$KNbO_3$

DESCRIPTION

$KNbO_3$ (Potassium Niobate) crystal (KN for short) is one of the very important nonlinear optical crystals. Its nonlinear optical quality factor, d^2/n^3, ranks first among all oxide crystals. The average refractive index of KN is 2.2, the theoretical value of reflectivity is 14%, and the theoretical transmittance is 86%. The crystal is chemically stable, has a large nonlinear optical coefficient, and direct frequency doubling (101 mW) of a semiconductor 860 nm laser has yielded nearly 40 mW of 430 nm blue light. the KN crystal, due to its special properties, makes it an important link in the development of microlasers for this new application. The realization of blue lasers is a top priority, and KN crystals are one of the most ideal materials for generating second harmonics and realizing blue lasers.

FEATURES

- Millisecond response time;
- Very low scattering loss;
- Large nonlinear optical coefficient;
- High nonlinear optical coefficient;
- Excellent photorefractive properties;
- High stability under light irradiation;
- Favorable phase matching characteristics

APPLICATIONS

- optical waveguide
- Frequency multiplier
- Electro Optics and nonlinear optics
- Photorefractive application of laser diode
- Optical second harmonic generation (SHG)
- Dynamic holography and optical phase conjugation in near infrared

NONLINEAR OPTICAL PROPERTIES

attribute	numerical value
Nonlinear optical coefficient	d_{31}=-15.8 pm/V，d_{32}=-18.3 pm/V@1064 nm
Minimum SHG wavelength	425 nm (type I NCPM, Y-cut or A-cut)
The acceptance angle of type I SHG is 1064 nm	Dq. 0.24 mrad cm (internal)
The acceptance temperature of type I SHG is 1064 nm	DT=0.3 ℃/cm

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LINEAR OPTICAL PROPERTIES

Properties	numerical value
Transparent range	400-5500 nm
Infrared cutoff wavelength	5.5 μm
Absorption loss	≤1%/cm at 1064 nm
Damage threshold	≤ 4 J / cm^2 at 527 nm (500ps, single pulse)
	≤ 6 J / cm^2 at 1054 nm (700ps, single pulse)

PHYSICAL AND CHEMICAL PROPERTIES

chemical formula	$KNbO_3$
crystal structure	Bevel, mm^2
Lattice parameters	a = 5.6896Å
	b = 3.9692Å
	c = 5.7256Å
Mass density	4.617 g/cm^3
melting point	1333 K
Curie temperature	498 K
Distribution of dielectric axis and crystal axis	X, Y, Z ⇒ b, a, c
P = specific heat CP at 0.101325mpa	c_p = 767 J/kgK
thermal conductivity	κ > 3.5 W/mK
thermal expansion	$a_a=5.010\times10^{-6}$/℃
	$a_b=1.410\times10^{-5}$/℃
	$a_c=5.010\times10^{-7}$/℃

EXPERIMENTAL VALUE OF TEMPERATURE BANDWIDTH AT T=295K

Interaction wavelength [μm]	θ_{exp} [deg]	ΔT [◦C]
YZ Plane, φ = 90◦		
SHG, o + o ⇒ e		
1.0642 ⇒ 0.5321	46.4	0.39
1.3382 ⇒ 0.6691	29.7	0.59
3.5303 ⇒ 1.76515	37.1	2.3
SFG, o + o ⇒ e		
5.2955 + 3.5303 ⇒ 2.1182	59.5	2.4
XZ Plane, φ = 0◦, θ >Vz		
SHG, o + o ⇒ e		
1.0642 ⇒ 0.5321	71.4	0.77
1.3382 ⇒ 0.6691	56.2	2.2
3.5303 ⇒ 1.76515	58.1	10.1

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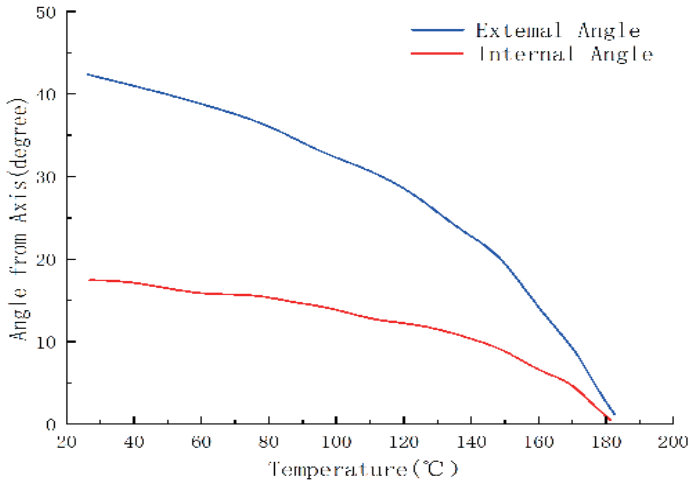
PHASE MATCHING ANGLE EXPERIMENTAL VALUE (T=293K)

