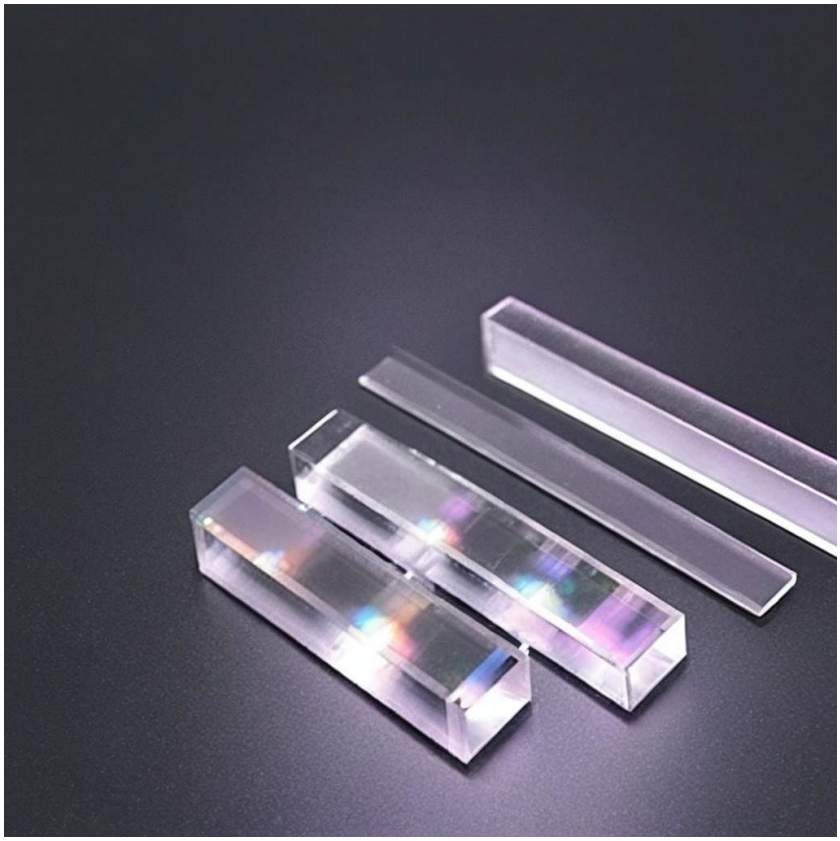
Photonics On Crystals

POC-OC-122438-Er:Yb:YAB Crystal Datasheet

1 Main Features

- High thermal conductivity and excellent transparency.
- Strong absorption and emission cross-sections for optimal laser performance.
- High Yb^{3+} to Er^{3+} energy transfer efficiency, minimizing losses.
- Wide absorption bandwidth near 976 nm for versatile laser pumping.
- Highly durable uniaxial crystal with robust structural integrity.



2. Material General Description

Er^{3+}/Yb^{3+} co-doped Yttrium Aluminum Borate (Er:Yb:YAB) crystals are designed for eye-safe laser applications, particularly at 1.55 µm. They offer superior thermal conductivity, high quantum efficiency, and minimal upconversion loss, outperforming alternative materials like phosphate glasses. With excellent transparency to environmental factors such as smoke and atmospheric absorption, Er:Yb:YAB crystals are well-suited for precise applications like LiDAR, 3D imaging, and target recognition. The robust structural integrity and high laser efficiency make it a preferred choice for both continuous wave (CW) and pulsed laser operations.

3. General Application and Examples

- **LiDAR Systems**: Utilized in remote sensing and 3D imaging due to its eye-safe wavelength and efficient laser output.

- **Telecommunications**: Offers stable and efficient operation in telecom lasers at 1.55 µm.
- **Medical Applications**: Suitable for diagnostics and surgical lasers due to its precision and high absorption capabilities.
- **Military and Aerospace**: Applied in targeting systems, rangefinders, and laser designators due to excellent penetration and robustness.
- **Scientific Research**: Preferred for high-precision spectroscopy and quantum applications requiring ultra-low noise.

