Yb:YAG - Ytterbium Doped Yttrium Aluminum Garnet (Yb:$Y_3Al_5O_{12}$)

Introduction

Ytterbium Doped Yttrium Aluminum Garnet (Yb:$Y_3Al_5O_{12}$, Yb:YAG) is one of the most promising laser-active materials and more suitable for diode-pumping than the traditional Nd-doped systems. 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-laser level lifetime, three to four times lower thermal loading per unit pump power. Yb:YAG crystal at 1030 nm is a good substitute for a Nd: YAG crystal at 1064 nm and its second harmonic at 515 nm may replace Ar-ion laser (with a large volume), which emit at 514 nm.

CASTECH's Yb:YAG Crystal is featured by

- Very low fractional heating, less than 11%
- Very high slope efficiency
- Broad absorption bands, about 8 nm @940 nm
- No excited-state absorption or up-conversion
- Conveniently pumped by reliable InGaAs diodes at 940 nm (or 970 nm)
- High thermal conductivity and large mechanical strength
- High optical quality

Table 1. Optical and Spectral Properties of Yb: YAG Crystal

Laser Transition	$^2F_{5/2} \rightarrow {}^2F_{7/2}$
Laser Wavelength	1030 nm
Photon Energy	1.93×10^{-19} J (@1030 nm)
Emission Linewidth	9 nm
Emission Cross Section	2.0×10^{-20} cm^2
Fluorescence Lifetime	1.2 ms
Diode Pump Band	940 nm or 970 nm
Pump Absorption Band Width	8 nm
Index of Refraction	1.82
Thermal Optical Coefficient	9×10^{-6}/°C
Loss Coefficient	0.003 cm^{-1}

Specifications of Yb: YAG crystal from CASTECH

Table 2. Material and Specifications

Dopant Concentration	Yb: 0.5~20 at%
Rod Sizes	Diameter: 2~20 mm, Length: 5~150 mm Upon request of customer
Dimensional Tolerances	Diameter: ±0.1mm Length: ±0.5 mm
Surface Quality	10/5 to MIL-PRF-13830B
Wavefront Distortion	< λ/8 @633 nm
Flatness	λ/8 @633 nm
Parallelism	20 arc sec
Perpendicularity	≦15 arc min
Extinction Ratio	≧28 dB
Barrel Finish	Ground Finish: 400#Grit
Chamfer	≦0.2 mm × 45°
AR Coating Reflectivity	AR-1030/940 nm, R < 0.2% @1030 nm, R < 0.5% @940 nm. Other coatings are available upon request.
Single Pass Loss	$< 3 \times 10^{-3}$ cm^{-1}