

Nd:GdVO₄ - Neodymium Doped Gadolinium Orthovanadate

CASTECH's Nd:GdVO₄ is featured by

- Large stimulated emission cross section at laser wavelength;
- High absorption coefficient and wide bandwidth at pump wavelength;
- Low dependency on pump wavelength;
- Good thermal conductivity;
- Low lasing threshold and high slope efficiency;
- High laser induced damage threshold;
- Strongly-polarized laser output.

Table 1. Basic Properties

Crystal Structure	Tetragonal, space group I4 ₁ /amd
Lattice Parameter	a = 7.21 Å, c = 6.35 Å
Lasing Transition	⁴ F _{3/2} → ⁴ I _{11/2}
Lasing Wavelength	1062.9 nm
Emission Cross Section (at 1064 nm)	7.6 × 10 ⁻¹⁹ cm ²
Absorption Cross Section (at 808 nm)	4.9 × 10 ⁻¹⁹ cm ²
Absorption Coefficient (at 808 nm)	74 cm ⁻¹
Index of Refractivity (at 1064 nm)	n _o = 1.972, n _e = 2.192
Thermal Conductivity (<110>)	11.7 W/m/K
Density	5.47 g/cm ³
Nd Dopant Level (atomic)	0.1%, 0.2%, 0.3%, 0.5%, 0.7%, 1.0%...

Table 2. Material Properties: Comparing Nd:GdVO₄ and Nd:YVO₄

Crystal	Nd:GdVO ₄	Nd:YVO ₄
Crystal Structure, Space Group	Tetragonal, I4 ₁ /amd	Tetragonal, I4 ₁ /amd
Lattice Parameter	a = 7.21 Å, c = 6.35 Å	a = 7.21 Å, c = 6.29 Å
Melting Temperature (°C)	1780	1825
Thermal Expansion @25 °C, × 10 ⁻⁶ /°C	a 1.5	a 4.43
	c 7.3	c 11.4
Specific Heat @25 °C, cal/mol·K	32.6	24.6
dn/dT, × 10 ⁻⁶ /°C	4.7	2.7

Table 3. Information Regarding Neodymium Laser Host Crystals

Crystal	Nd:YVO ₄	Nd:GdVO ₄	Nd:YAG
Laser Wavelengths	1064.3 nm, 1342.0 nm	1062.9 nm, 1340 nm	1064.2 nm, 1338.2 nm
Emission Bandwidth (linewidth at 1064 nm)	0.8 nm	No data	0.6 nm
Effective Laser Cross Section (emission cross section at 1064 nm)	$15.6 \times 10^{-19} \text{ cm}^2$	$7.6 \times 10^{-19} \text{ cm}^2$	$6.5 \times 10^{-19} \text{ cm}^2$
Polarization	Parallel to c-axis	Parallel to c-axis	unpolarized
Fluorescence Lifetime with 1% Nd Doping	~ 100 μs	~ 95 μs	~ 230 μs
Pump Wavelength	808.5 nm	808.4 nm	807.5 nm
Peak Pump Absorption at 1% Doping	~ 41 cm^{-1}	~ 57 cm^{-1}	
Thermal Conductivity	5.1 W/m/K	11.7 W/m/K	14 W/m/K
Doping Concentration Range	0.1 - 3.0%	0.1 - 3.0%	0.3- 2.0%

Specifications of Nd:GdVO₄ crystal from CASTECH

Table 4. Specifications

Dimension Tolerance	(W \pm 0.1 mm) \times (H \pm 0.1 mm) \times (L +0.2/-0.1 mm)
Clear Aperture	Central 90% of the diameter
Flatness	$\leq \lambda/8$ @633 nm (L \geq 2.5 mm) $\leq \lambda/4$ @633 nm (L < 2.5 mm)
Surface Quality (Scratch/Dig)	10/5 to MIL-PRF-13830B
Transmitted Wavefront Distortion	$\leq \lambda/4$ @633 nm
Parallelism	20 arc sec
Perpendicularity	≤ 15 arc min
Angle Tolerance	$\leq \pm 0.5^\circ$
Chamfer	$\leq 0.2 \text{ mm} \times 45^\circ$
Chip	$\leq 0.1 \text{ mm}$
AR Coating	R < 0.2% @1064 nm
HR Coating	R > 99.8% @1064 nm, T > 95% @808 nm
Quality Warranty Period	One year under proper use.