4. Chemical, Physical, or Structural Properties

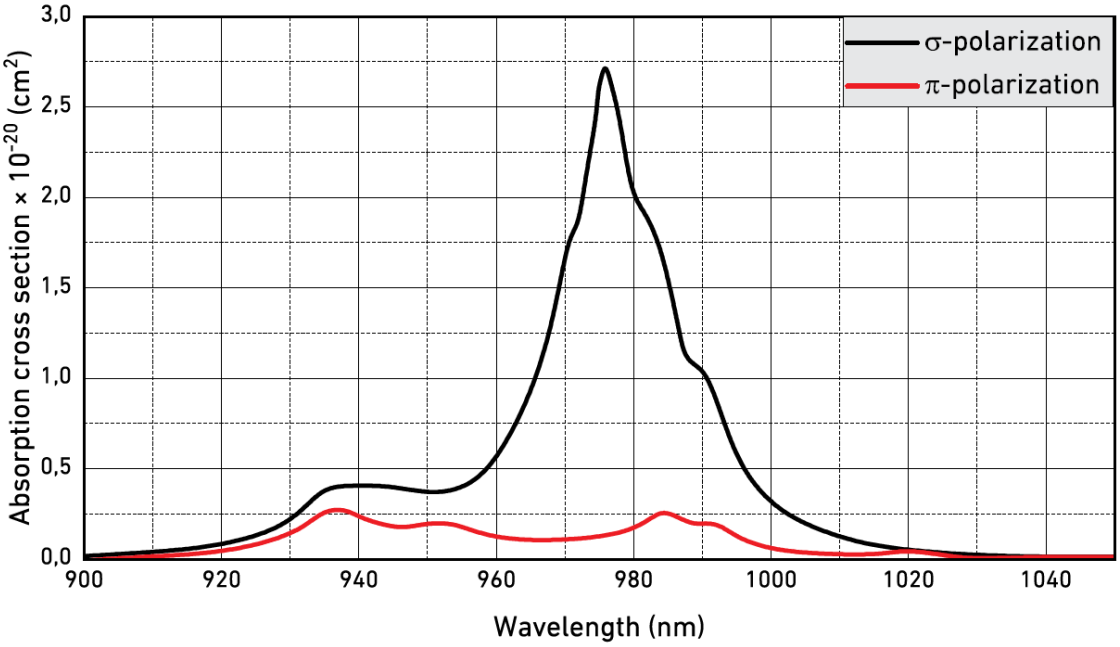
Property	**Specification**
Chemical Formula	Er:Yb:YAl$(BO_3)_4$
Crystal Structure	Trigonal, D_{32}-R32
Atomic Density	0.55 × 10^{20} atoms/cm^3 (at.% Yb^{3+} or Er^{3+})
Mohs Hardness	7.5 Mohs
Density	3.7 g/cm^3
Refractive Index	1.75 (nε), 1.68 (no) at 1550 nm
Thermal Expansion	10^-6/K, anisotropic: 2.0 (a-axis), 9.7 (c-axis)
Thermal Conductivity	4.7 W/m/K

5. Optical, Laser, or Nonlinear Optical Properties

Parameter	**Er:Yb:YAB**	**Comparison (Phosphate Glass)**
Pumping Wavelength	976 nm	976 nm
Peak Absorption Cross-section	3 × 10^-20 cm^2 (σ-polarization)	1 × 10^-20 cm^2
FWHM of Absorption Band	19 nm	10 nm
Peak Fluorescence Wavelength	1530 nm	1533 nm
Emission Cross-section	2 × 10^-20 cm^2	0.8 × 10^-20 cm^2
Fluorescence Lifetime	0.3 ms	0.8 ms
Refraction Index	1.75 (nε), 1.68 (no)	1.54
Maximum Slope Efficiency	>30%	>30%

6. Spectrum Transmission Curves

Spectrum transmission curves highlight high absorption near 976 nm and strong emission at 1530 nm with minimal overlap, enabling efficient laser operation and high selectivity. Data consolidated indicates high pump efficiency.



7. Coating Specification

- **AR Coating**: Anti-reflection coating for 976 nm and 1480–1600 nm, with reflectivity R < 0.25%.
- **Custom Coatings**: Available for additional wavelengths upon request.

8. Standard Fabrication Specifications

Specification	**Value**
Dopant Concentration	Er^{3+}: 0.1–3 at.%, Yb^{3+}: 5–30 at.%
Dimension Tolerance	±0.1 mm
Surface Quality	10/5 to MIL-PRF-13830B
Wavefront Distortion	<λ/8 at 633 nm
Parallelism	<20 arc sec
Perpendicularity	<15 arc min
Flatness	<λ/8 at 633 nm
Chamfer	<0.2 mm × 45°

9. POC Strength and Capabilities

Photonics On Crystals (POC) leverages cutting-edge manufacturing techniques to produce premium-grade Er:Yb:YAB crystals. Our rigorous quality control ensures high consistency and customization capabilities, with flexible design options tailored to meet the demands of scientific, industrial, and military applications.

10. Standard Products

Dimensions	Length	End Faces	Doping	Coating	Price (USD)
3 × 3 mm	1 mm	Brewster-angle cut	12% Yb^{3+}, 1.5% Er^{3+}	AR @ 976 nm + 1480–1600 nm	$540
3 × 3 mm	2 mm	Right-angle cut	12% Yb^{3+}, 1.5% Er^{3+}	Uncoated	$540
3 × 3 mm	3 mm	Right-angle cut	12% Yb^{3+}, 1.5% Er^{3+}	AR @ 976 nm + 1480–1600 nm	$590
Customization	As required	As required	As required	As required	Request Quote