Photonics On Crystals

POC-OC-122428-Nd:YAG Crystal Datasheet

1 Main Features

1. **High Optical Quality**: High efficiency and low absorption loss at 1064 nm, ensuring superior performance in laser systems.
2. **Excellent Thermal Conductivity**: Supports high power density and stable operation.
3. **Versatile Applications**: Suitable for CW, pulsed, Q-switched, and mode-locked laser operations.
4. **Mechanical Strength**: High durability and resistance to thermal shock for long-term use.
5. **Custom Configurations**: Available in rods, slabs, and coated configurations for specific needs.

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2. Material General Description

Neodymium Doped Yttrium Aluminum Garnet (Nd:YAG) is one of the earliest and most widely used laser host crystals. It combines outstanding optical, thermal, and mechanical properties, making it a ubiquitous choice for near-infrared solid-state laser systems. Its cubic crystal structure ensures isotropic optical behavior, eliminating the need for polarization correction in most applications.

Nd:YAG exhibits high thermal conductivity, excellent optical homogeneity, and low laser-induced damage thresholds, making it ideal for both high-power and low-power laser operations. With an

emission wavelength of 1064 nm and a strong absorption band at 808 nm, Nd:YAG efficiently converts pump energy into laser output with minimal losses.

Due to its reliability, Nd:YAG is used in diverse fields such as industrial machining, medical treatments, scientific research, and military applications. The crystal is available in a variety of dopant concentrations, dimensions, and coatings to meet specific operational requirements.

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3. General Applications and Examples

Nd:YAG crystals are essential in numerous industries due to their versatility and high performance. Below are some key applications:

1. Industrial Applications

- **Laser Machining and Welding**: High-power Nd:YAG lasers are used for precision cutting, drilling, and welding.
- **Example**: Nd:YAG lasers are employed in automotive manufacturing for joining metal components.

2. Medical Applications

- **Surgical Lasers**: Nd:YAG lasers operating at 1064 nm are used in soft tissue surgeries and tattoo removal.
- **Example**: Nd:YAG lasers provide precision and control in ophthalmic and dermatological treatments.

3. Scientific Research

- **Nonlinear Optics**: Nd:YAG lasers are used as pump sources for frequency doubling and parametric generation.
- **Example**: Nd:YAG lasers enable generation of green light at 532 nm using KTP crystals.

4. Military and Defense

- **Range Finding and Targeting**: Compact Nd:YAG laser systems are used in range finders and laser designators.
- **Example**: Nd:YAG lasers provide long-range accuracy in military-grade equipment.

5. Display and Entertainment

- **Laser Light Shows**: High-power Nd:YAG lasers generate vibrant displays for entertainment.
- **Example**: Laser projectors utilizing Nd:YAG crystals produce colorful, high-resolution imagery.

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4. Chemical, Physical, and Structural Properties

Property	Value

Chemical Formula	Nd:Y3Al5O12
Crystal Structure	Cubic
Lattice Constant	12.01 Å
Density	4.56 g/cm³
Melting Point	1970 °C
Mohs Hardness	8.5 (High mechanical strength)
Thermal Conductivity	14 W/m·K at 20 °C; 10.5 W/m·K at 100 °C
Thermal Expansion Coefficient	7.8×10^{-6} /K (<111>)
Refractive Index	1.82 at 1064 nm
Stimulated Emission Cross-Section	2.8×10^{-19} cm² at 1064 nm

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5. Optical, Laser, and Nonlinear Optical Properties

Property	**Value**
Lasing Wavelength	1064 nm
Pump Wavelength	807.5 nm
Relaxation Time of Terminal Lasing Level	30 ns
Fluorescent Lifetime	550 µs
Loss Coefficient	0.003 cm^{-1} at 1064 nm
Linewidth	0.6 nm
Polarized Emission	Unpolarized
Thermal Birefringence	High

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6. Spectrum Transmission Curves

Nd:YAG crystals have a high transmission efficiency at 1064 nm and a strong absorption peak at 807.5 nm, ideal for diode pumping. Spectrum transmission curves show excellent transparency across visible and near-infrared wavelengths, ensuring minimal loss during operation.

