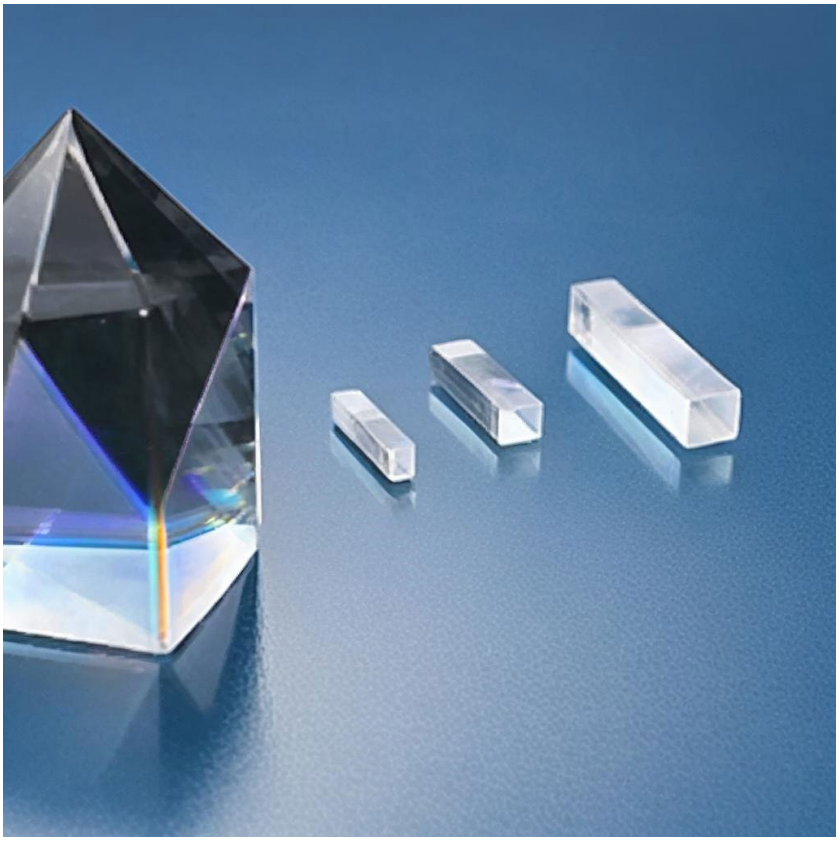
Photonics On Crystals

POC-OC-122433-Yb:CaF2 Crystal Datasheet

1 Main Features

- Isotropic crystal with cubic symmetry.
- Long fluorescence lifetime and broad absorption bands.
- Low quantum defect, suitable for high-power laser operations.
- Wide optical transmission range (0.12 µm–10 µm).
- Custom coatings available to meet specific requirements.



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2. Material General Description

Ytterbium-doped Calcium Fluoride (Yb:CaF_2) is a cutting-edge laser material offering a combination of low quantum defect and extended fluorescence lifetime. Synthesized using the Czochralski growth technique, Yb:CaF_2 is highly valued for its broad absorption bandwidth and minimal nonlinear effects under intense laser irradiation. These properties make it ideal for ultra-short pulse generation and high-power laser applications. Its cubic crystal structure ensures isotropy, which facilitates uniform optical behavior, and its low thermal expansion coefficient enhances thermal stability.

With a wide optical transmission range extending from 0.12 µm to 10 µm, Yb:CaF_2 is well-suited for femtosecond solid-state lasers. Additionally, the material's low dispersion behavior minimizes phase

distortion during laser pulse propagation. These unique properties enable its usage across scientific and industrial applications requiring precision and high energy efficiency.

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3. General Applications and Examples

Yb:CaF_2 crystals find applications in:

- **Femtosecond Laser Systems:** Ideal for generating high-energy pulses with durations in the femtosecond range.
- **High-Power Laser Systems:** Their high thermal conductivity and low quantum defect support high-power diode-pumped solid-state lasers.
- **Material Processing:** Used in precise machining, micromachining, and laser welding.
- **Medical Lasers:** Suitable for laser-based surgeries and dermatological procedures requiring high precision.
- **Scientific Research:** Widely applied in research for ultra-fast phenomena and spectroscopy due to their broad absorption and emission spectra.

For example, Yb:CaF_2 is instrumental in diode-pumped systems generating femtosecond pulses at high average power for industrial and research applications.

