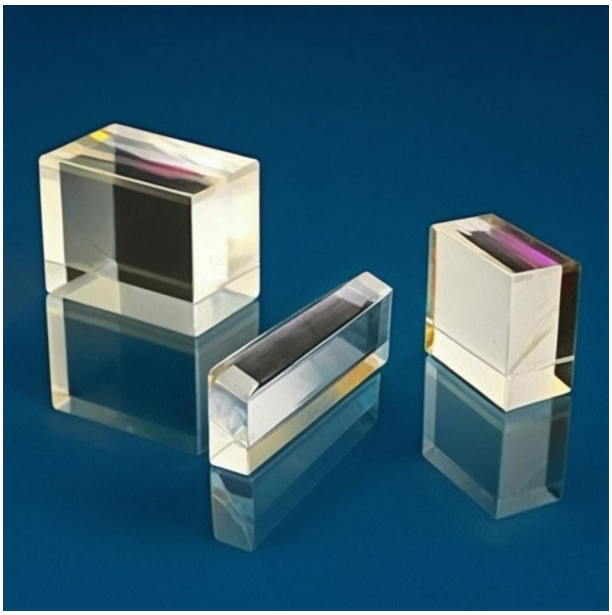
Photonics On Crystals

POC-OC-122412-KDP Crystal Datasheet

1 Main Features

- Broad transparency range (200–1500 nm) with excellent UV radiation transmission.
- High laser-induced damage threshold, exceeding 5 GW/cm² at 1064 nm.
- Stable electro-optic coefficients suitable for Pockels cells and Q-switches.
- Custom crystal dimensions and coatings available upon request.
- High optical homogeneity and low birefringence for precise optical performance.



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2. Material General Description

Potassium Dihydrogen Phosphate (KDP) is a widely used nonlinear optical (NLO) material, known for its exceptional UV transmission, high damage threshold, and reliable electro-optic performance. Its applications span frequency doubling, tripling, and quadrupling of Nd:YAG lasers at room temperature. Additionally, KDP serves as an excellent electro-optic material in Pockels cells, Q-switches, and modulators due to its high electro-optic coefficients and low refractive indices. These properties make KDP crystals indispensable in applications requiring high optical clarity, minimal birefringence, and high-power laser compatibility. POC offers high-quality, customizable KDP crystals optimized for specific laser parameters and environmental conditions.

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3. General Applications

1. **Nonlinear Optical Applications**
    - Frequency doubling (SHG) of Nd:YAG lasers to generate green light at 532 nm.

- Frequency tripling (THG) and quadrupling for UV laser generation in high-power laser systems.
- Second and third harmonic generation in Ti:Sapphire and Alexandrite lasers.

2. **Electro-Optic Applications**
   - Widely used in Pockels cells for Q-switching, enabling precise modulation of laser outputs.
   - Essential in optical modulators for laser intensity and polarization control.
3. **Scientific and Industrial Uses**
   - UV spectroscopy systems due to excellent UV transmission and high laser-induced damage threshold.
   - Laser-based lithography and precision micromachining.

Examples: KDP crystals are integral in laser frequency doubling, achieving efficient green laser generation (532 nm) and high-energy UV light generation through tripling or quadrupling. They also form the core of Pockels cells in advanced laser systems used in scientific research and industry.

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4. Chemical and Structural Properties

Property	**KDP (KH_2PO_4)**	**DKDP (KD_2PO_4)**
Chemical Formula	KH_2PO_4	KD_2PO_4
Transparency Range (nm)	200–1500	200–1600
Lattice Parameters (Å)	a = 7.448, c = 6.977	a = 7.497, c = 6.854
Density (g/cm^3)	2.332	2.355
Nonlinear Coefficient (d_{36}) (pm/V)	0.44	0.40
Refractive Indices (1064 nm)	n_o = 1.4938, n_e = 1.4599	n_o = 1.4948, n_e = 1.4554
Electro-optic Coefficients (pm/V)	λ_{41} = 8.8, λ_{63} = 10.3	λ_{41} = 8.8, λ_{63} = 25.0
Longitudinal Half-wave Voltage (kV)	Vπ = 7.65 (λ = 546 nm)	Vπ = 2.98 (λ = 546 nm)
Damage Threshold (GW/cm^2)	>5	>3

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5. Optical and Nonlinear Optical Properties

Property	**Value for KDP**	**Value for DKDP**
Transparency Range (nm)	200–1500	200–1600
Refractive Indices (1064 nm)	n_o = 1.4938, n_e = 1.4599	n_o = 1.4948, n_e = 1.4554

Nonlinear Coefficients (pm/V)	d_{36} = 0.44	d_{36} = 0.40
Sellmeier Equation (λ in μm):		
- KDP	$n_o^2 = 2.259276 + 0.01008956 / (\lambda^2 - 0.012942625) + 13.00522\lambda^2 / (\lambda^2 - 400)$	
- DKDP	$n_o^2 = 1.957554 + 0.2091391\lambda^2 / (\lambda^2 - 0.0281399) - 0.02824391\lambda^2 + 0.004977826\lambda^2$	
Damage Threshold (1064 nm) (GW/cm²)	>5	>3

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6. Spectrum Transmission Curves

(Spectrum transmission curves for KDP crystals can be provided upon request, showcasing excellent UV and visible light transmission characteristics.)

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7. Coating Specification

- **AR Coatings:** Anti-reflective coatings for 532 nm and 1064 nm wavelengths with high durability.
- **Dual-band Coating:** Optimized for SHG and THG applications with low reflectance (<0.2% at 1064 nm and <0.5% at 532 nm).
- **Customization:** Other coatings (e.g., BBAR, HR) are available upon request based on application requirements.

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8. Standard Fabrication Specifications

Specification	**Value**
Dimension Tolerance (mm)	W x H ± 0.1 x L ± 0.2
Angle Tolerance (°)	$\Delta\theta \leq 0.25°$, $\Delta\phi \leq 0.25°$
Parallelism (arc seconds)	<20
Perpendicularity (arc minutes)	<5
Surface Flatness	λ/8 @ 633 nm
Scratch and Dig	20/10
Damage Threshold (AR Coated)	>5 GW/cm² @ 1064 nm (10 ns, 10 Hz)
Coating	AR coatings on both surfaces

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9. POC Strength and Capabilities

POC provides superior quality KDP crystals with extensive customization options to suit specific industrial and scientific applications. High optical homogeneity, precision polishing, and robust coatings ensure compatibility with high-power laser systems. Our engineering team assists in designing and producing crystals tailored to your laser parameters, ensuring optimal performance.

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10. Standard Products

Material	Dimensions (mm)	Coatings	Application	Price (USD)
KDP	12 x 12 x 12	AR 532/1064 nm	SHG @ 532 nm	470
DKDP	15 x 15 x 20	AR 1064 nm	THG @ 1064 nm	580
Custom	Upon Request	Custom Coatings	Specified Application	Contact Us