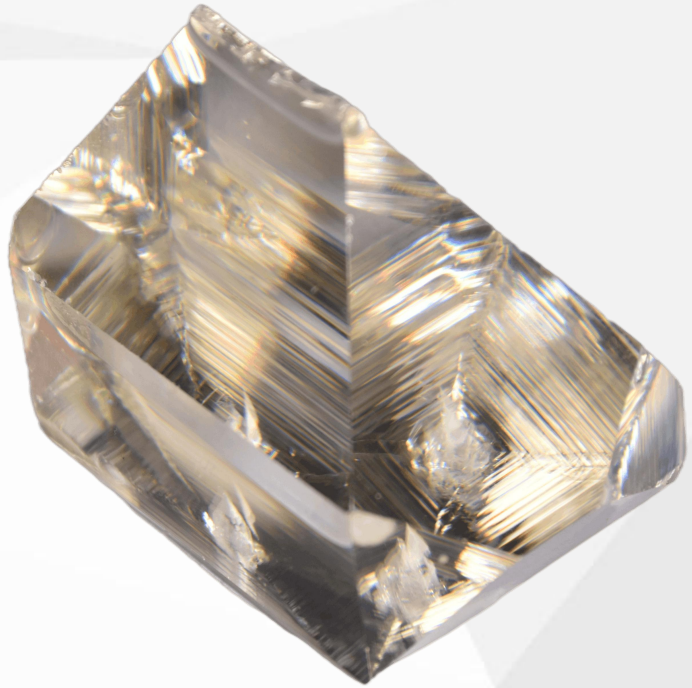
KTP crystals



Potassium Titanyl Phosphate (KTiOPO4 or KTP) KTP is the most commonly used material for frequency doubling of Nd:YAG and other Nd-doped lasers, particularly when the power density is at a low or medium level. To date, extra and intra-cavity frequency doubled Nd:lasers using KTP have become a preferred pumping source for visible dye lasers and tunable Ti:Sapphire lasers as well as their amplifiers. They are also useful green sources for many research and industry applications. KTP is also being used for intracavity mixing of 0.81μm diode and 1.064μm Nd:YAG laser to generate blue light and intracavity SHG of Nd:YAG or Nd:YAP lasers at 1.3μm to produce red light.

In addition to unique NLO features, KTP also has promising E-O and dielectric properties that are comparable to LiNbO3. These advantaged properties make KTP extremely useful to various E-O devices.
KTP is expected to replace LiNbO3 crystal in the considerable volume application of E-O modulators, when other merits of KTP are combined into account, such as high damage threshold, wide optical bandwidth (>15GHZ), thermal and mechanical stability, and low loss, etc.

K T P c r y s t a l s

- Efficient frequency conversion(1064nm SHG conversion efficiency is about 80%)
- Large nonlinear optical coefficients(15 times that of KDP)
- Wide angular bandwidth and small walk-off angle
- Broad temperature and spectral bandwidth
- High thermal conductivity (2 times that of BNN crystal)

- Frequency Doubling (SHG) of Nd-doped La sers for Green/Red Output
- Frequency Mixing (SFM) of Nd Laser and Diode Laser for Blue Output
- Parametric Sources (OPG, OPA and OPO) for 0.6mm-4.5mm Tunable Output
- Electrical Optical(E-O) Modulators, Optical Switches, and Directional Couplers
- Optical Waveguides for Integrated NLO and E-O Devices

a=6.404Å, b=10.615Å, c=12.814Å, Z=8

Nonlinear Properties	
Phase matching range	497nm – 3300 nm
Nonlinear coefficients (@ 10-64nm)	d_{31}=2.54pm/V, d_{31}=4.35pm/V, d_{31}=16.9pm/Vd_{24}=3.64pm/V, d_{15}=1.91pm/V at 1.064 mm
Effective nonlinear optical coefficients	$d_{eff}(II) \approx (d_{24} - d_{15})\sin^2 q \sin^2 j - (d_{15}\sin^2 j + d_{24}\cos^2 j)\sin q$

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Basic Properties of KTP	
Crystal structure	Orthorhombic
Melting point	1172°C
Curie Point	936°C
Lattice parameters	a=6.404Å, b=10.615Å, c=12.814Å, Z=8
Temperature of decomposition	~1150°C
Transition temperature	936°C
Mohs hardness	»5
Density	2.945 g/cm^3
Color	colorless
Hygroscopic Susceptibility	No
Specific heat	0.1737 cal/g.°C
Thermal conductivity	0.13 W/cm/°C
Electrical conductivity	3.5x10^{-8} s/cm (c-axis, 22°C, 1KHz)
Thermal expansion coefficients	a_1 = 11 x 10^{-6} °C^{-1}a_2 = 9 x 10^{-6} °C^{-1}a_3 = 0.6 x 10^{-6} °C^{-1}
Thermal conductivity coefficients	k_1 = 2.0 x 10^{-2} W/cm °Ck_2 = 3.0 x 10^{-2} W/cm °Ck_3 = 3.3 x 10^{-2} W/cm °C
Transmitting range	350nm ~ 4500nm
Phase Matching Range	984nm ~ 3400nm
Absorption coefficients	a < 1%/cm @1064nm and 532nm

Type II SHG of 1064nm Laser	
Phase matching angle	q=90°, f=23.2°
Effective nonlinear optical coefficients	d_{eff} » 8.3 x d_{36}(KDP)
Angular acceptance	D_θ= 75 mrad D_ϕ= 18 mrad
Temperature acceptance	25°C.cm
Spectral acceptance	5.6 Åcm
Walk-off angle	1 mrad
Optical damage threshold	1.5-2.0MW/cm^2

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Technical Parameters	
Dimension	1x1x0.05 - 30x30x40 mm
Phase matching type	Type II, θ=90°; ϕ=phase-matching angle
Typical Coating	a) S1&S2: AR @1064nm R<0.1%; AR @ 532nm, R<0.25%.b) S1: HR @1064nm, R>99.8%; HT @808nm, T>5%S2: AR @1064nm, R<0.1%; AR @532nm, R<0.25%Customized coating available upon customer request.
Angle tolerance	6'Δθ< ± 0.5°; Δϕ< ±0.5°
Dimension tolerance	±0.02 - 0.1 mm(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm) for NKC series
Flatness	λ/8 @ 633nm
Scratch/Dig code	10/5 Scratch/dig per MIL-O-13830A
Parallelism	<10'better than 10 arc seconds for NKC series
Perpendicularity	5'5 arc minutes for NKC series
Wavefront distortion	less than λ/8 @ 633nm
Clear aperture	90% central area
Working temperature	25°C - 80°C
Homogeneity	dn ~10^{-6}/cm