$Nd:GdVO_4$ - Neodymium Doped Gadolinium Orthovanadate

CASTECH's $Nd:GdVO_4$ 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	$^4F_{3/2} \rightarrow {}^4I_{11/2}$
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 Concentration	0.1%, 0.2%, 0.3%, 0.5%, 0.7%, 1.0%...

Table 2. Material Properties: Comparing $Nd:GdVO_4$ and $Nd:YVO_4$

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, $\times 10^{-6}$/°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, $\times 10^{-6}$/°C	4.7		2.7	

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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)	15.6×10^{-19} cm^2	7.6×10^{-19} cm^2	6.5×10^{-19} 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 $Nd:GdVO_4$ crystal from CASTECH

Table 4. Specifications

Dimension Tolerance	(W ± 0.1 mm) × (H ± 0.1 mm) × (L +0.2/-0.1 mm)
Clear Aperture	Central 90% of the diameter
Flatness	≦λ/8 @633 nm (L≧2.5 mm) ≦λ/4 @633 nm (L<2.5 mm)
Surface Quality (Scratch/Dig)	10/5 to MIL-PRF-13830B
Transmitted Wavefront Distortion	≦λ/4 @633 nm
Parallelism	20 arc sec
Perpendicularity	≦15 arc min
Angle Tolerance	≦±0.5°
Chamfer	≦0.2 mm × 45°
Chip	≦0.1 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.