$LiNbO_3$(LN)

DESCRIPTION

$LiNbO_3$ crystal has been widely used in optical waveguide and optical communication technology because of its excellent electro-optical properties. It is an ideal substrate material for many integrated optoelectronic devices. Because of the large electro-optic coefficient of $LiNbO_3$, the half-wave voltage is low. The electro-optic effect of $LiNbO_3$ crystal is usually used to modulate the optical signal. Electro-optic modulation is divided into longitudinal and transverse, and $LiNbO_3$ is mainly used in transverse modulation. It has been widely used in medium and low power solid-state lasers.

APPLICATIONS

- 532nm laser
  Holography
- 1064nm laser
  Medical Applications
- 2940nm laser
- Pulse range finder
- Laser target indicator
- Electro-optic Q-switch

FEATURES

- wide transparency range
- High electro-optic efficiency
- Stable mechanical and chemical properties
- Low absorption loss
- low damage threshold
- Small volume
- Not easy to deliquesce
- High temperature stability
- Large electro-optic coefficient
- Easy to grow into large crystal

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LiNbO3(LN)

PARAMETERS

PHYSICAL AND OPTICAL PROPERTIES

Property	Value
Chemical formula	$LiNbO_3$
Crystal structure	trigonal
Space group	R_3C
Density	5
Optical homogeneity	~ 5 x 10^{-5} / cm
Transparency range	420 – 5200 nm
Absorption coefficient	~ 0.1 % / cm @ 1064 nm
Refractive indices at 1064 nm	n_e = 2.146, n_o = 2.220 @ 1300 nm n_e = 2.156, n_o = 2.232 @ 1064 nm n_e = 2.203, n_o = 2.286 @ 632.8 nm
Sellmeier equations (λ, μm)	$n_o^2 = 4.9048 + 0.11768 / (\lambda^2 - 0.04750) - 0.027169\lambda^2$ $n_e^2 = 4.5820 + 0.099169 / (\lambda^2 - 0.04443) - 0.021950\lambda^2$
Thermal expansion coefficient @ 25 °C	//a, 2.0 x 10^{-6} / K //c, 2.2 x 10^{-6} / K
Thermal conductivity	~ 5 W/m/K @ 25 °C
Thermal optical coefficient	d_{no}/d_T = -0.874 x 10^{-6} / K at 1.4 μm d_{ne}/d_T = 39.073 x 10^{-6} / K at 1.4 μm

STANDARD SPECIFICATIONS OF LASER GRADE $LINBO_3$ CRYSTALS

Property	Value
Transmitted wavefront distortion	better than l/4 @ 633nm
Dimension tolerance	(W±0.1mm) x (H±0.1mm) x (L±0.2mm)
Clear aperture	over 90% central diameter
Flatness	1/8 @ 633nm
Surface quality	20 /10 Scratch/Dig
Parallelism	better than 20 arc sec
Perpendicularity	5 arc min
Angle tolerance	D_q < 0.5°, D_f < 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 0.532 nm per surface

$LINBO_3$ SPECIFICATION FOR OPTICAL WAVEGUIDE

Property	Value
Operating wavelength range	1.525-1.605μm
Extinction ratio	＜20dB
Half wave voltage	＜6V
DC bias voltage	＜8V
Input characteristic impedance	50Ω
Light reflection	≤-50dB
Maximum input electric power	20dBm
Maximum input optical power	10-100mW
Storage temperature	-40-85℃
Operating temperature	-40-70℃

$LINBO_3$ GENERAL SPECIFICATION FOR Q-SWITCH

Property	Value
Refractive retardation	Γ=πLnr22V/λd
Refractive indices at 1064 nm	R_{33}=32pm/V R_{31}=10pm/V R_{22}=6.8 pm/V
Aperture	4x4mm ~ 9x9mm
Length	15~25mm
Tolerance of size	+/-0.1mm
Chamfer	<0.5mm x 45°
Accuracy of orientation	<5 arc min
Parallelism	<10 arc sec
Flatness	l/8 at 632.8 nm
Wavefront Distortion	<l/4 at 632.8 nm
Extinction Ratio	>400:1 @ 633nm, dia 6mm beam

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PIEZOELECTRIC PROPERTY

Elastic stiffness coefficient $c_{ij}/(10^{10}N/m^2)$	C_{11}	C_{12}	C_{13}	C_{14}	C_{33}	C_{44}
	20.3	5.3	7.5	0.9	24.5	6.0
Elastic compliance coefficient $s_{ij}/(10^{-12}m^2/N)$	S_{11}	S_{12}	S_{13}	S_{14}	S_{33}	S_{44}
	5.78	-1.01	-1.47	-1.02	5.02	17.0
Piezoelectric strain constant $dij/(10^{-11}C/N)$	d_{11}	d_{15}	d_{22}	d_{31}	d_{33}	
	8	7.4	2.04	-0.086	1.62	
Dielectric constant	$\varepsilon^T_{11}/\varepsilon 0$					
	78					
Electromechanical coupling coefficient $k_{ij}(\%)$	k_{15}	k_{31}				
	68	50				

NONLINEAR OPTICAL PROPERTIES

NLO Coefficients	d_{33} = 34.4 pm/V
	$d_{31} = d_{15}$ = 5.95 pm/V
	d_{22} = 3.07 pm/V
Efficiency NLO Coefficients	d_{eff} =5.7 pm/V or ~14.6 x d_{36} (KDP) for frequency doubling 1300 nm
	d_{eff} =5.3 pm/V or ~13.6 x d_{36} (KDP) for OPO pumped at 1064 nm
	d_{eff} =17.6 pm/V or ~45 x d_{36} (KDP) for quasi-phase-matched structure
Electro-Optic Coefficients	g^T_{33} = 32 pm/V, g^S_{33} = 31 pm/V
	g^T_{31} =10 pm/V, g^S_{31}=8.6 pm/V
	g^T_{22} = 6.8 pm/V, g^S_{22}= 3.4 pm/V
Half-Wave Voltage, DC Electrical field||z, light ^z:	3.03 KV
Electrical field||x or y, light||z:	4.02 KV
Damage Threshold	g^T_{22} = 6.8 pm/V, g^S_{22}= 3.4 pm/V