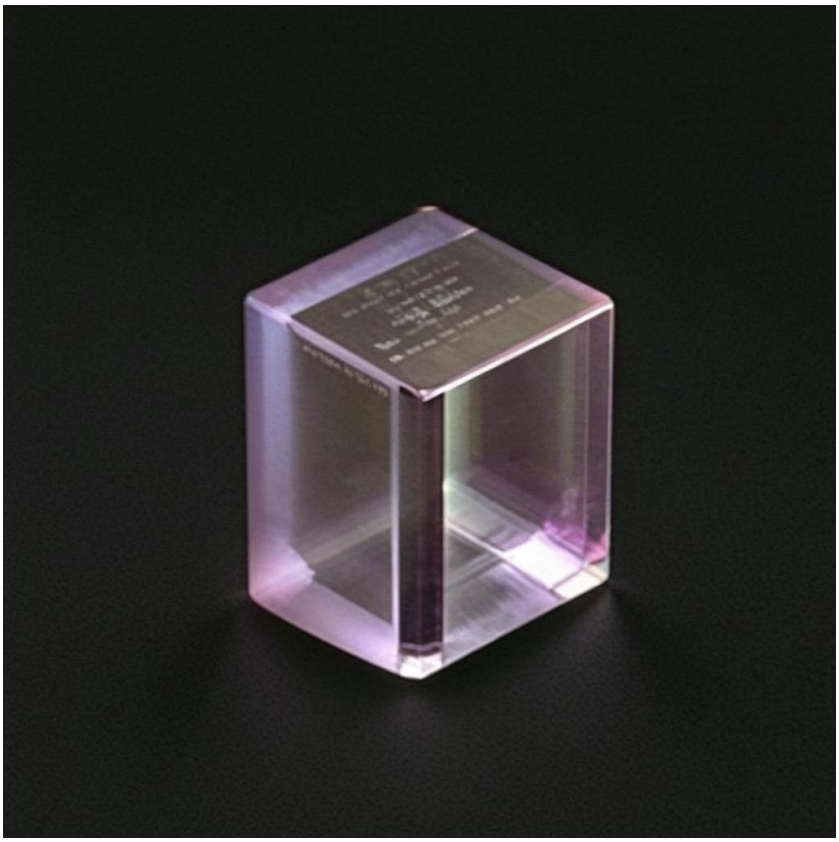
Photonics On Crystals

POC-OC-122440-Nd:Ce:YAG Crystal Datasheet

1 Main Features

- **High Energy Efficiency**: Enhanced by co-doping with Neodymium (Nd) and Cerium (Ce) ions.
- **Reduced Thermal Distortion**: Optimal for high-power laser systems with stable performance.
- **Anti-UV Radiation Capability**: Strong absorption in UV spectral regions for enhanced pumping efficiency.
- **High Optical Quality**: Supports precise beam quality with minimal scattering.
- **Customizable Design**: Available in various sizes and specifications tailored to application needs.



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2. Material General Description

Nd:Ce:YAG (Neodymium and Cerium Co-doped Yttrium Aluminum Garnet) crystal is an advanced laser material that offers improved energy transfer and enhanced thermal properties. By utilizing Cerium as a sensitizer, the crystal demonstrates superior energy transfer efficiency, reducing thermal distortion and improving beam quality. This makes Nd:Ce:YAG particularly suited for high-energy laser applications.

Compared to standard Nd:YAG, the co-doped Nd:Ce:YAG provides a higher output energy at the same pumping level. Its strong absorption in the UV spectral region enhances pumping efficiency,

while its high thermal conductivity ensures stable operation under high power. It operates at the fundamental lasing wavelength of 1064 nm and shares similar damage thresholds and mechanical properties with traditional Nd:YAG crystals.

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3. General Applications and Examples

Nd:Ce:YAG crystals find applications across diverse fields due to their superior optical, thermal, and mechanical properties. Below are some examples:

1. **Industrial Applications**:
    - High-energy lasers for cutting, welding, and engraving processes.
    - Laser systems for precision micromachining and material processing.
2. **Medical Applications**:
    - Ophthalmic lasers for procedures such as glaucoma treatment and retinal repair.
    - Surgical lasers for minimally invasive operations requiring precise ablation.
3. **Scientific Research**:
    - Fundamental research requiring high-energy pulses with low distortion.
    - Ultrafast laser systems for spectroscopy and particle acceleration studies.
4. **Military and Defense**:
    - Directed energy weapons requiring stable, high-power laser sources.
    - Rangefinders and targeting systems with reliable energy transfer efficiency.
5. **Consumer and Commercial Products**:
    - Laser-based display systems with high optical quality.
    - Precision tools for LIDAR systems and remote sensing technologies.

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4. Chemical, Physical, and Structural Properties

Property	**Specification**
Crystal Structure	Cubic Garnet
Chemical Formula	Nd:Ce:Y3Al5O12
Growth Method	Czochralski
Density	4.56 g/cm³
Dopant Concentration	Nd: 1.1–1.4 at.%, Ce: 0.05–0.1 at.%
Refractive Index	1.8197 @ 1064 nm

Thermal Conductivity	12.1 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	^4F3/2 → ^4I11/2
Laser Wavelength	1064 nm (Primary), 1319 nm (Secondary)
Photon Energy	1.86 × 10^-19 J @ 1.064 µm
Emission Linewidth	4.5 Å @ 1.064 µm
Emission Cross Section	2.7–8.8 × 10^-19 cm^2
Fluorescence Lifetime	230 µs (Nd 1 at.%)
Mode of Operation	CW, Pulsed, Q-switched
Energy Storage Efficiency	Enhanced by Ce doping
Pump Source	Flashlamp or diode pump

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6. Spectrum Transmission Curves

Nd:Ce:YAG exhibits strong absorption at 808 nm for efficient pumping and high emission at 1064 nm, ensuring optimal energy conversion. Its emission spectrum features a narrow bandwidth, allowing for precise and stable laser operation.

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7. Coating Specification

- **Standard Coating**:
  - AR-coated for 808 nm (pump wavelength) and 1064 nm (emission wavelength).
  - Reflectivity < 0.2% per surface.
- **Custom Coating**:
  - Available upon request, tailored to application-specific requirements.

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8. Standard Fabrication Specifications

Specification	Value
Rod Dimensions	Diameter: 3–6 mm, Length: 40–80 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

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9. POC Strength and Capabilities

Photonics On Crystals (POC) is a leading manufacturer of high-quality laser crystals, including Nd:Ce:YAG. With advanced crystal growth technologies and rigorous quality control, POC delivers superior products tailored to meet the exacting standards of various industries. Our expertise in customization ensures that each crystal is optimized for its specific application, supported by exceptional technical support and fast delivery.

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10. Standard Products

Dimensions	Length	End Faces	Doping	Coating	Price (USD)
3 × 3 mm	10 mm	Brewster-angle cut	Nd: 1.2%, Ce: 0.05%	AR-coated @1064 nm	$620
5 × 5 mm	20 mm	Right-angle cut	Nd: 1.4%, Ce: 0.1%	AR-coated @1064 nm	$720
10 × 10 mm	50 mm	Brewster-angle cut	Nd: 1.1%, Ce: 0.08%	Custom Coating	$920
Customization	As needed	As needed	As requested	As requested	Request Quote