Optical Homogeneity	~ 5 x 10 ⁻⁵ /cm
Sellmeier Equations (l in m)	n _o ² (l) = 4.9048 + 0.11768/(l ² - 0.04750) - 0.027169 l ² n _e ² (l) = 4.5820 + 0.099169/(l ² - 0.04443) - 0.021950 l ²

NLO Coefficients	d ₃₃ = 34.4 pm/V d ₃₁ = d ₁₅ = 5.95 pm/V d ₂₂ = 3.07 pm/V
Electro-Optic Coefficients	g _{T33} = 32 pm/V, g _{S33} = 31 pm/V g _{T31} = 10 pm/V, g _{S31} = 8.6 pm/V g _{T22} = 6.8 pm/V, g _{S22} = 3.4 pm/V,
Half-Wave Voltage, DC	3.03 KV
Electrical field z, light ^ z	4.02 KV
Electrical field x or y, light z	
Damage Threshold	200 MW/cm ² (10 ns)
Efficiency NLO Coefficients	d _{eff} = 5.7pm/V or ~14.6xd ₃₆ (KDP) for frequency doubling 1300 nm; d _{eff} = 5.3pm/V or ~13.6xd ₃₆ (KDP) for OPO pumped at 1300nm; d _{eff} = 17.6pm/V or ~45xd ₃₆ (KDP) for quasi-phase-matched structure;