Interaction wavelength [μm]	φ_{exp} [deg]
XY plane, θ= 90°	
SHG, e + e ⇒ o	
0.946 ⇒ 0.473	≈30
4.7599 ⇒ 2.37995	69.9
YZ plane, φ = 90°	θ_{exp} [deg]
SHG, o + o ⇒ e	
0.86 ⇒ 0.43	83.5
0.89 ⇒ 0.445	70.7
0.92 ⇒ 0.46	64
0.94 ⇒ 0.47	60.5
1.0642 ⇒ 0.5321	46.4
1.3188 ⇒ 0.6594	30.6
1.3382 ⇒ 0.6691	29.7
3.5303 ⇒ 1.76515	37.3
4.7291 ⇒ 2.36455	77.3
SFG, o + o ⇒ e	
1.3188 + 0.6594 ⇒ 0.4396	62.3
1.3188 + 1.0642 ⇒ 0.5889	37.7
4.7762 + 3.1841 ⇒ 1.9105	46.6
5.2955 + 3.5303 ⇒ 2.1182	59.5
XZ plane, φ = 0°, θ > Vz	
SHG, o + o ⇒ e	
1.0642 ⇒ 0.5321	70.4
1.3188 ⇒ 0.6594	56.8
1.3382 ⇒ 0.6691	56.2
3.5303 ⇒ 1.76515	58.8
SFG, o + o ⇒ e	
1.3188 + 1.0642 ⇒ 0.5889	62.6
5.2955 + 3.5303 ⇒ 2.1182	86.1

SPECTRA



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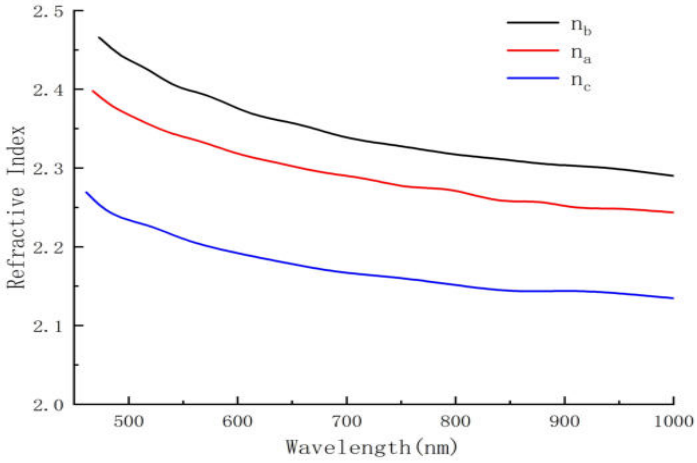
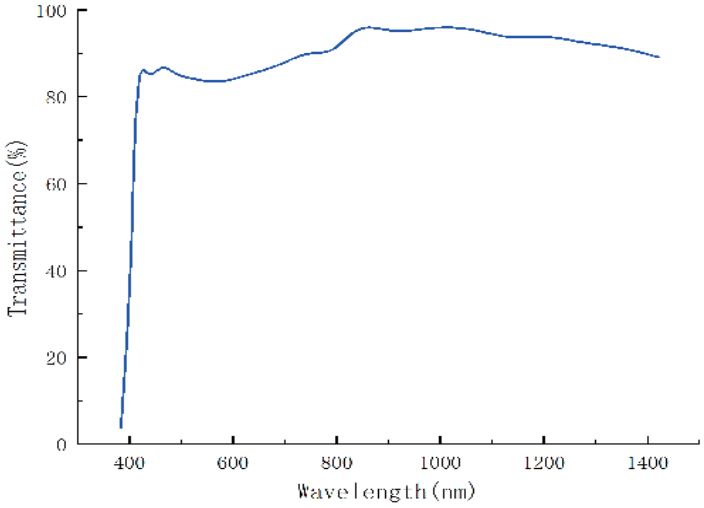
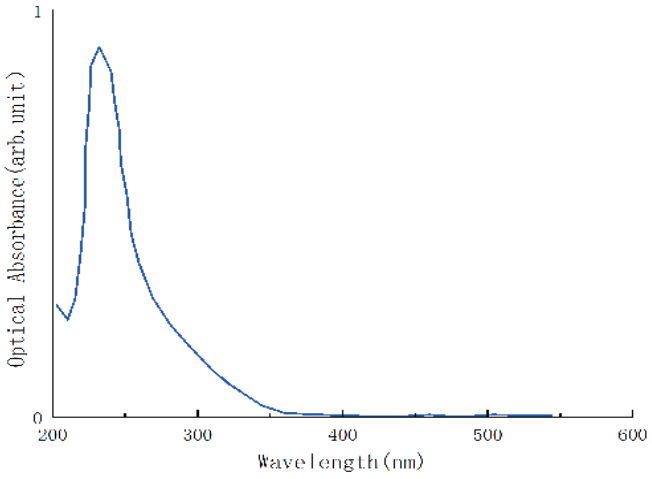

2.5
2.4
2.3
2.2
2.1
2.0
Refractive Index
500
600
700
800
900
1000
Wavelength(nm)
n_b
n_a
n_c


100
80
60
40
20
0
Transmittance(%)
400
600
800
1000
1200
1400
Wavelength(nm)


1
0
Optical Absorbance(arb.unit.)
200
300
400
500
600
Wavelength(nm)