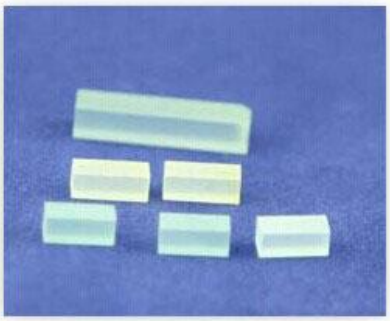
Nd:YVO4 Crystals

- **Doping concentration range from 0.1% - 3%**
- **Various size bulk and finished crystals, size up to φ20x20mm**
- **A variety of coatings are available**

Neodymium doped Gadolinium Vanadate or Nd:YVO4 crystal is one of the most efficient laser host crystal for DPSS lasers. Its large stimulated emission cross-section at lasing wavelength, high absorption coefficient and wide absorption bandwidth at pump wavelength, high damage threshold as well as good physical, optical and mechanical properties make Nd:YVO4 an excellent crystal for high power, stable and cost effective DPSS lasers. Hangzhou Shalom EO offers the **Nd:YVO4** with Nd doping range of 0.1%-3% and with size up to Diam20x20mm.



- Doping concentration range from 0.1% to 3%.
- Doping concentration tolerance: ±0.05%(atm% < 1%),±0.1%(atm%≥1%).
- Various size bulk and finished high quality **Nd:YVO4 crystals** up to Φ20x20mm3, respectively;
- Both ends AR/AR-1064/808nm, R < 0.2%@1064nm,R < 2%@808nm
- S1:HR@1064&532 nm,HT808 nm, R > 99.8%@1064&532nm, T > 90%@808nm
  S2:AR@1064&532 nm, R < 0.2%@1064nm,R < 0.5%@532nm
- S1:HR@1064,HT808, R > 99.8%@1064nm,T > 95%@808nm S2:AR@1064, R < 0.1%@1064nm.
- S1,S2 AR-coated, S3:gold/chrome plated.
- Both ends AR/AR-1064 nm; S3:AR-808 nm
- Other coatings are available upon request.

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Specifications	
Transmitting wavefront distortion	less than λ/4 @ 633nm
Clear aperture	>90% central area
Chamfer	≤0.2mm@45degree
Chip	≤0.1mm
Flatness	λ/8 @ 633 nm
Scratch/Dig	10/5
Parallelism	better than 10arc seconds
Perpendicularity	≤5 arc minutes
Angle tolerance	≤0.5°
Quality Warranty Period	one year under proper use

Physical and optical properties	
Atomic Density	1.26x1020 atoms/cm3 (Nd1.0%)
Crystal Structure	Zircon Tetragonal, space group D4h-I4/amd a=b=7.1193A,c=6.2892A
Density	4.22g/cm3
Mohs Hardness	4-5(Glass-like)
Thermal Expansion Coefficient(300K)	αa=4.43x10-6/K αc=11.37x10-6/K
Thermal Conductivity Coefficient(300K)	//C:0.0523W/cm/K ⊥C:0.0510W/cm/K
Lasing wavelength	1064nm,1342nm
Thermal optical coefficient (300K)	dno/dT=8.5×10-6/K dne/dT=2.9×10-6/K
Stimulated emission cross-section	25×10-19cm2@ 1064nm
Fluorescent lifetime	90μs(1% Nd doping)
Absorption coefficient	31.4cm-1@810nm
Intrinsic loss	0.02cm-1@1064nm
Gain bandwidth	0.96nm@1064nm
Polarized laser emission	π polarization; parallel to optic axis(c-axis)
Diode pumped optical to optical efficiency	>60%
Sellemeier equations (λ in um)	n02=3.77834+0.069736/(λ2-0.04724)-0.010813λ2 ne2=4.59905+0.110534/(λ2-0.04813)-0.012676λ2

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Nd:YVO4's advantages over Nd:YAG

As high as about five times larger absorption efficient over a wide pumping bandwidth around 808 nm (therefore, the dependency on pumping wavelength is much lower and a strong tendency to the single mode output).

As large as three times larger stimulated emission cross-section at the lasing wavelength of 1064nm.

Lower lasing threshold and higher slope efficiency.

As a uniaxial crystal with a large birefringence, the emission is only linearly polarized.

Laser Properties of Nd:YVO4

1. One of the most attractive character of Nd:YVO4 is, compared with Nd:YAG, it has 5 times larger absorption coefficient in a broader absorption bandwidth around the 808 nm peak pump wavelength, which just matches the standard of high power laser diodes currently available. This means a smaller **Nd:YVO4 crystal** that could be used for the laser, leading to a more compact laser system. For a given output power, this also means a lower power level at which the laser diode operates, thus extending the lifetime of the expensive laser diode. The broader absorption bandwidth of Nd:YVO4 which may reaches 2.4 to 6.3 times that of Nd:YAG, is also valuable. Besides more efficient pumping, Nd:YVO4 also means a broader range of selection of diode specifications. This will be helpful to laser system makers for wider tolerance and lower cost choice.

2. Nd:YVO4 crystal has larger stimulated emission cross-sections, both at 1064nm and 1342nm. When a-axis cut Nd:YVO4 crystal lasing at 1064m, it is about 4 times higher than that of Nd:YAG, while at 1340nm the stimulated cross-section is 18 times larger, which leads to a CW operation completely outperforming Nd:YAG at 1320nm. These make Nd:YVO4 laser be easy to maintain a strong single line emission at the two wavelengths.

3. Another important character of Nd:YVO4 lasers is, because it is an uniaxial rather than a high symmetry of cubic as Nd:YAG, what it emits is only a linearly polarized, thus avoiding undesired birefringent effects on the frequency conversion. Although the lifetime of Nd:YVO4 is about 2.7 times shorter than that of Nd:YAG, its slope efficiency can be still quite high for a proper design of laser cavity, because of its high pump quantum efficiency.

The major laser properties of Nd:YVO4 vs Nd:YAG are listed in Table below, including stimulated emission cross-sections (σ), Absorption Coefficient (α) Fluorescent lifetime (τ),Absorption Length (La),threshold Power (Pth) and Pump Quantum Efficiency (ηs).

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Laser Properties of Nd:YVO4 vs Nd:YAG

LASER CRYSTAL	DOPING (atm%)	σ (x10-19cm2)	α (cm-1)	τ (μs)	La (mm)	Pth (mW)	ηs (%)
Nd:YVO4(a-cut)	1.0	25	31.2	90	0.32	30	52
	2.0	25	72.4	50	0.14	78	48.6
Nd:YVO4(c-cut)	1.1	7	9.2	90		231	45.5
Nd:YAG	0.85	6	7.1	230	1.41	115	38.6

Typical Results of Nd:YVO4:

Diode pumped Nd:YVO4 laser output comparing with diode pumped Nd:YAG laser.

Crystals	Size (mm3)	Pump Power	Output (at 1064nm)
Nd:YVO4	3x3x1	850mW	350mW
Nd:YVO4	3x3x5	15W	6W
Nd:YAG	3x3x2	850mW	34mW

- Diode pumped Nd:YVO4+KTP green laser
- 8W green laser was generated from a 15W LD pumped 0.5% Nd:YVO4 with intracavity KTP
- 200mW green outputs are generated from 1W LD pumped 2% Nd:YVO4 lasers

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