KTP – POTASSIUM TITANYL PHOSPHATE

Features

- Excellent nonlinear, electro-optical and acousto-optical properties
- High nonlinear coefficient
- Wide transparency range
- Broad angular acceptance
- Broad thermal acceptance

We offer:

- Crystal size up to 10×10×20 mm
- Singleband and dualband AR and BBAR coatings
- Standard and customised mounts and housings
- Free technical consulting.

KTP is a standard crystal mostly used in extracavity configuration when a single pass through the crystal is required.

KTP crystals are optimised for SHG intracavity configuration in low peak power CW lasers. Due to the large number of passes through the crystal, low insertion losses and high homogeneity are essential for conversion efficiency. The special highest quality material selected by SHG efficiency mapping of each crystal, fine surface polishing and dual band AR coatings with very low losses allow EKSMA OPTICS to produce KTP crystals suitable for intracavity SHG application.

Standard specifications

Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

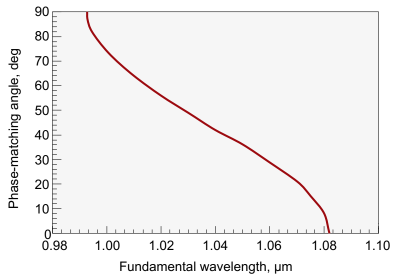

Fig. 1. Type 2 SHG in x-y plane

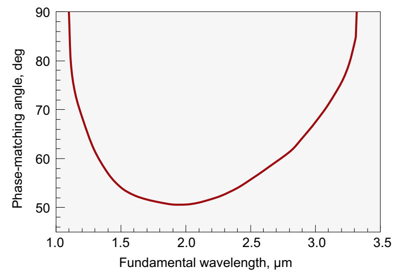

Fig. 2. Type 2 SHG in x-z plane

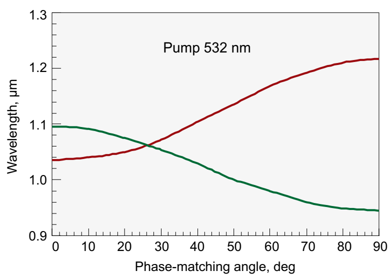

Fig. 3. OPO tuning curve in x-y plane

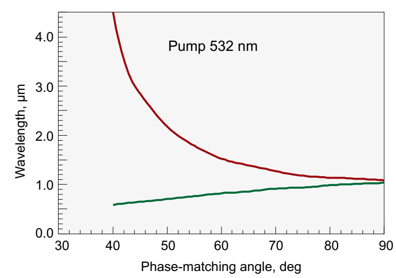

Fig. 4. OPO tuning curve in x-z plane

Fig. 1 represents Type 2 SHG tuning curve of KTP in x-y plane. In x-y plane the slope $\partial(\Delta k)/\partial\theta$ 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. Otherwise in x-z plane the slope $\partial(\Delta k)/\partial\lambda$ is almost zero for wavelengths in the range 1.5–2.5 µm and this corresponds to quasi-wavelength noncritical phase-matching, which ensures a large spectral acceptance (see Fig. 2). Wavelength noncritical phase-matching is highly desirable for frequency conversion of short pulses.

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 and Fig. 4 show the phase-matching angles for OPO/OPA pumped at 532 nm in x-y and x-z plane respectively.

Standard Crystals list

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	Price, EUR
3x3x5	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	**KTP-401**	76
3x3x10	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	**KTP-402**	109
4x4x6	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	**KTP-403**	118
7x7x9	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	**KTP-404**	529

Physical properties

Crystal structure	orthorhombic
Point group	mm2
Space group	$Pna2_1$
Lattice constants, Å	a = 6.404, b = 10.616, c = 12.814, z = 8
Density, g/cm^3	3.01
Melting point, °C	1172
Transition temperature, °C	936
Mohs hardness	5
Thermal expansion coefficients, °C^{-1}	$a_x = 11\times10^{-6}$, $a_y = 9\times10^{-6}$, $a_z = 0.6\times10^{-6}$
Thermal conductivity, W/cm°C	13
Not hygroscopic	

Optical properties

Transparency	350–4400 nm	
Refractive indices	at 1064 nm	at 532 nm
	$n_x = 1.7404$	$n_x = 1.7797$
	$n_y = 1.7479$	$n_y = 1.7897$
	$n_z = 1.8296$	$n_z = 1.8877$
Thermooptic coefficients in 0.4 – 1.0 µm range	$\partial n_x/\partial T = 1.1\times10^{-5}\,(K)^{-1}$ $\partial n_y/\partial T = 1.3\times10^{-5}\,(K)^{-1}$ $\partial n_z/\partial T = 1.6\times10^{-5}\,(K)^{-1}$	
Wavelength dispersion of refractive indices	$n_x^2 = 3.0067 + 0.0395/(\lambda^2 - 0.04251) - 0.01247\times\lambda^2$ $n_y^2 = 3.0319 + 0.04152/(\lambda^2 - 0.04586) - 0.01337\times\lambda^2$ $n_z^2 = 3.3134 + 0.05694/(\lambda^2 - 0.05941) - 0.016713\times\lambda^2$	

Nonlinear properties

Phase matching range for:	
Type 2 SHG in x-y plane	0.99÷1.08 µm
Type 2 SHG in x-z plane	1.1÷3.4 µm
For Type 2, SHG @ 1064 nm, cut angle θ=90°, φ=23.5°	
Walk-off	4 mrad
Angular acceptances	$\Delta\theta = 55$ mrad × cm $\Delta\varphi = 10$ mrad × cm
Thermal acceptance	$\Delta T = 22$ K × cm
Spectral acceptance	$\Delta v = 0.56$ nm × cm
Up to 80% extracavity SHG efficiency	
Effective nonlinearity	
x-y plane	$d_{eoe} = d_{oee} = d_{15}\sin^2\varphi + d_{24}\cos^2\varphi$
x-z plane	$d_{oeo} = d_{eoo} = d_{24}\sin\theta$ $d_{31} = \pm 1.95$ pm/V $d_{32} = \pm 3.9$ pm/V $d_{33} = \pm 15.3$ pm/V $d_{24} = d_{32}$ $d_{15} = d_{31}$
Damage threshold	>500 MW/cm^2 *for pulses λ=1064 nm, τ=10 ns, 10 Hz, TEM_{00}*

Related Products

Crystal Oven TC2
See page 2.28

Ring Holders for Nonlinear Crystals
See page 2.26

Heatpoint Crystal Oven
See page 2.29

Positioning Mount 840-0199 for Nonlinear Crystal Housing
See page 2.27