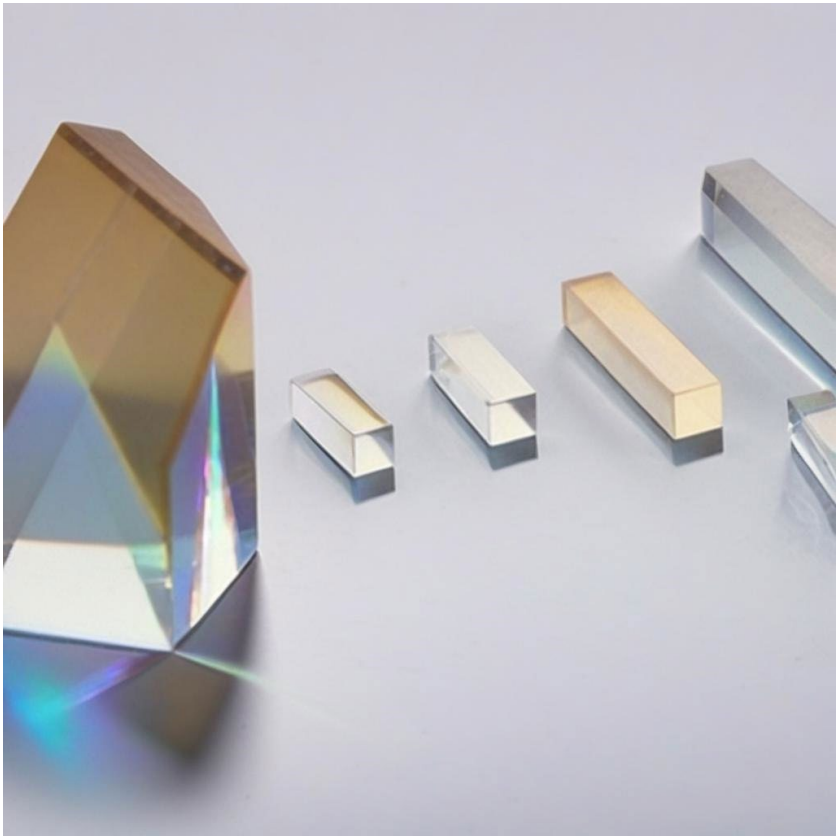
Photonics On Crystals

POC-OC-122441-Ho:Cr:Tm:YAG Crystal Datasheet

1 Main Features

- **High Slope Efficiency**: Enhanced performance for efficient energy conversion.
- **Versatile Pumping Sources**: Compatible with both flashlamp and diode pumping.
- **Stable at Room Temperature**: Ensures reliable operation in various environments.
- **Eye-Safe Wavelength Range**: Ideal for applications requiring safety standards.
- **Customizable Design**: Available in various specifications tailored to user needs.



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2. Material General Description

The Ho:Cr:Tm:YAG (Holmium, Chromium, Thulium co-doped Yttrium Aluminum Garnet) crystal is a high-efficiency laser material emitting at a wavelength of 2.1 µm. This emission wavelength is particularly valuable for medical, atmospheric, and industrial applications due to its position in the eye-safe range and its compatibility with biological tissues.

The co-doping of Ho, Cr, and Tm ions enhances energy transfer, reduces the lasing threshold, and improves slope efficiency. The Cr ions act as sensitizers, absorbing pump energy efficiently and transferring it to the Tm ions, which subsequently transfer the energy to the Ho ions for final laser emission. This process ensures high efficiency and excellent thermal stability, making Ho:Cr:Tm:YAG a preferred material for CW and pulsed lasers.

With its ability to be pumped by flashlamps or diodes, combined with high optical quality and thermal conductivity, this crystal meets the demanding requirements of modern laser systems.

