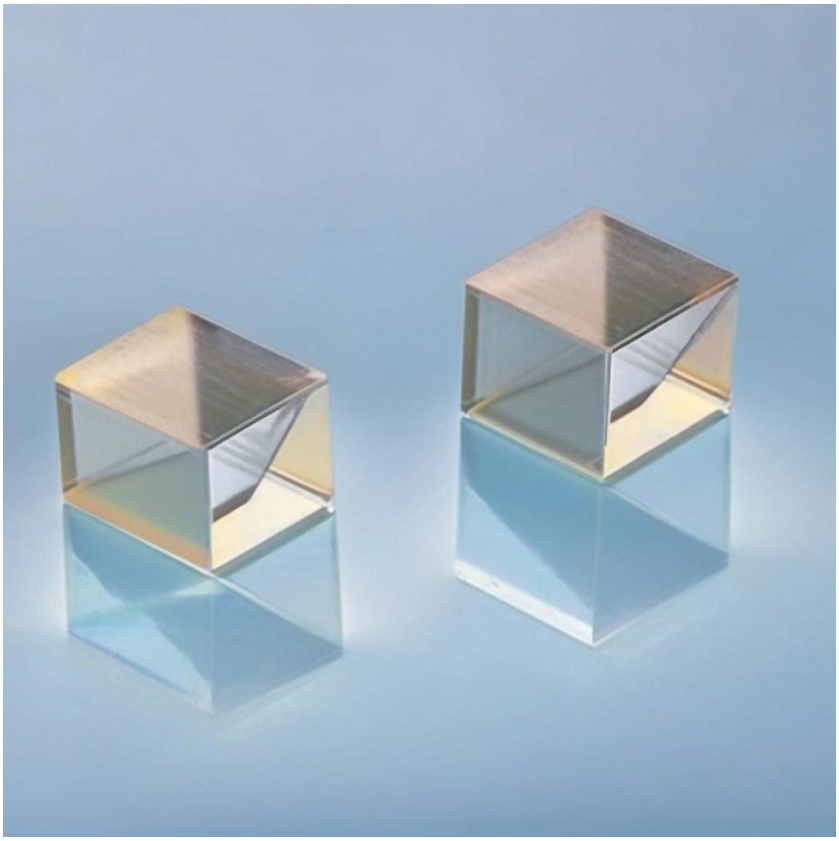
Photonics On Crystals

POC-OC-122460-Tm:YAP Crystal Datasheet

1 Main Features

- High absorption efficiency for pump wavelengths near 795 nm.
- Strong alignment with AlGaAs diode laser emissions.
- Broader absorption bandwidth compared to Tm:YAG crystals.
- Excellent thermal conductivity and mechanical durability.
- Customizable crystals available upon request.



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2. Material General Description

The Tm:YAP (Thulium-doped Yttrium Aluminum Perovskite, Tm:$YAlO_3$) crystal is a significant advancement in 2 µm laser emission. Its physical and chemical properties are similar to Tm:YAG, but Tm:YAP offers enhanced absorption efficiency at 795 nm, aligning perfectly with the emission spectra of AlGaAs high-power laser diodes. This improved alignment makes Tm:YAP a highly efficient crystal for high-energy systems. Additionally, its broader absorption band, approximately 4 nm wider than Tm:YAG, delivers higher pumping efficiency and output stability. These properties make Tm:YAP crystals a prime choice for medical laser systems and military applications requiring superior performance and precision.

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3. General Applications and Examples

1. **Medical Lasers**:
    - Tm:YAP crystals are widely used in surgical laser systems due to their high absorption efficiency and precise energy emission.
    - They are used for minimally invasive procedures such as tissue ablation, vascular surgery, and laser lithotripsy.
    - Their reliability in medical environments ensures consistent output in laser-based diagnostic equipment.
2. **Military and Defense**:
    - Tm:YAP is a reliable choice for military-grade laser targeting systems.
    - It provides enhanced beam quality for high-precision laser weaponry and defense applications.
    - Tm:YAP supports advanced thermal imaging and distance measurement for military-grade LiDAR systems.
3. **Industrial Applications**:
    - The broad emission wavelength and energy storage make it ideal for material processing applications, including cutting, welding, and surface treatments.
    - Its mechanical and thermal durability enables its use in high-performance machining systems.
4. **Scientific Research**:
    - The stability of Tm:YAP lasers makes them suitable for spectroscopy and advanced optical research in photonics.
    - They are used in femtosecond laser setups for generating short and high-intensity pulses.

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4. Chemical, Physical, and Structural Properties

Property	**Value**
Chemical Formula	Tm:$YAlO_3$
Dopant Concentration	1.0–4.0 at%
Melting Point	1870 °C
Density	5.35 g/cm³
Mohs Hardness	8.5
Thermal Conductivity	11 $W \cdot m^{-1} \cdot K^{-1}$

Pump Absorption Peaks	794.8 nm (a-axis), 793.5 nm (b-axis)
Emission Wavelength	1.98 µm (a-axis, c-axis), 1.94 µm (b-axis)
Fluorescence Lifetime	4.4–7.7 ms
Refractive Index	1.91
Central Emission Peak	1050 nm

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5. Optical, Laser, or Nonlinear Optical Properties

Property	**Value**
Absorption Efficiency	794–795 nm
Absorption Bandwidth	Broad (~4 nm wider than Tm:YAG)
Pumping Source Compatibility	AlGaAs diode lasers
Laser Emission Wavelength	~2 µm (1.98 µm or 1.94 µm depending on axes)
Polarization	Linear
Thermal Lens Compensation	Negative index shift offset by end-face bulging

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6. Spectrum Transmission Curve

The Tm:YAP crystal exhibits strong absorption near 795 nm and emission peaks around 1.94 µm and 1.98 µm, making it an efficient medium for 2 µm lasers. If additional spectrum data is needed, POC can provide further details upon request.

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7. Coating Specification

- AR Coating: Anti-reflective coatings for optimized performance at 794 nm (pump wavelength) and 1.98 µm (laser wavelength).
- Custom coatings are available based on specific operational requirements.

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8. Standard Fabrication Specifications

Specification	**Value**
Orientation	a-cut or c-cut
Length Tolerance	±0.1 mm
Face Dimensions	±0.01 mm
Parallelism Error	<20 arcsec

Perpendicularity Error	<10 arcmin
Surface Quality	20–10 Scratch–Dig
Surface Flatness	λ/6 at 632.8 nm
Protective Chamfers	<0.1 mm at 45°

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9. POC Strength and Capabilities

Photonics On Crystals (POC) is dedicated to delivering high-performance laser crystals tailored to meet the rigorous demands of the photonics and optics industries. With advanced manufacturing capabilities, POC provides:

- Customization services for dimensions, coatings, and doping levels.
- High-quality control to ensure excellent surface flatness and scratch–dig ratios.
- Fast response times and global shipping.
- Competitive pricing with reliable technical support.

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10. Standard Products

Face Dimensions	Length	Doping (%)	Coatings	Price (USD)
3 × 3 mm	8 mm	3%	Uncoated	540
3 × 3 mm	8 mm	3%	AR@794 nm + 1800–1960 nm	590
Customizable	Custom	Custom	Custom coatings available	Request