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4. Chemical, Physical, and Structural Properties

Property	Value
Chemical Formula	Yb:CaF_2
Crystal Structure	Cubic
Cleavage Plane	(111)
Melting Point	1418 °C
Nonlinear Refractive Index	1.9 × 10^-16 cm^2/W
Density	3.18 g/cm^3
Thermal Conductivity	9.71 W/m·K
Thermal Expansion Coefficient	18.41 × 10^-6 K^-1
Mohs Hardness	4

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5. Optical and Laser Properties

Property	Value
Absorption Peak Wavelength	979 nm

Absorption Cross Section @ 980 nm	5.4 × 10^-21 cm²
Emission Cross Section @ 1035 nm	2.3 × 10^-21 cm²
Fluorescence Lifetime	2.2 ms
Refractive Index @ 1035 nm	1.42866

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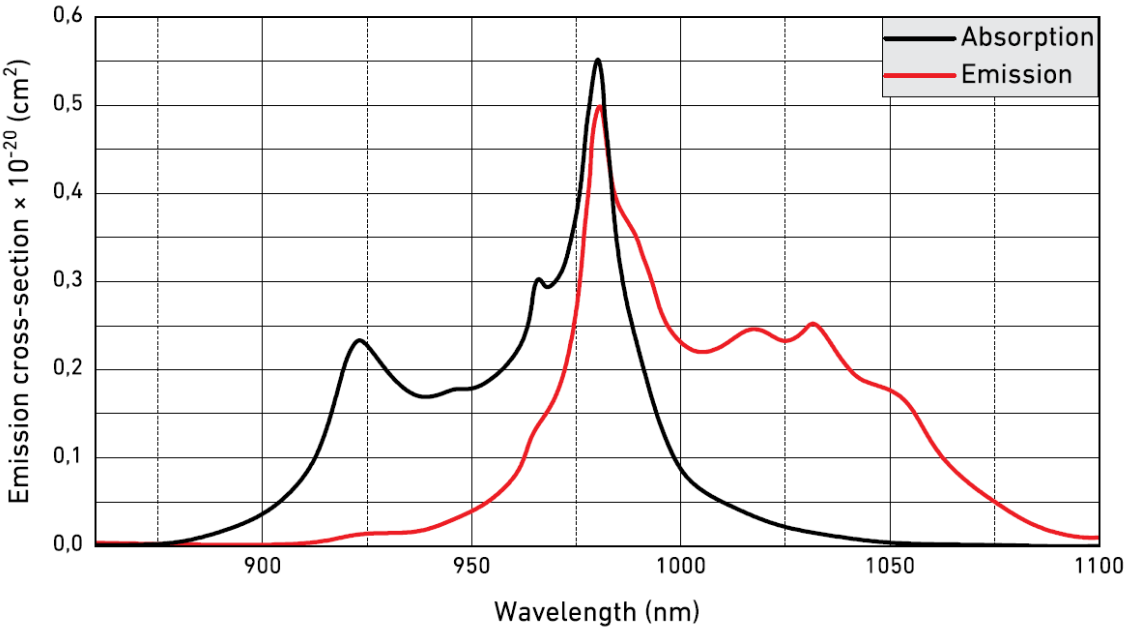
6. Spectrum Transmission Curves

The transmission curve reveals high optical transmission in the range of 0.12 µm to 10 µm, showcasing suitability for various wavelength operations.



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7. Coating Specifications

Coating Type	**Reflection Coefficient**
AR @ 980 nm–1060 nm	R < 0.2%
Custom Coatings	Available on request

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8. Standard Fabrication Specifications

Parameter	**Value**
Orientation	(111)
Clear Aperture	> 90%
Surface Flatness	λ/10 @ 632.8 nm

Parallelism Error	< 20 arc sec
Perpendicularity Error	< 10 arc min
Chamfer	0.15 mm at 45°
Surface Quality (Scratch/Dig)	10/5
Dimensional Tolerance	Diameter: ±0.1 mm, Length: ±0.5 mm

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9. POC Strength and Capabilities

Photonics On Crystals (POC) excels in the production of high-precision laser crystals tailored to meet diverse industrial and research demands. With advanced manufacturing facilities and quality control protocols, POC ensures consistent performance and unmatched reliability. Customization options, from doping levels to coatings, further enhance compatibility with specialized laser systems.

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10. Standard Products

Dimensions (mm)	Length (mm)	End Faces	Doping	Coatings	Price (USD)
10 × 10	10	Brewster-angle cut	1%	Uncoated	590
10 × 10	10	Right-angle cut	1%	AR @ 980 nm–1070 nm	590
3 × 3	5	Brewster-angle cut	3%	Uncoated	590
3 × 3	5	Right-angle cut	3%	AR @ 980 nm–1070 nm	590
Custom	Upon request	Upon request	Custom	Custom	Upon request

For more details, please contact **Photonics On Crystals (POC)**.