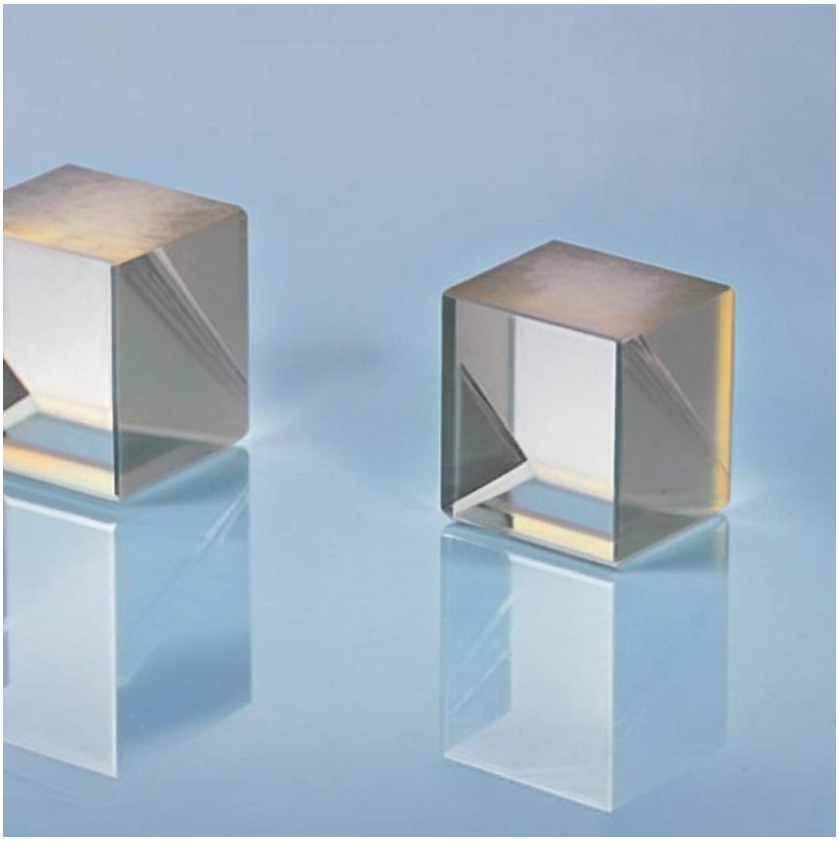
Photonics On Crystals

POC-OC-122431-Yb:CALGO Crystal Datasheet

1 Main Features

- High absorption coefficient at 979 nm, enabling efficient pump utilization.
- Wide emission spectrum (994-1050 nm) for tunable and broadband laser applications.
- Low quantum defect (as low as 1.5%), ensuring minimal thermal load.
- High thermal conductivity (up to 6.9 W/m·K), ideal for high-power lasers.
- High slope efficiency with diode pumping (up to 55%), offering energy-efficient operation.



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2. Material General Description

Ytterbium Doped Calcium Gadolinium Aluminate (Yb:CALGO) is a cutting-edge laser gain material designed for advanced photonics applications. Its tetragonal crystal structure and outstanding thermal properties make it particularly suitable for high-power and ultrafast laser systems. The broad emission spectrum, ranging from 994 nm to 1050 nm, supports tunable and broadband laser outputs, while the high absorption coefficient at 979 nm aligns perfectly with the emission wavelength of commercial laser diodes.

Yb:CALGO stands out for its low quantum defect, reducing thermal management challenges in high-energy lasers. Furthermore, its high thermal conductivity ensures efficient heat dissipation, critical for maintaining optical performance and longevity. This material supports various Yb-doping concentrations, allowing customization for diverse laser configurations. With its robust mechanical

properties and low lasing threshold, Yb:CALGO is a preferred choice for ultrafast pulsed lasers and other demanding photonics applications.

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3. General Applications and Examples

Yb:CALGO is widely used in numerous laser applications, including but not limited to:

1. **High-Power Lasers**: Its high thermal conductivity and slope efficiency make it ideal for industrial lasers used in materials processing, cutting, and welding.
2. **Ultrafast Lasers**: With a broad emission spectrum and low quantum defect, Yb:CALGO enables the generation of sub-100 fs pulses, which are essential for precision micromachining, biomedical imaging, and research.
3. **Tunable Lasers**: The 994-1050 nm wavelength range allows for tuning across a wide spectrum, making Yb:CALGO a versatile material for spectroscopy and other scientific applications.
4. **Diode-Pumped Solid-State Lasers (DPSSL)**: The high absorption coefficient at 979 nm ensures efficient energy conversion, making it compatible with commercial laser diodes.
5. **Scientific Research**: Yb:CALGO crystals are used in experimental setups requiring high-energy, stable, and reliable laser sources.

Examples:

- A 23 W diode-pumped laser achieved 5.5 W output with a 10% output coupler.
- Another system demonstrated 12.5 W average power with 94 fs pulse duration using 28 W pump power.

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4. Chemical, Physical, or Structural Properties

Property	**Value**
Chemical Formula	Yb:CaGdAlO4 (Yb:CALGO)
Crystal Structure	Tetragonal
Space Group	14/mm
Lattice Parameters	a = 3.6585 Å, c = 11.978 Å
Melting Point	1850 °C
Density	4.8 g/cm³
Mohs Hardness	6
Thermal Conductivity	K_1001 = 6.9 W/m·K; K_001 = 6.3 W/m·K
Thermal Expansion Coefficient	10.1 × 10^-6 K^-1 (a-axis), 16.2 × 10^-6 K^-1 (c-axis)

Laser Wavelength	994-1050 nm
Absorption Wavelength	979 nm
Absorption Cross-Section	0.8 × 10^-20 cm² (at 979 nm)

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5. Optical, Laser, or Nonlinear Optical Properties

Optical Property	**Value**
Peak Stimulated Emission Cross Section	2.7 × 10^-20 cm²
Transparency Range	979-1050 nm
Fluorescence Lifetime	420 µs
FWHM	80 nm
Absorption Bandwidth	979 nm

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6. Spectrum Transmission Curves

The transparency curve indicates broad transmission across 994-1050 nm, supporting tunable laser operations. The absorption peak at 979 nm ensures optimal diode pumping efficiency.

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7. Coating Specifications

- **Standard Coating**: AR-1030/980 nm.
- Reflectivity: R < 0.2% at 1030 nm, R < 0.5% at 980 nm.
- Custom coatings available upon request for specific laser applications.

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8. Standard Fabrication Specifications

Specification	**Value**
Orientation	a or c
Standard Dopant Concentrations	Yb: 1%, 2%, 3%, 5%
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

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9. POC Strength and Capabilities

Photonics On Crystals (POC) provides state-of-the-art Yb:CALGO crystals, tailored for high-performance laser systems. With advanced manufacturing techniques and rigorous quality control, POC ensures each crystal meets stringent specifications for industrial, scientific, and medical applications. Custom doping levels, dimensions, and coatings are available to meet diverse customer requirements.

Key Capabilities:

- Extensive customization options for dopant concentrations, dimensions, and coatings.
- Precision fabrication with high-quality surface finishing and optical clarity.
- Robust technical support and expertise in laser crystal technology.

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10. Standard Products

Face Dimensions	Length	End Faces	Doping	Coatings	SKU	Price (USD)
3 mm × 3 mm	5 mm	Right-angle cut	3%	AR-980 nm, 1030 nm	7798	480
3 mm × 3 mm	5 mm	Brewster-angle cut	5%	Uncoated	7799	420
Custom Dimensions	Custom	Custom	Up to 5%	Upon request	Custom	Upon request