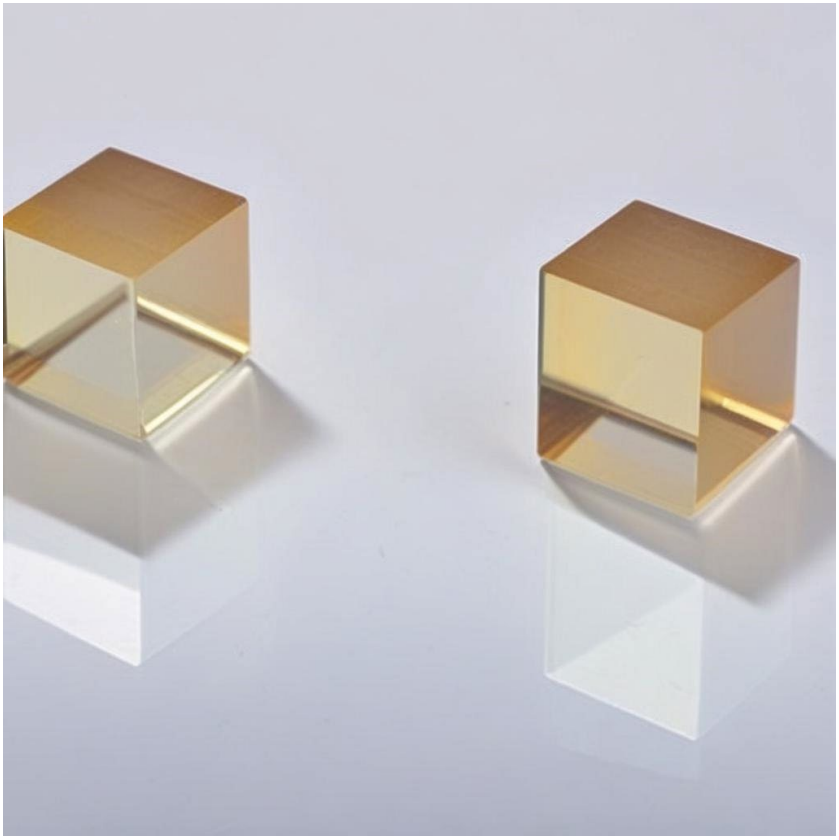
Photonics On Crystals

POC-OC-122407-GTR-KTP Crystal Datasheet

1. Main Features (Summary)

- High gray tracking resistance, making it ideal for high repetition rate and high-power laser systems.
- Superior damage threshold compared to conventional KTP crystals, ensuring reliability in demanding applications.
- Optimized for second harmonic generation (SHG), optical parametric oscillators (OPO), and other nonlinear optical applications.
- Enhanced bulk absorption properties, reducing IR absorption and improving overall optical performance.
- Precision fabrication with strict quality control for dimensions, coatings, and surface flatness.



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2. Material General Description

Gray Tracking Resistance Potassium Titanyl Phosphate (GTR-KTP) crystals are advanced nonlinear optical materials engineered to overcome the limitations of conventional KTP crystals, particularly their susceptibility to gray tracking. This phenomenon leads to increased IR absorption, reducing the efficiency and lifespan of the crystal in high-power laser systems. GTR-KTP crystals, developed with innovative manufacturing processes, exhibit significantly higher resistance to gray tracking and lower absorption in the UV and visible regions, making them suitable for a wide range of applications such as frequency doubling, parametric oscillation, and laser amplification.

GTR-KTP crystals maintain the desirable properties of conventional KTP, such as a high nonlinear optical coefficient, wide angular and temperature bandwidths, and low walk-off angle. Additionally, these crystals boast a higher laser damage threshold, making them reliable for high-energy and high-repetition laser applications. These unique properties, combined with high durability and chemical stability, position GTR-KTP crystals as a superior choice for industrial, scientific, and medical laser systems.

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3. General Applications and Examples

GTR-KTP crystals are widely utilized in applications that demand high-performance nonlinear optical materials with improved durability and resistance to gray tracking. Some notable applications include:

1. Laser Frequency Doubling (SHG):

- GTR-KTP crystals are commonly used to double the frequency of Nd:YAG and Nd:YVO_4 lasers, generating visible green laser output (532 nm) from the fundamental 1064 nm wavelength.
- Example: Efficient SHG processes with improved damage thresholds for high-power continuous-wave (CW) and pulsed laser systems.

