

KTP

KTP (K₂TiOPO₄) is a nonlinear optical crystal, which possesses excellent nonlinear and electro-optic properties. It has large nonlinear optical coefficients and wide angular bandwidth and small walk-off angle, etc. which make it suitable for various nonlinear frequency conversion and wave guide application.

Due to very high effective nonlinearity ($d_{\text{eff}} \sim 8.3 \times d_{36}$ (KDP) at 1.06 μm) and excellent optical properties, KTP perfectly suits as lasing material in various applications. The phase matching range of KTP crystal lies in 0.99-3.3 μm region. This allows us to use KTP as an intracavity and extracavity frequency double for the most commonly used lasers, such as Nd:YAG, Nd:Glass and Nd:YLF.

Physical and Optical Properties

Crystal structure	Orthorhombic, point group mm 2
Melting point	1172°C incongruent
Cell parameters	a=6.404?, b=10.616?, c=12.814?, Z=8
Curie point	936°C
Mohs hardness	~5
Density	3.01 g/cm ³
Color	colorless
Hygroscopic susceptibility	no
Specific heat	0.1643 cal/g.°C
Thermal conductivity	0.13 W/cm/°K
Electrical conductivity	3.5x10 ⁻⁸ s/cm (c-axis, 22°C, 1KHz)

Transmitting range	350nm~4500nm			
Refractive indices		n x	n y	n z
	1064nm	1.738	1.745	1.830
	532nm	1.778	1.789	1.889
Absorption coefficients	a < 1%/cm @1.064 μm and 0.532 μm			
Phase matchable range	0.984 - 3.4 μm			
Therm-optic coefficients	dn x /dT=1.1x10 ⁻⁵ /°C, dn y /dT=1.3x10 ⁻⁵ /°C, dn z /dT=1.6x10 ⁻⁵ /°C			
Nonlinear optical coefficients	d ₃₁ =2.54pm/V, d ₃₂ =4.35pm/V, d ₃₃ =16.9pm/V d ₂₄ =3.64pm/V, d ₁₅ =1.91pm/V at 1.064 mm d _{eff} (II) ≈ (d ₂₄ - d ₁₅)sin ² f sin ² q - (d ₁₅ sin ² f + d ₂₄ cos ² f)sin q			
Electro-optic coefficients		Low frequency(pm/V)	High frequency(pm/V)	
	r ₁₃	9.5	8.8	
	r ₂₃	15.7	13.8	
	r ₃₃	36.3	35	
	r ₅₁	7.3	6.9	
r ₄₂	9.3	8.8		
Dielectric constant	e _{eff} =13			
Sellmeier equations	n _x ² =3.0065+0.03901/(² -0.04251)-0.01327 ² n _y ² =3.0333+0.04154/(² -0.04547)-0.01408 ² n _z ² =3.3134+0.05694/(² -0.05658)-0.01682 ²			

Capabilities :

- 1) Aperture: 1x1 ~ 10x10mm
- 2) Length: 0.05 ~ 20mm
- 3) Phase Matching Angle:
Determined by different homonic generation
typical $\theta=90^\circ$; $\varphi=23.5^\circ$ for SHG 1064nm
- 4) Phase matching type: Type II
- 5) 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%
Different coating specification upon customer request.

Typical Specification and Tolerance:

- 1) Angle tolerance: $\Delta\theta < \pm 0.5^\circ$; $\Delta\phi < \pm 0.5^\circ$
- 2) Dimension tolerance: $(W \pm 0.1\text{mm}) \times (H \pm 0.1\text{mm}) \times (L + 0.2\text{mm}/-0.1\text{mm})$
- 3) Flatness: $\lambda/8 @ 633\text{nm}$
- 4) Scratch/Dig code: better than 10/5 Scratch/dig per MIL-O-13830A
- 5) Parallelism: < 20 arc seconds
- 6) Perpendicularity: < 5 arc minutes
- 7) Wavefront distortion: $< \lambda/8 @ 633\text{nm}$
- 8) Clear aperture: $> 90\%$ central area

Notes:

To inquiry or order a finished KTP crystals, please specify the specification listed above, we kindly request engineering drawing to specify orientation, Please consult us for the designs if you're sure about the phase matching angle for others' special application.

Fig. 1 represents Type 2 SHG tuning curve of KTP in x-y plane. In x-y plane the slope $d(Dk)/dq$ is small. This corresponds to quasi-angular noncritical phase matching, which ensures the double advantage of a large acceptance angle and a small walk off

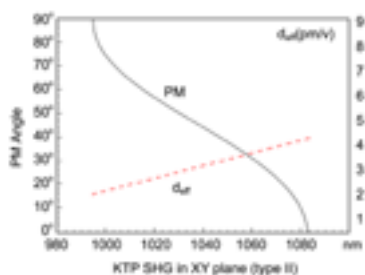


Fig.1

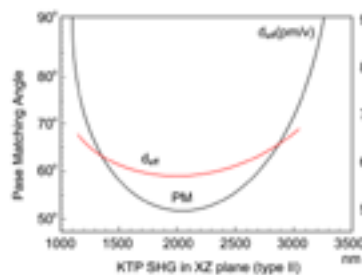


Fig.2

Fig. 2 represents Type 2 SHG tuning curve of KTP in x-z plane. in x-z plane the slope $d(Dk)/dq$ is almost zero for wavelengths in the range 1.5-2.5 m m and this corresponds to quasi-wavelength noncritical phase matching, which ensures a large spectral acceptance. Wavelength noncritical phase matching is highly desirable for frequency conversion of short pulses.

Figures 3 and 4 show the phase matching angles for OPO/OPA pumped at 532 nm in x-y and x-z plane respectively. As a lasing material for OPG, OPA or OPO, KTP can most usefully be pumped by Nd lasers and their second harmonic or any other source with intermediate wavelength, such as a dye laser (near 600 nm).

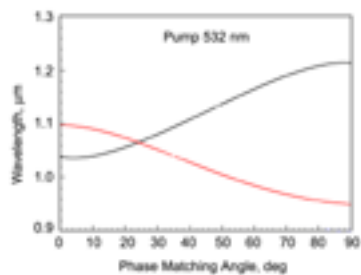


Fig.3

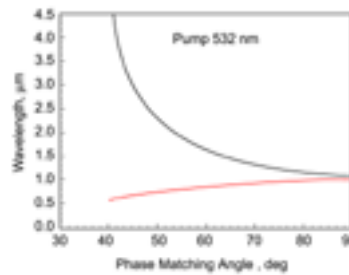


Fig.4