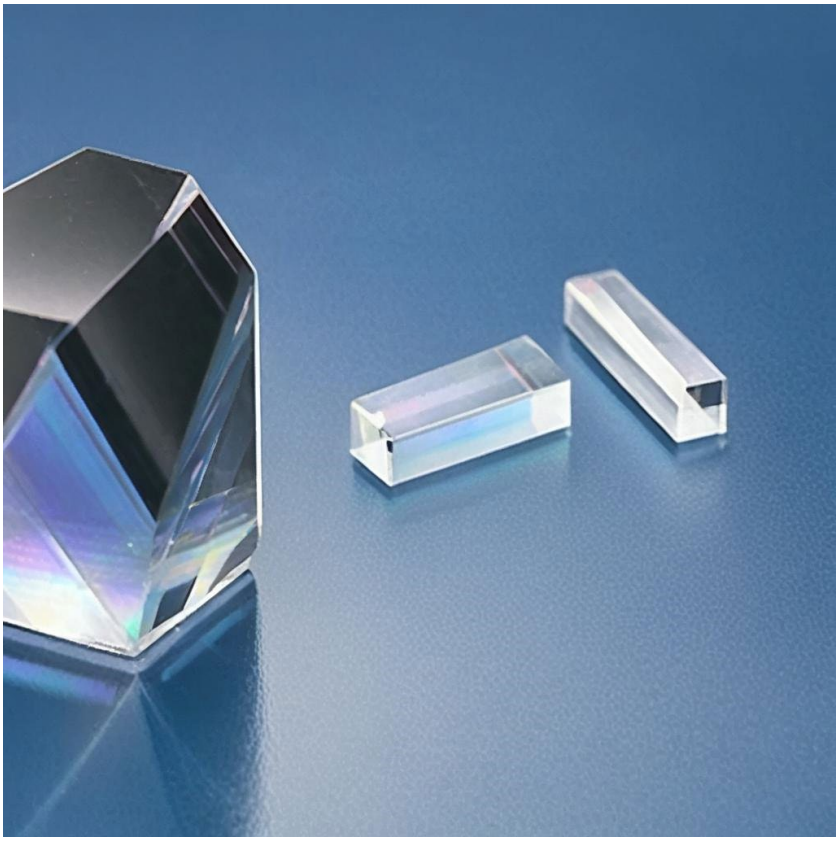
Photonics On Crystals

POC-OC-122427-Nd:GdVO4 Crystal Datasheet

1 Main Features

1. **High Stimulated Emission Cross-Section**: Offers excellent lasing performance with a value of 7.6×10^{-19} cm² at 1064 nm.
2. **Efficient Energy Absorption**: Higher absorption coefficient and broader bandwidth at the pump wavelength (~808 nm) compared to Nd:YVO4.
3. **Superior Thermal Properties**: Provides better thermal conductivity and higher power output capabilities than Nd:YVO4 crystals.
4. **Low Lasing Threshold**: Enables high slope efficiency for diode-pumped laser systems.
5. **Linearly Polarized Emission**: Maintains polarization parallel to the optical axis, minimizing energy loss during lasing.



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2. Material General Description

Neodymium Doped Gadolinium Orthovanadate (Nd:GdVO4) is a high-performance laser host crystal optimized for diode-pumped solid-state lasers (DPSSLs). Its excellent physical and optical properties make it a preferred material for high-power applications. Nd:GdVO4 offers a larger stimulated emission cross-section and higher energy absorption efficiency than Nd:YVO4, with better thermal management capabilities.

This crystal is particularly suitable for applications requiring high power density and efficient energy conversion. Its superior thermal conductivity supports continuous-wave and pulsed laser operations, enabling compact laser designs with high output stability. The uniaxial birefringence of Nd:GdVO4 ensures linearly polarized emission, making it highly effective for frequency doubling and nonlinear processes.

Nd:GdVO4 crystals are widely used in industries such as material processing, medical instrumentation, spectroscopy, and scientific research.