2. Optical Parametric Oscillators (OPO):

- The crystals are integral to optical parametric oscillators for generating tunable laser outputs in the visible and near-infrared (IR) ranges.
- Example: Tunable outputs covering wavelengths from 700 nm to 4500 nm, utilized in scientific research and spectroscopy.

3. Medical and Biomedical Applications:

- GTR-KTP crystals are used in medical lasers for procedures such as laser surgery, tattoo removal, and skin resurfacing, where stable and reliable laser performance is essential.

4. High-Power Laser Systems:

- Ideal for high-repetition-rate lasers, GTR-KTP crystals are employed in laser-based industrial machining, precision cutting, and marking systems.

5. Spectroscopy and Imaging:

- With their broad spectral range and low IR absorption, GTR-KTP crystals are well-suited for spectroscopic instruments and advanced imaging technologies.

GTR-KTP's unique properties ensure higher conversion efficiencies, longer crystal lifespans, and reduced maintenance, making them a preferred choice for demanding applications.

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4. Chemical and Structural Properties of GTR-KTP Crystals

Property	Specification

Crystal Structure	Orthorhombic, Space group $Pna2_1$
Lattice Parameters	a = 6.404 Å, b = 10.616 Å, c = 12.814 Å
Density	3.01 g/cm³
Melting Point	Approximately 1172 °C
Thermal Expansion Coefficients	$a_1 = 11 \times 10^{-6}$/°C, $a_2 = 9 \times 10^{-6}$/°C, $a_3 = 0.6 \times 10^{-6}$/°C
Thermal Conductivity	13 W/m·K
Chemical Stability	Non-hygroscopic, resistant to environmental degradation

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5. Optical and Nonlinear Optical Properties of GTR-KTP Crystals

Property	**Specification**
Transparency Range	350–4500 nm
SHG Phase Matching Range	497–1800 nm (Type II)
Nonlinear Coefficients (pm/V)	$d_{31} = 6.5$, $d_{32} = 5.5$, $d_{33} = 13.7$
Damage Threshold	>1.8 GW/cm² at 1064 nm (10 ns, 1 Hz)
Walk-off Angle	0.55° at 1064 nm
Absorption Coefficients	<0.1% at 1064 nm, <1% at 532 nm
Refractive Index (n)	$n_x = 1.807$, $n_y = 1.841$, $nz = 1.899$
Thermal-Optic Coefficients (°C⁻¹)	$dn_x/dT = 1.1 \times 10^{-5}$, $dn_y/dT = 1.3 \times 10^{-5}$, $dnz/dT = 1.6 \times 10^{-5}$

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6. Spectrum Transmission Curves

- The transmission curves illustrate low absorption in the visible and UV regions, ensuring high optical transmission and efficiency for SHG and OPO processes.

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7. Coating Specification

Base Material	**AR Coating**	**Reflectance**
GTR-KTP	Dual Band AR (1064/532 nm)	R < 0.2% @ 1064 nm, R < 0.5% @ 532 nm
	HR Coating (1064 nm)	R > 99.8% @ 1064 nm
	Broad Band AR (OPO Range)	R < 2% @ 1064–266 nm

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8. Standard Fabrication Specifications

Parameter	Specification
Dimension Tolerance	±0.1 mm × ±0.1 mm × ±0.1 mm
Angle Tolerance	Δθ < 0.25°, Δϕ < 0.25°
Surface Quality	10/5 to MIL-PRF-13830B
Flatness	λ/8 @ 633 nm
Parallelism	<20 arc seconds
Perpendicularity	<15 arc minutes
Clear Aperture	>90% of the diameter
Damage Threshold	>1 GW/cm² @ 1064 nm, >0.3 GW/cm² @ 532 nm
Warranty	One year under proper use

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9. POC Strength and Capabilities

Photonics On Crystals specializes in high-quality GTR-KTP crystals with superior performance characteristics. Our strengths include:

- Advanced manufacturing processes ensuring exceptional gray tracking resistance and optical properties.
- Custom fabrication to meet exacting application requirements.
- Extensive inventory with fast turnaround for standard and custom dimensions.
- Competitive pricing and excellent technical support for optimal customer satisfaction.

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10. Standard Products and Customization

Face Dimensions (mm)	Length (mm)	Coatings	Application	Price (USD)
3 × 3	5	AR@1064/532 nm	SHG of Nd:YAG lasers	350
5 × 5	10	HR@1064 nm	High-power laser systems	500
7 × 7	15	BBAR (OPO range)	OPO and parametric gain	750
Custom	Custom	Upon Request	Custom Applications	TBD

For additional customization, please contact us.