(*Graphical data available upon request.*)

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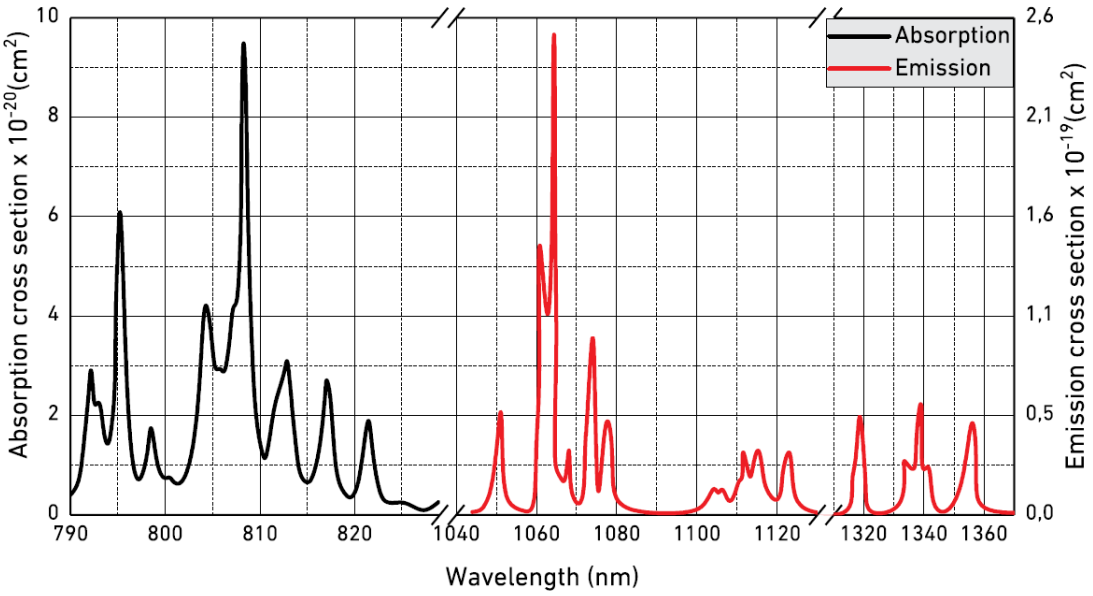

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7. Coating Specification

Coating Type	Specifications
HR Coating	R > 99.8% at 1064 nm, R < 0.5% at 808 nm
AR Coating	R < 0.2% at 1064 nm, R < 0.5% at 808 nm
Custom Coatings	Available upon request

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8. Standard Fabrication Specifications

Specification	Value
Dimension Tolerance	±0.1 mm (standard); ±0.01 mm (high precision)
Clear Aperture	Central 90% of the diameter
Surface Quality	10-5 Scratch-Dig
Surface Flatness	λ/8 at 633 nm
Parallelism	<20 arc seconds
Perpendicularity	<5 arc minutes
Chamfer	0.2 mm at 45°
Damage Threshold	>500 MW/cm² at 1064 nm (10 ns, 10 Hz)

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9. POC Strength and Capabilities

Photonics On Crystals

Photonics On Crystals (POC) is a trusted supplier of high-quality Nd:YAG crystals. Our capabilities include:

- **Custom Fabrication**: Tailored dimensions, dopant concentrations, and coatings to meet specific requirements.
- **Precision Engineering**: Advanced production techniques ensure optical homogeneity and high damage thresholds.
- **Global Support**: Expertise in integrating Nd:YAG crystals into diverse laser systems.

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10. Standard Products

Product Code	Dimensions (mm)	Doping Level (Nd)	Coating	Price (USD)
NDYAG-01	3 × 3 × 0.5	1.0%	AR @ 808 nm / 1064 nm	Request Quote
NDYAG-02	6 × 6 × 1	0.6%	Customizable	Request Quote
NDYAG-03	10 × 10 × 2	1.1%	Customizable	Request Quote
Custom-NDYAG	Customizable	Customizable	Customizable	Request Quote