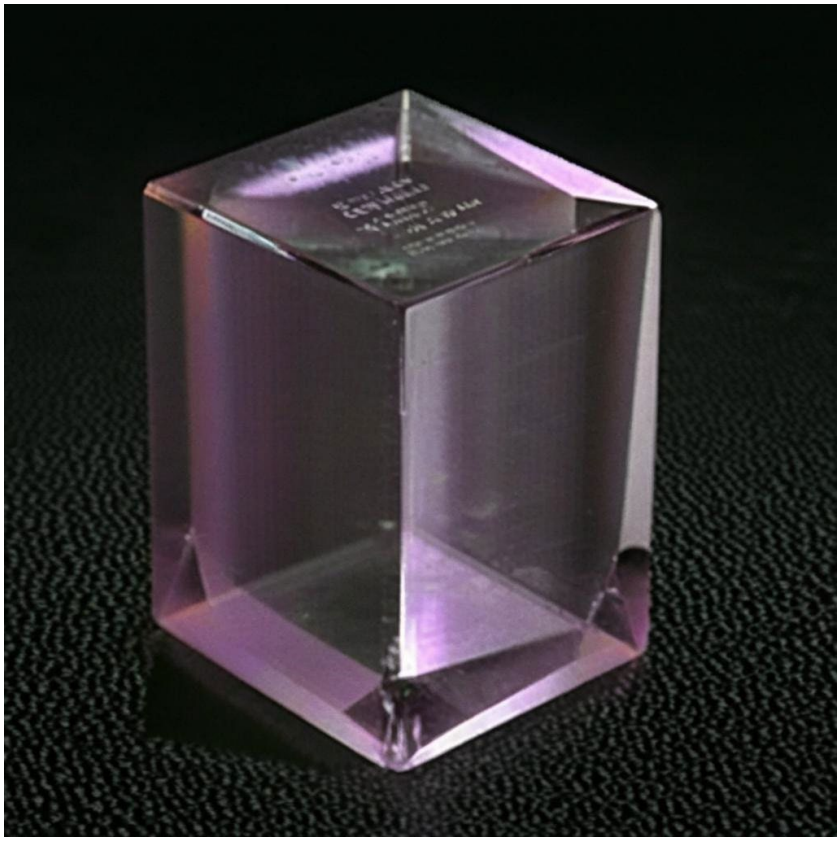
Photonics On Crystals

POC-OC-122481-Cr^{2+}/ZnS Crystal Datasheet

1 Main Features

- Broad tunability across the entire mid-IR spectrum (1.5–4.0 µm).
- High absorption and emission cross-sections for efficient laser output.
- Excellent mechanical strength and durability for long-term use.
- Low thermal lensing effect, ensuring high laser stability.
- Ideal material for mid-IR laser systems and medical applications.



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2. Material General Description

Cr^{2+}/ZnS crystals are doped zinc sulfide crystals that exhibit exceptional optical and physical properties, making them a preferred choice for mid-infrared (mid-IR) laser applications. These crystals have a broad emission spectrum and high thermal stability, allowing for tunable laser output between 1.5 and 4.0 µm. Cr^{2+} ions embedded in the ZnS crystal lattice provide strong absorption and emission properties that are critical for solid-state laser systems. This material is highly durable, with excellent resistance to environmental degradation and thermal fluctuations. Additionally, Cr^{2+}/ZnS crystals are suitable for pumping by widely available diode and solid-state lasers, enhancing their versatility in advanced photonics applications.

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3. General Applications and Examples

1. **Mid-IR Tunable Laser Systems:**
   Cr^{2+}/ZnS crystals are extensively utilized in mid-infrared laser systems due to their wide tunable range of 1.5–4.0 µm. These lasers find applications in medical diagnostics, chemical sensing, and environmental monitoring.
2. **Medical Applications:**
   The unique optical properties of Cr^{2+}/ZnS crystals make them suitable for tissue ablation, laser surgery, and dermatology, particularly in the mid-infrared spectrum where water absorption is optimal for soft tissues.
3. **OPO Applications (Optical Parametric Oscillators):**
   Cr^{2+}/ZnS crystals serve as the gain medium for mid-infrared OPO systems used in spectroscopy, remote sensing, and laser-induced fluorescence.
4. **Industrial Uses:**
   These crystals are employed in materials processing applications such as precision cutting and marking, where mid-IR lasers provide a high degree of control and efficiency.
5. **Research Applications:**
   Cr^{2+}/ZnS crystals are widely used in laser research to develop advanced mid-IR laser systems and test novel laser pumping configurations.

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4. Chemical, Physical, or Structural Properties

Property	Value
Chemical Formula	ZnS with Cr^{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	1.5–4.0 µm
Absorption Cross-Section	High
Emission Cross-Section	High
Pump Wavelength Range	~0.9–1.2 µm
Laser Damage Threshold	>500 MW/cm²

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6. Spectrum Transmission Curves

The transmission spectrum of Cr^{2+}/ZnS crystal spans a wide range, with high transparency from 0.4 to 12 µm. The transmission curves highlight efficient light propagation in the mid-infrared region, making it ideal for IR lasers. Graphical representations of the spectrum are available on request.

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7. Coating Specification

- **Anti-Reflection Coating:** Optimized for 1.5–4.0 µm with a reflectance of <0.5%.
- **Durability Coatings:** Enhance resistance to environmental damage and mechanical wear.
- **Custom Coatings:** Available on request for specific wavelength ranges or 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 the production and customization of Cr^{2+}/ZnS crystals for high-performance laser systems. POC employs advanced fabrication techniques and state-of-the-art facilities to deliver premium quality products. Our dedicated R&D team ensures that all crystals meet stringent optical and physical standards while offering custom solutions tailored to client needs.

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10. Standard Products

Product	Dimensions	Price (USD)
Cr^{2+}/ZnS Laser Rods	10–50 mm length	$1,000–$5,000
Cr^{2+}/ZnS Windows	20–100 mm diameter	$1,500–$8,000
Cr^{2+}/ZnS Gain Mediums	Custom dimensions	$3,000–$15,000
Customization Options	Available on request	Contact for quote