

Yb:CALGO - Ytterbium Doped Calcium Gadolinium Aluminate (Yb:CaGdAlO₄)

Introduction

Ytterbium Doped Calcium Gadolinium Aluminate (Yb:CaGdAlO₄ or Yb:CALGO) is a promising new laser gain material which possess several important advantages. The crystal structure of CALGO is tetragonal. When it is pumped at 979 nm under π configuration, we can get broad emission spectra from 994 nm to 1050 nm in σ configuration. This implies a very low quantum defect (down to 1.5%) and gives a good expectation of obtaining ultra-fast pulse. In addition, Yb:CALGO also has a thermal conductivity of up to $k=6.7$ W/m/K, making it suitable for high-power laser applications.

CASTECH's Yb:CaGdAlO₄ is featured by

- High absorption coefficient @979 nm
- High stimulated emission cross section
- Low laser threshold
- Extremely low quantum defect
- Broad output @994-1050 nm
- High slope efficiency with diode pumping (up to 55%)
- Various Yb-doping concentration



Applications

- Over 5.5 W output power is obtained by 23 W incident pumping diode laser with 10% output coupler;
- Output power as high as 12.5 W and 94 fs pulses for 28 W pumping power was reported.

Table 1. Basic Properties

Crystal Structure	Tetragonal
Point group	I4/mm
Lattice Parameter	$a = 3.6585 \text{ \AA}$, $c = 11.978 \text{ \AA}$
Melting Point	1850 °C
Mohs Hardness	6 Mohs
Density	4.8 g/cm ³
Thermal Conductivity	$K_{[001]} = 6.3 \text{ W/m/K}$, $K_{[100]} = 6.9 \text{ W/m/K}$
Thermal Expansion Coefficients	$10.1 \times 10^{-6} / \text{K}$ (// a), $16.2 \times 10^{-6} / \text{K}$ (// c)
Laser Wavelength	994-1050 nm
Absorption Wavelength	979 nm
Absorption Cross Section (π configuration at 979 nm)	$2.7 \times 10^{-20} \text{ cm}^2$



Specifications of Yb: CaGdAlO₄ crystal from CASTECH

Table 2. Specifications of Yb: CaGdAlO₄

Orientation	a or c
Standard Dopant Concentration	Yb: 1, 2, 3, 5 at. %
Maximum Length	50 mm
Surface Quality (Scratch/Dig)	10/5 to MIL-PRF-13830B
Dimensional Tolerances	Diameter: ± 0.1 mm Length: ± 0.5 mm
Parallelism	20 arc sec
Perpendicularity	≤ 15 arc min
Coating	AR-1030/980 nm, R<0.2% @1030 nm, R<0.5% @980 nm. Other coatings are available upon request.