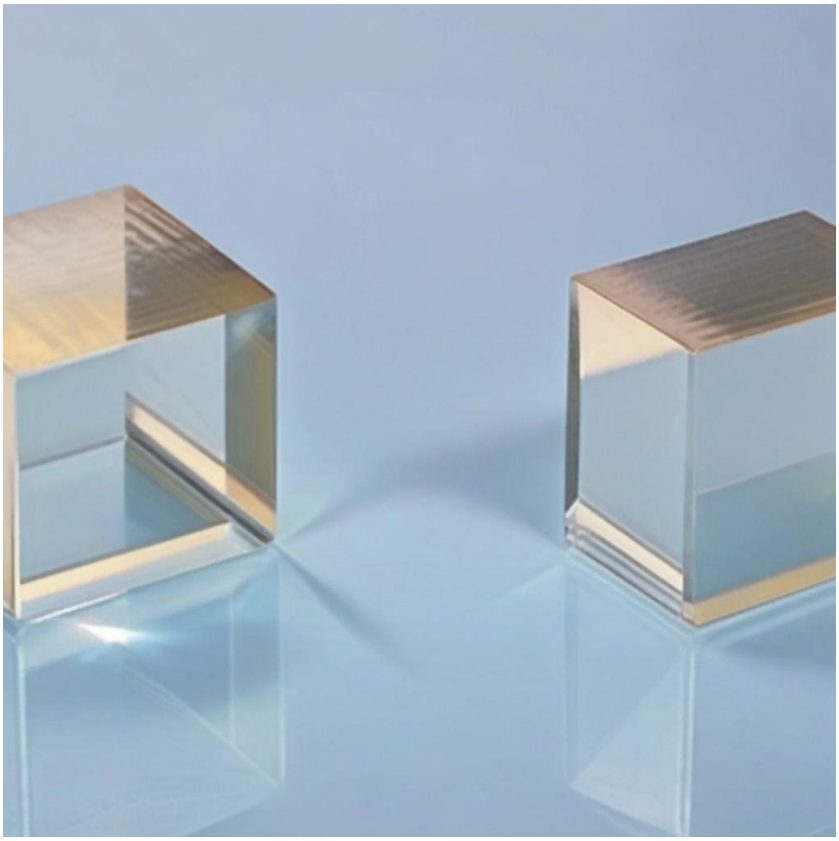
Photonics On Crystals

POC-OC-122445-Ho:YAG Crystal Datasheet

1 Main Features

- High optical quality and conversion efficiency for superior laser performance.
- Operates at 2090 nm, ideal for eye-safe wavelengths with high atmospheric transmittance.
- Exceptional tissue penetration for medical applications with minimal surrounding damage.
- Applicable for mid-IR nonlinear effects, enabling wavelengths of 3–5 µm.
- High extinction ratio (>28 dB) ensures precision and minimal optical losses.



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2. Material General Description

Holmium-doped Yttrium Aluminum Garnet (Ho:YAG) crystals offer advanced functionality in the field of mid-infrared (IR) laser systems. The 2090 nm emission wavelength lies within an atmospheric transparency window and aligns with the water absorption peak in human tissues, making Ho:YAG indispensable in medical, sensing, and laser rangefinding applications.

Ho:YAG is also preferred in medical laser surgeries for precise tissue ablation with minimal collateral damage, penetrating only a few microns. It has excellent thermal conductivity, ensuring stability during prolonged operations. Additionally, the crystal is utilized in nonlinear optical systems to achieve wavelengths in the 3–5 µm range for extended IR applications.

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3. General Application and Examples

Ho:YAG crystals are versatile and widely used in applications including:

- **Medical Applications**: High-precision tissue ablation for surgical procedures such as urology and dermatology, benefiting from the shallow tissue penetration and minimized thermal damage.
- **Atmospheric Sensing**: Ho:YAG lasers' mid-IR wavelengths allow for high-resolution sensing and probing in atmospheric research, leveraging its strong absorption at water vapor peaks.
- **Industrial Applications**: Cutting-edge laser rangefinding, welding, and microfabrication take advantage of Ho:YAG's robust beam quality.
- **Nonlinear Optics**: Enabling wavelengths of 3–5 µm by coupling Ho:YAG lasers with ZGP crystals for specialized IR applications.
- **Military Applications**: Rangefinding, target designation, and secure optical communication systems.

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4. Chemical, Physical, and Structural Properties

Property	Value
Crystal Formula	Ho:YAG (Y3Al5O12)
Crystal Structure	Cubic, <111> Orientation
Lattice Parameter	12.01 Å
Melting Point	1970 °C
Density	4.56 g/cm³
Mohs Hardness	8.5
Thermal Conductivity	10 W/m·K
Thermal Expansion	8.1 × 10^-6/K
Specific Heat	0.65 J/g·K
Extinction Ratio	>28 dB

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5. Optical and Laser Properties

Property	Value
Emission Wavelength	2090 nm
Refractive Index	1.82
Fluorescence Lifetime	8 ms

Absorption Peak Wavelength	1900 nm
Pumping Wavelength	1940 nm
Laser Transition	5I7 to 5I8
Optical Clarity (Transmission)	>90%

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6. Spectrum Transmission Curve

Due to Ho:YAG's superior optical clarity, transmission spectra exhibit high transmittance at 2090 nm, with minimal loss across the mid-IR region. This is ideal for medical lasers requiring precise wavelength control. If additional details are required, POC can provide custom data.

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7. Coating Specifications

- AR Coating: Custom anti-reflection coatings available for 2094 nm and adjacent wavelengths.
- Standard: Reflectivity < 0.2% @ 2094 nm.
- Coating Durability: High threshold coatings for durability under high-power operations.

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8. Standard Fabrication Specifications

Parameter	**Specification**
Orientation	<111>
Diameter Tolerance	+0/-0.05 mm
Length Tolerance	±0.5 mm
Surface Flatness	λ/10 @ 632 nm
Parallelism	<10 arc sec
Perpendicularity	<5 arc min
Surface Quality (Scratch/Dig)	10-5
Clear Aperture	>90%
Chamfer	0.1 mm x 45°

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9. POC Strength and Capabilities

Photonics On Crystals (POC) offers Ho:YAG crystals with unparalleled precision and performance. POC's state-of-the-art facilities ensure strict quality control and consistent production standards. Our expertise in crystal growth and custom fabrication allows us to cater to a variety of customer needs, including:

- Custom doping levels.
- Precision dimensions for medical and industrial-grade systems.
- Advanced AR and HR coatings.

POC is committed to delivering high-performance Ho:YAG crystals for global markets, ensuring customer satisfaction with tailored solutions.

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10. Standard Products

Dimension	Length	End Faces	Coating	Price (USD)
3 x 3 mm	10 mm	Brewster	AR @ 2094 nm	Request
5 x 5 mm	15 mm	Flat/Flat	Uncoated	Request
8 x 8 mm	20 mm	Brewster	AR/HR @ 2090 nm	Request
Custom	Custom	Custom	Custom	Request

Custom sizes, doping levels, and coatings available upon request.