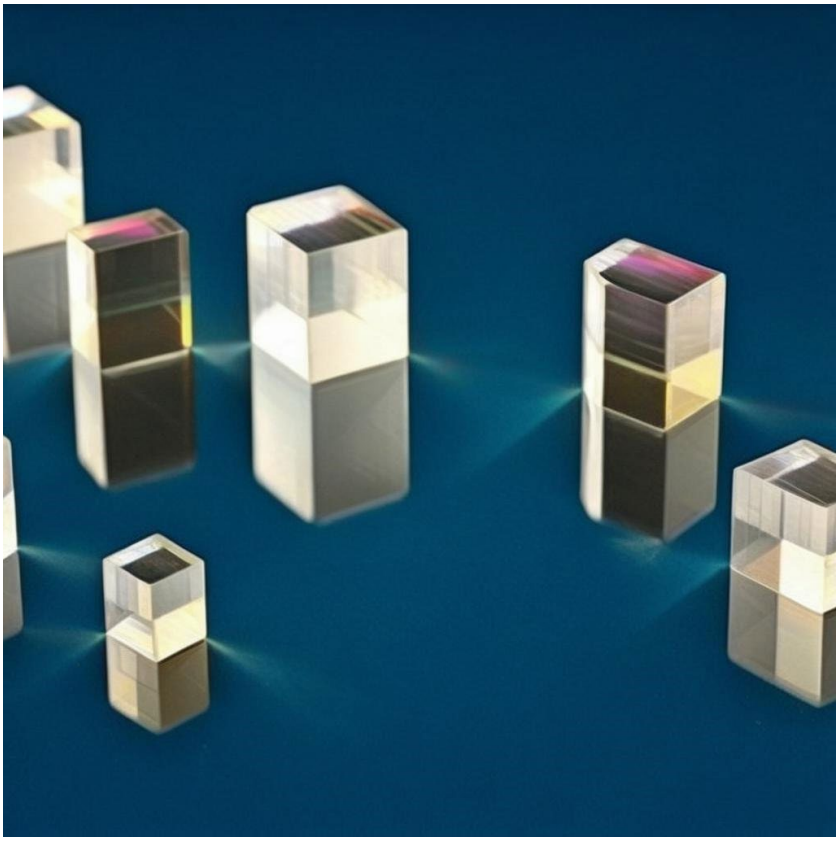
Photonics On Crystals

POC-OC-122483-Fe^{2+}/ZnS Crystal Datasheet

1 Main Features

- Wide tunability in the mid-IR spectrum (2.5–4.0 µm).
- High optical gain and low non-radiative losses, making it ideal for laser systems.
- Excellent thermal and mechanical properties for high-power applications.
- Durable and chemically stable for long-term use in industrial and medical environments.
- Customizable dimensions and coatings to meet various application needs.



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2. Material General Description

Fe^{2+}/ZnS crystals are doped zinc sulfide crystals specifically engineered for high-performance mid-infrared (mid-IR) laser systems. These crystals are characterized by their wide transparency range (0.4–12 µm) and strong absorption/emission properties in the mid-IR range, particularly from 2.5–4.0 µm. The doping of ZnS with iron ions enhances its optical gain and minimizes non-radiative losses, resulting in high-efficiency laser output. Fe^{2+}/ZnS crystals exhibit excellent thermal stability, mechanical durability, and chemical resistance, making them suitable for challenging environments. These properties, combined with their versatility and customizability, make Fe^{2+}/ZnS an indispensable component for mid-IR laser technology and spectroscopy applications.

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3. General Applications and Examples

1. **Mid-IR Laser Systems:**
   Fe^{2+}/ZnS crystals are utilized as active laser media in high-power mid-IR lasers for materials processing, enabling precise cutting and engraving of a wide range of materials.
2. **Medical Laser Applications:**
   The crystals' mid-IR tunability and high optical gain make them suitable for medical applications like laser surgery and dermatological treatments, providing precise energy delivery with minimal thermal damage to surrounding tissues.
3. **Spectroscopy and Gas Sensing:**
   Fe^{2+}/ZnS crystals are key components in tunable laser systems for gas spectroscopy, environmental monitoring, and industrial diagnostics, especially in applications requiring detection of trace gases.
4. **Optical Parametric Oscillators (OPOs):**
   These crystals are frequently used in OPO systems to generate coherent radiation in the mid-IR range, finding applications in scientific research, bioimaging, and defense.
5. **Infrared Imaging Systems:**
   Fe^{2+}/ZnS crystals contribute to high-performance thermal imaging systems for surveillance, military, and industrial purposes, where accurate imaging in the mid-IR range is essential.

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4. Chemical, Physical, or Structural Properties

Property	Value
Chemical Formula	ZnS with Fe^{2+} doping
Density	4.09 g/cm³
Thermal Conductivity	~27 $W \cdot m^{-1} \cdot K^{-1}$
Melting Point	~1700°C
Hardness	~3.5 (Moh's scale)
Crystal Structure	Cubic
Refractive Index	~2.3
Orientation	<111>, <110>, <100>
Cleavage Plane	<111>

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5. Optical, Laser, or Nonlinear Optical Properties

Property	Value
Transparency Range	0.4–12 µm

Emission Wavelength Range	2.5–4.0 µm
Absorption Cross-Section	High
Emission Cross-Section	High
Pump Wavelength Range	~1.9–2.1 µm
Laser Damage Threshold	>500 MW/cm²

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6. Spectrum Transmission Curves

The transmission spectrum of Fe^{2+}/ZnS crystal showcases excellent transparency over a wide wavelength range, with strong absorption and emission properties in the mid-IR region. Detailed graphs depicting transmission curves are available upon request.

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7. Coating Specification

- **Anti-Reflection Coating:** Custom coatings optimized for 2.5–4.0 µm range with reflectance <0.5%.
- **Durable Coatings:** Coatings designed to withstand harsh environmental conditions and prolonged laser exposure.
- **Specialized Coatings:** Tailored coatings available for specific laser applications.

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8. Standard Fabrication Specifications

Specification	Value
Dimensional Tolerance	±0.05 mm
Surface Quality	40-20 (scratch-dig rating)
Surface Flatness	λ/8 @ 632.8 nm
Parallelism	<30 arcsec
Bevel	<0.25 × 45°
Diameter Range	Up to 100 mm
Thickness Range	1–10 mm

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9. POC Strength and Capabilities

Photonics On Crystals (POC) specializes in high-quality Fe^{2+}/ZnS crystals for advanced photonics and laser applications. POC leverages cutting-edge fabrication technologies to produce custom solutions tailored to meet the unique requirements of industrial, scientific, and medical clients. Our rigorous quality control ensures reliable, high-performance products for demanding applications.

10. Standard Products

Product	Dimensions	Price (USD)
Fe^{2+}/ZnS Laser Rods	10–50 mm length	$1,200–$6,000
Fe^{2+}/ZnS Optical Windows	20–100 mm diameter	$2,000–$9,000
Fe^{2+}/ZnS Gain Mediums	Custom dimensions	$3,500–$16,000
Customization Options	Available on request	Contact for quote