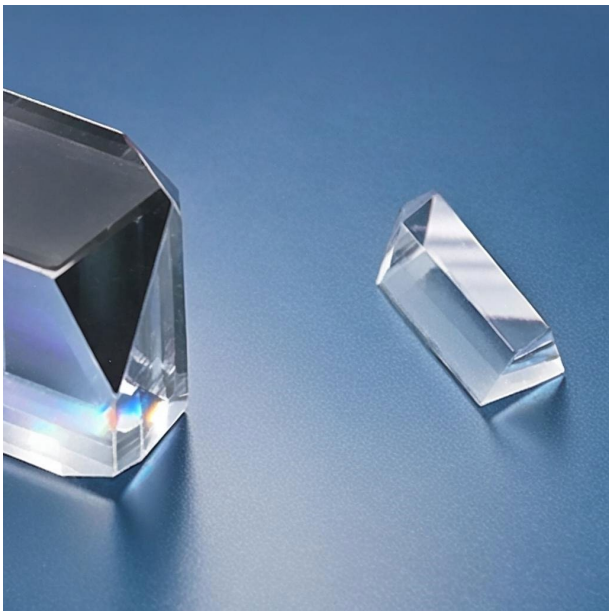
Photonics On Crystals

POC-OC-122409-KTA Crystal Datasheet

1 Main Features

- High nonlinear optical and electro-optical coefficients, with reduced absorption in the 2.0-5.0 μm range.
- Broad angular and temperature bandwidth for enhanced application flexibility.
- High damage threshold and low ionic conductivity for superior durability.
- Crystal dimensions ranging from 0.1 mm to 30 mm, available with AR-coating up to 3300 nm.
- Re-polishing and re-coating services with fast delivery (15-20 working days for polished/AR-coated products).



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2. Material General Description

Potassium Titanyl Arsenate ($KTiOAsO_4$), commonly referred to as KTA Crystal, is a high-performance nonlinear optical material primarily used in Optical Parametric Oscillation (OPO) applications. KTA exhibits superior optical and electro-optical properties, including significantly reduced absorption in the mid-infrared (2.0-5.0 μm) region, broader temperature acceptance, and a lower dielectric constant compared to its counterpart KTP (Potassium Titanyl Phosphate). Its high damage threshold, minimal ionic conductivity, and stable chemical properties make it ideal for demanding applications in laser systems, medical devices, and advanced photonics.

KTA's transparency range extends from 350 nm to 5300 nm, making it versatile for both visible and infrared applications. The crystal's low thermal conductivity is compensated by its high optical quality, making it a preferred choice for frequency mixing, parametric generation, and Q-switching.

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3. General Applications and Examples

KTA Crystals are widely employed in photonic systems due to their exceptional nonlinear optical properties. Some key applications include:

1. **Optical Parametric Oscillators (OPOs):**
    - KTA is extensively used in tunable OPO systems for generating coherent radiation in the mid-infrared (2.0-5.0 µm) range.
    - Example: A KTA-based OPO can provide outputs from 1083 nm to 3789 nm with efficiency exceeding 50%.
2. **Frequency Doubling and Mixing:**
    - KTA efficiently converts laser wavelengths into higher harmonics, such as doubling and tripling frequencies of Nd:YAG and other infrared lasers.
    - Example: SHG and SFG in medical and industrial laser systems for specific wavelength outputs.
3. **Q-Switching:**
    - KTA's high damage threshold and reduced absorption are ideal for electro-optical Q-switching in high-power laser systems.
    - Example: Compact Q-switched lasers for LiDAR and material processing.
4. **Advanced Optical Applications:**
    - Suitable for applications like difference frequency generation (DFG), sum frequency generation (SFG), and electro-optical modulators.
    - Example: Generating THz radiation in terahertz systems using DFG in a KTA crystal.
5. **Custom Configurations:**
    - Customization in dimensions, coatings, and properties ensures adaptability for scientific, industrial, and medical innovations.

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4. Chemical and Structural Properties

Property	**Details**
Crystal Structure	Orthorhombic, Point group mm2
Lattice Parameters	a = 13.125 Å, b = 6.5716 Å, c = 10.786 Å
Melting Point	1130°C
Mohs Hardness	~5
Density	3.454 g/cm³
Thermal Conductivity	K1: 1.8 W/m·K, K2: 1.9 W/m·K, K3: 2.1 W/m·K

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5. Optical and Nonlinear Optical Properties

Property	Details
Transparency Range	350-5300 nm
Absorption Coefficients	<0.05%/cm @ 1064 nm, 1533 nm
NLO Susceptibilities	d_{31} = 2.76 pm/V, d_{32} = 4.74 pm/V, d_{33} = 18.5 pm/V
Electro-Optical Constants	r_{13} = 37.5 pm/V, r_{33} = 15.4 pm/V
SHG Phase Matchable Range	1083-3789 nm
Sellmeier Equations (λ in μm)	$n^2 = A + B\lambda^2/(\lambda^2 - C^2) - D\lambda^2$
Constants for Sellmeier Equations:	A = 1.90713, B = 1.23522, C = 0.19692, D = 0.01025

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6. Spectrum Transmission Curves

Spectrum transmission data confirms KTA's high transparency from 350 nm to 5300 nm, ensuring low absorption losses and broad applicability in optical systems.

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7. Coating Specification

- Anti-Reflection (AR) Coatings:
  - Visible region (350-700 nm)
  - Near-IR region (700-2500 nm)
  - Broadband AR coatings up to 3300 nm
- Coating Durability: High resistance to damage and scratches under standard operating conditions.
- Custom Coating Options: Available upon request.

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8. Standard Fabrication Specifications

Specification	Details
Dimension Tolerance	W × H (± 0.1 mm) × L (+0.5/-0.1 mm)
Angle Tolerance	Δθ < 0.25°, Δϕ < 0.25°
Parallelism	< 20 arc seconds
Surface Flatness	λ/8 @ 633 nm
Scratch/Dig	10/5
Wavefront Distortion	λ/8 @ 633 nm

Chamfer	0.1 mm @ 45°
Damage Threshold	>0.5 GW/cm² (AR-coated @ 1064 nm)

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9. POC Strength and Capabilities

The KTA crystal stands out due to its ability to handle high optical powers while maintaining excellent stability and performance. Its chemical inertness and high mechanical strength allow for long-term use in both industrial and scientific systems. With customized fabrication capabilities, including precise coatings and tailored dimensions, KTA provides a versatile solution for cutting-edge photonic technologies.

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10. Standard Products

Face Dimensions (mm)	Length (mm)	Coating	Application	Price (USD)
3 × 3	5	AR@1064 nm	SHG Type II	$350
5 × 5	10	AR@532 nm	OPO	$480
7 × 7	15	Broadband AR	SFG/DFG	$650
Custom	Custom	Upon Request	Tailored for Applications	Quote Available