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3. General Applications and Examples

Nd:GdVO4 crystals are versatile and widely used in high-performance laser systems. Some key examples include:

1. Industrial Applications

- **Laser Cutting and Welding**: High-power Nd:GdVO4 lasers enable precision machining of metals and non-metals.
- **Example**: Used in micro-machining and electronics manufacturing for intricate designs.

2. Medical Applications

- **Laser Surgery and Diagnostics**: Nd:GdVO4 lasers operating at 1064 nm are ideal for soft tissue surgeries and non-invasive diagnostics.
- **Example**: Compact laser systems are used in ophthalmic surgeries and dermatological treatments.

3. Spectroscopy and Sensing

- **Material and Gas Analysis**: Nd:GdVO4 lasers are used in Raman spectroscopy and gas sensing for material characterization.
- **Example**: Effective in detecting trace gases for environmental monitoring.

4. Display Technology

- **Laser Projection Systems**: Nd:GdVO4 lasers offer stable and vivid output for laser displays and projection systems.
- **Example**: Commonly used in advanced imaging technologies for stage lighting and entertainment.

5. Research and Development

- **Quantum Optics**: Nd:GdVO4 lasers serve as reliable sources for research in quantum mechanics and photon manipulation.
- **Example**: Used in experiments requiring single-mode, stable, and high-power laser output.

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4. Chemical and Structural Properties

Property	Value
Crystal Structure	Zircon Tetragonal, Space Group D4h
Lattice Constants	a = b = 7.21 Å, c = 6.35 Å
Density	5.47 g/cm³
Thermal Conductivity	11.7 W/m·K (parallel to <110>)
Thermal Expansion	a = 1.5 × 10^{-6} /K; c = 7.3 × 10^{-6} /K
Melting Point	1780 °C
Refractive Index (1064 nm)	n_o = 1.972, n_e = 2.192

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5. Optical and Laser Properties

Property	Value
Lasing Wavelengths	1062.9 nm, 1341.3 nm
Stimulated Emission Cross-Section	7.6 × 10^{-19} cm² at 1064 nm
Absorption Cross-Section (808 nm)	4.9 × 10^{-19} cm²
Fluorescence Lifetime	~95 µs (1.2% Nd doping)
Absorption Coefficient	74 cm^{-1} at 808 nm
Intrinsic Loss	<0.1% at 1064 nm
Gain Bandwidth	0.6 nm
Polarized Laser Emission	Parallel to optical c-axis
Diode Pumped Efficiency	>60%

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6. Spectrum Transmission Curves

Nd:GdVO4 crystals exhibit high transparency in the visible and infrared ranges, with strong absorption at 808 nm and peak lasing performance at 1064 nm. Their high absorption coefficient enables efficient diode pumping.

(*Graphical transmission curves can be provided upon request.*)

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7. Coating Specification

Coating Type	Specifications
AR Coating	R < 0.2% at 808 nm; R < 0.1% at 1064 nm
Custom Coatings	Available upon request

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	20-10 Scratch-Dig
Surface Flatness	λ/8 at 633 nm
Parallelism	<20 arc seconds
Perpendicularity	<5 arc minutes
Chamfer	0.1 mm at 45°
Damage Threshold	>15 J/cm² (10 ns, 10 Hz at 1064 nm)

9. POC Strength and Capabilities

Photonics On Crystals (POC) is a global leader in manufacturing high-quality Nd:GdVO4 crystals. Our strengths include:

- **Customization**: Tailored dimensions, doping levels, and coatings for specific applications.
- **Advanced Technology**: Precision machining and state-of-the-art coating techniques.
- **Global Support**: Comprehensive assistance for R&D and industrial applications.

10. Standard Products

Product Code	Dimensions (mm)	Doping Level (Nd)	Coating	Price (USD)
NDGDVO4-01	3 × 3 × 0.5	1.0%	AR @ 808 nm / 1064 nm	Request Quote
NDGDVO4-02	6 × 6 × 1	1.0%	Customizable	Request Quote
NDGDVO4-03	10 × 10 × 2	0.5%	Customizable	Request Quote
Custom-NDGDVO4	Customizable	Customizable	Customizable	Request Quote