

## Yb:YAG

Yb:YAG crystal is one of the most promising laser materials emitting wavelength at 1030 nm. It is easily to be pumped by reliable InGaAs laser diodes at 940 nm, due to its peak absorption wavelength at around 940 nm. Compared with the commonly used Nd:YAG crystal, Yb:YAG crystal has a much larger absorption bandwidth to reduce thermal management requirements for diode lasers, a longer upper-state lifetime, 3-4 times lower thermal loading per unit pump power. Yb:YAG crystal is expected to replace Nd:YAG crystal for high power diode-pumped lasers and other potential applications, such as, its doubling wavelength is 515 nm very close to that of Ar-ion laser (514 nm), which makes it possible to replace large volume Ar-ion laser.



AOTK has grown high quality Yb:YAG crystal with advanced technique. Disks, rods and slabs can be available on customers' request now.

### Yb:YAG advanced properties

- High Slope Efficiency
- Low Fractional Heating, Less Than < 11%
- No Excited-State Absorption or Up-Conversion
- Broad Absorption Bandwidth, about 18 nm @ 940 nm
- Conveniently Pumped by Reliable InGaAs Diodes at 940nm (or 970nm)
- High Thermal Conductivity and Strength

### Basic Properties

#### 1. Structural and Physical Properties

Chemical Formula	Yb:Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>
Crystal Structure	Cubic
Lattice Parameters	12.01Å
Mohs Hardness	8.5
Density	4.56 g/cm <sup>3</sup>
Melting Point	1970°C
Specific Heat	0.59J/g.cm <sup>3</sup>
Modulus of Elasticity	310GPa
Young's Modulus	3.17X10 <sup>4</sup> Kg/mm <sup>2</sup>
Tensile Strength	0.13~0.26GPa
Thermal Expansion Coefficient	8.2x10 <sup>-6</sup> /K [100]
	7.2x10 <sup>-6</sup> /K [110]
	7.8x10 <sup>-6</sup> /K [111]
Thermal Conductivity	14W/m/K @ 20°C; 10.5W/m/K @ 100°C
Thermal Optical Coefficient (dn/dT)	7.3×10 <sup>-6</sup> /°C
Thermal Shock Resistance	790W/m

#### 2. Optical and Spectral Properties

Yb Dopant concentration	5 ~ 30 at%
Laser Wavelength	1030nm
Photon Energy	1.93×10 <sup>-19</sup> J @1030nm
Emission Linewidth	9nm
Emission Cross Section	2.0×10 <sup>-20</sup> cm <sup>2</sup>

Fluorescence Lifetime	1.2 ms
Diode Pump Band	940nm or 970nm
Pump Absorption Band Width	8 nm
Index of Refraction	1.82
Thermal Optical Coefficient	$9 \times 10^{-6}/^{\circ}\text{C}$
Loss Coefficient	$0.003 \text{ cm}^{-1}$

#### Standard Specifications

Wavefront Distortion	$< \lambda/8$ @633 nm
Extinction Ratio	>28dB
Dimension Tolerances	Rods with diameter: $\pm 0.05$ mm, Length: $\pm 0.2$ mm
Surface Finish	10/5 scratch/dig as per MIL-O-13830A
Flatness	$\lambda/10$ @632.8 nm
Parallelism	< 10 arc seconds
Perpendicularity	< 5 arc minutes
Barrel Finish	50-80 micro-inch (RMS)
Clear Aperture	> Central 90%
Chamfer	<0.1 mm @ 45deg.
Coatings	1) S1&S2 - AR@ 940 & 1030 nm 2) S1- AR@ 940nm + 1030nm, S2- HR@ 940+1030 nm 3) S1- HR @1030nm&HT@ 940nm, S2- AR@ 1030nm

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