

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 pi configuration, we can get broad emission spectra from 994 nm to 1050 nm in theta 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	$a = 3.6585 \text{ \AA}$, $c = 1.1978 \text{ \AA}$
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	$10.1 \times 10^{-6} / \text{K}$ ($\parallel a$), $16.2 \times 10^{-6} / \text{K}$ ($\parallel c$)
Laser Wavelength	994-1050 nm
Absorption Wavelength	979 nm
Absorption Cross Section (phi 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% atm%
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.