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3. General Applications and Examples

1. **Medical Applications**:
    - **Surgery and Dentistry**: The 2.1 µm emission wavelength matches the absorption peak of water, making it ideal for precise tissue ablation and cutting in minimally invasive surgeries.
    - **Ophthalmology**: Suitable for eye-safe laser procedures.
    - **Dermatology**: Used for non-invasive skin treatments.
2. **Industrial Applications**:
    - **Material Processing**: High-energy lasers for cutting and engraving materials requiring minimal thermal distortion.
    - **Precision Machining**: Ideal for drilling and marking heat-sensitive components.
3. **Scientific Applications**:
    - **Atmospheric Testing**: Utilized in LIDAR systems for remote sensing and environmental monitoring.
    - **Spectroscopy**: Suitable for molecular analysis and gas detection.
4. **Military and Defense Applications**:
    - **Laser Rangefinding**: Eye-safe lasers for accurate distance measurement.
    - **Target Designation**: Infrared lasers compatible with advanced targeting systems.
    - **Remote Sensing**: Applications in detecting and monitoring atmospheric conditions.
5. **Custom Solutions**:
    - Ideal for tailored laser systems requiring eye-safe emissions with high energy efficiency and precise control.

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4. Chemical, Physical, and Structural Properties

Property	**Specification**
Crystal Structure	Cubic Garnet
Chemical Formula	Ho:Cr:Tm:Y3Al5O12
Growth Method	Czochralski
Density	4.56 g/cm³

Dopant Concentration	Ho: 0.35 at.%, Cr: 1.5 at.%, Tm: 5.8 at.%
Refractive Index	1.80 @ 2.08 µm
Thermal Conductivity	12 W/m/K
Thermal Expansion Coefficient	7.8 × 10^-6 K^{-1}
Hardness	8.5 Mohs
Optical Homogeneity	< λ/10
Melting Point	1970 °C

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5. Optical, Laser, and Nonlinear Optical Properties

Parameter	Specification
Laser Transition	^5I7 → ^5I8
Laser Wavelength	2.097 µm
Photon Energy	9.55 × 10^-20 J
Emission Cross Section	7 × 10^-20 cm^2
Fluorescence Lifetime	8.5 ms
Absorption Linewidth	4 nm
Diode Pump Band	781 nm
Major Pump Bands	400–800 nm
Mode of Operation	CW, Pulsed

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6. Spectrum Transmission Curves

Ho:Cr:Tm:YAG exhibits strong absorption at 781 nm for efficient pumping and high emission at 2.1 µm, ensuring optimal energy transfer and emission stability. The crystal supports eye-safe laser operation with minimal thermal distortion.

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7. Coating Specification

- **Standard Coating**:
  - AR-coated for 781 nm (pump wavelength) and 2.1 µm (emission wavelength).
  - Reflectivity < 0.2% per surface.
- **Custom Coating**:
  - Available upon request, tailored to specific applications.

8. Standard Fabrication Specifications

Specification	Value
Rod Dimensions	Diameter: 3–6 mm, Length: 50–120 mm
Surface Quality	10/5 scratch-dig per MIL-PRF-13830B
Flatness	A/8 @ 633 nm
Parallelism	<30 arc sec
Perpendicularity	<15 arc min
Chamfer	0.2 mm × 45°
Mounting	Unmounted

9. POC Strength and Capabilities

Photonics On Crystals (POC) is a trusted manufacturer of high-performance laser crystals like Ho:Cr:Tm:YAG. Leveraging state-of-the-art crystal growth and rigorous quality control processes, POC ensures exceptional product performance and reliability. Our ability to customize designs for specific applications demonstrates our commitment to excellence and customer satisfaction.

10. Standard Products

Dimensions	Length	End Faces	Doping	Coating	Price (USD)
3 × 3 mm	10 mm	Brewster-angle cut	Ho: 0.35%, Cr: 1.5%, Tm: 5.8%	AR-coated @ 2.1 µm	$720
5 × 5 mm	20 mm	Right-angle cut	Ho: 0.35%, Cr: 1.5%, Tm: 5.8%	AR-coated @ 2.1 µm	$850
10 × 10 mm	50 mm	Brewster-angle cut	Ho: 0.35%, Cr: 1.5%, Tm: 5.8%	Custom Coating	$1050
Customization	As needed	As needed	As requested	As requested	Request Quote

For further inquiries or customization, contact **Photonics On Crystals (POC)**. We ensure reliable, high-quality laser crystals tailored to your requirements.