Photonics On Crystals

POC-OC-122442-Ti:Sapphire Crystal Datasheet

1 Main Features

- Wide tunable wavelength range from 660 to 1050 nm for versatile laser applications.
- High thermal conductivity of 52 W/mK ensuring excellent heat dissipation.
- Strong laser gain with a high fluorescence lifetime of 3.2 µs at 300 K.
- Robust optical and mechanical properties with a high damage threshold.
- Applicable in femtosecond lasers, ultrashort-pulse generation, and regenerative amplifiers.

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2. Material General Description

Ti:Sapphire Crystal (Ti^{3+}:Al_2O_3) is a titanium-doped sapphire material known for its tunability and high optical gain. It is extensively used in femtosecond mode-locked oscillators and amplifiers, enabling ultrashort pulse generation below 10 fs. Its high thermal conductivity and superior mechanical strength make it suitable for high-power laser applications. Grown using the Temperature Gradient Technique (TGT), the crystal is free of scattering and dislocations, ensuring premium optical quality and high damage thresholds. The absorption band of Ti:Sapphire, centered at 490 nm, allows efficient pumping by Nd:YAG, Nd:YLF, and Nd:YVO_4 lasers.

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3. General Applications and Examples

- **Mode-Locked Oscillators and Amplifiers:** Ti:Sapphire is the preferred crystal for ultrafast pulse lasers used in applications such as time-resolved spectroscopy, optical coherence tomography, and frequency comb generation.
- **Tunable Lasers:** The broad tuning range from 660 to 1050 nm makes it an excellent choice for spectroscopy, material processing, and nonlinear optics.
- **Ultrafast Pulsed Lasers:** Doubling with NLO crystals like BBO, it produces UV and DUV radiation for advanced scientific research and micromachining.
- **Medical Imaging:** Used in biomedical imaging systems such as multiphoton microscopy.
- **Scientific Research:** As a pump source for Optical Parametric Oscillators (OPOs), Ti:Sapphire facilitates a wide range of experiments requiring tunable wavelengths and high power outputs.

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4. Chemical, Physical, and Structural Properties

Property	Value
Chemical Formula	$Ti^{3+}:Al_2O_3$
Crystal Structure	Hexagonal
Lattice Parameters	a=4.758 Å, c=12.991 Å
Density	3.98 g/cm³
Melting Point	2040°C
Mohs Hardness	9
Thermal Conductivity	52 W/mK
Specific Heat	0.42 J/g·K
Thermal Expansion	8.4×10^{-6}/°C

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5. Optical, Laser, or Nonlinear Optical Properties

Property	Value
Tuning Range	660 – 1050 nm
Absorption Range	400 – 600 nm
Absorption Peak	488 nm
Emission Peak	795 nm
Fluorescence Lifetime	3.2 µs (T = 300 K)
Refractive Index	1.76 @800 nm

Laser Action	4-Level Vibronic
Peak Cross-Section	3–4 × 10^{-19} cm^2

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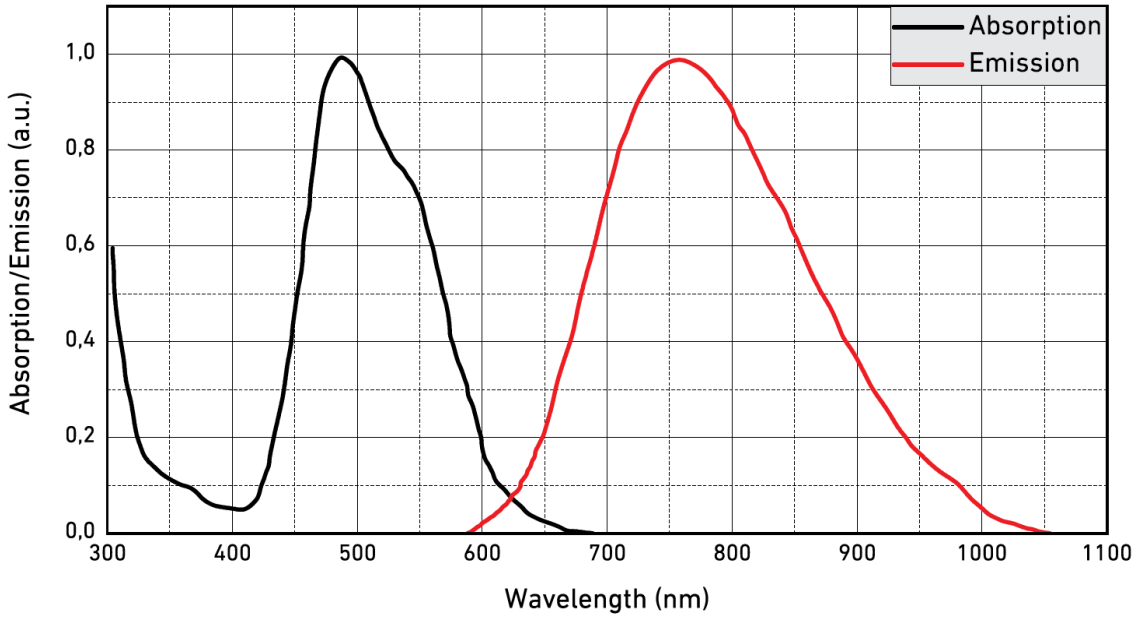
6. Spectrum Transmission Curve

Absorption and emission spectra confirm strong peaks at 488 nm and 795 nm, respectively, with broad tunability.



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7. Coating Specifications

- **AR-Coating:** Available upon request for specified wavelengths (e.g., 532 nm, 750–850 nm).
- **Custom Coatings:** Options for tailored coatings depending on application requirements.

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8. Standard Fabrication Specifications

Parameter	Specification
Dopant Concentration	0.06 – 0.26 atm%
Diameter	2 – 30 mm
Length	2 – 30 mm
Surface Quality (Scratch/Dig)	40/20 to MIL-PRF-13830B
Flatness	λ/8 @633 nm
Wavefront Distortion	λ/4 @633 nm

Parallelism	<20 arc sec
Perpendicularity	<15 arc min
Chamfer	0.1 mm × 45°

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9. POC Strength and Capabilities

Photonics On Crystals (POC) is a trusted provider of high-quality Ti:Sapphire crystals, delivering:

- Precision fabrication with strict tolerances for high-performance applications.
- Advanced crystal growth techniques ensuring optical clarity and durability.
- Tailored coatings and custom dimensions to meet diverse customer needs.
- Commitment to supporting scientific innovation and industrial advancements with top-tier laser crystals.

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10. Standard Products

Face Dimensions	Length	End Faces	Coatings	Price (USD)
3 × 3 mm	5 mm	Brewster-angle cut	Uncoated	$880
3 × 3 mm	5 mm	Right-angle cut	AR@532 nm + 750–850 nm	$600
6 × 6 mm	15 mm	Brewster-angle cut	Uncoated	$1000
12 × 12 mm	25 mm	Right-angle cut	AR@532 nm + 750–850 nm	$2150
50 × 50 mm	30 mm	Right-angle cut	Custom Coating Options Available	Request Quote

Customization available upon request.