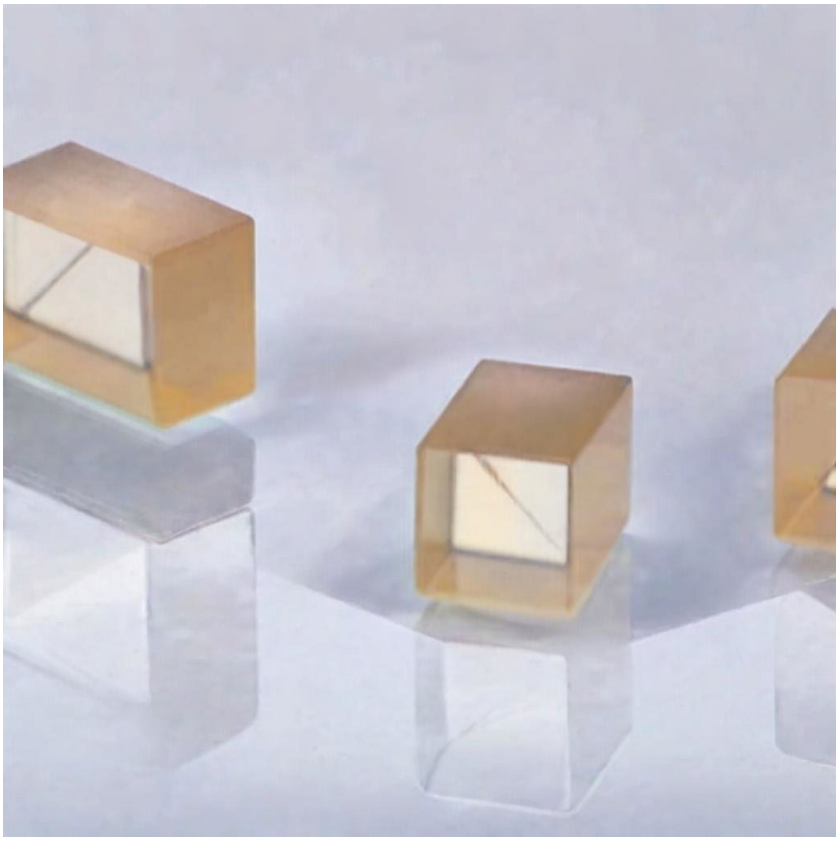
Photonics On Crystals

POC-OC-122425-AgGaSe2 Crystal Datasheet

1. Main Features

1. **Broad Transmission Range**: Operates from 0.73 µm to 18.3 µm, ideal for mid-IR and far-IR applications.
2. **High Nonlinear Coefficient**: Efficient for SHG, DFG, OPO, and other nonlinear optical processes with d_eff = 33 pm/V at 10.6 µm.
3. **Low Absorption and High Transparency**: Excellent performance with low absorption at key wavelengths.
4. **High Thermal and Damage Threshold**: Withstands high laser intensities with >10 MW/cm² damage threshold at 10.6 µm.
5. **Versatile Applications**: Suitable for CO_2 lasers, solid-state lasers, and tunable OPO systems.



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2. Material General Description

Silver Gallium Selenide ($AgGaSe_2$) is a nonlinear optical crystal with a wide transparency range of 0.73–18.3 µm, making it indispensable for mid-infrared and far-infrared optical systems. Known for its exceptional nonlinear optical coefficients (d_eff = 33 pm/V at 10.6 µm), $AgGaSe_2$ is commonly used in frequency conversion processes, including second-harmonic generation (SHG), optical parametric oscillation (OPO), and difference frequency generation (DFG).

With low absorption, high damage thresholds, and precise phase-matching capabilities, $AgGaSe_2$ is a critical component for CO_2 lasers, tunable laser sources, and infrared spectroscopy systems. Its Sellmeier equations ensure accurate refractive index calculations, allowing efficient design of nonlinear optical systems.

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3. General Applications and Examples

$AgGaSe_2$ crystals are versatile and widely used in high-performance nonlinear optical systems. Below are some of the key applications:

1. Frequency Conversion:

- Efficient SHG, DFG, and SFG processes for IR and mid-IR wavelengths.
- **Example**: Used for generating mid-IR wavelengths from CO and CO_2 laser systems in industrial and scientific research.

2. Optical Parametric Oscillators (OPOs):

- Enables tunable wavelength generation from 4.0 to 18.3 µm.
- **Example**: $AgGaSe_2$-based OPOs are applied in environmental gas sensing and medical diagnostics.

3. Mid-IR Lasers:

- Enhances the functionality of CO_2 and CO lasers for high-precision cutting, engraving, and spectroscopy.
- **Example**: Used in industrial laser systems for cutting and material processing.

4. Spectroscopy and Sensing:

- Facilitates mid-IR spectroscopy for material and biomedical analysis.
- **Example**: Ideal for infrared imaging and detection systems in research labs.

5. Quantum Optics:

- Supports advanced quantum systems requiring mid-IR photon generation and manipulation.
- **Example**: Used in secure quantum communication systems and IR photon detectors.

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4. Chemical and Structural Properties

Property	**Value**
Chemical Formula	$AgGaSe_2$
Crystal Structure	Tetragonal, 42m
Lattice Parameters	a = 5.992 Å, c = 10.8803 Å
Density	5.7 g/cm³

Mohs Hardness	3.35
Melting Point	851 °C
Transparency Range	0.73 µm–18.3 µm
Nonlinear Coefficients	d_eff = 33 pm/V at 10.6 µm
Thermal Conductivity	1.4 W/m·K
Thermal Expansion Coefficient	19.8×10^{-6}/°C

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5. Optical and Nonlinear Optical Properties

Property	**Value**
Nonlinear Process	SHG, DFG, SFG, and OPO
Refractive Indices (10.6 µm)	$n_o = 2.5917$, $n_e = 2.5585$
Absorption Coefficient	<0.05 cm^{-1} at 1.064 µm; <0.02 cm^{-1} at 10.6 µm
Laser Damage Threshold	>10 MW/cm^2 (150 ns pulses at 10.6 µm)
Sellmeier Equations	$n^2 = 6.6792 + 0.4598/(\lambda^2 - 0.2122) - 0.00126\lambda^2$
	$n^2 = 6.8507 + 0.4297/(\lambda^2 - 0.1584) - 0.00125\lambda^2$

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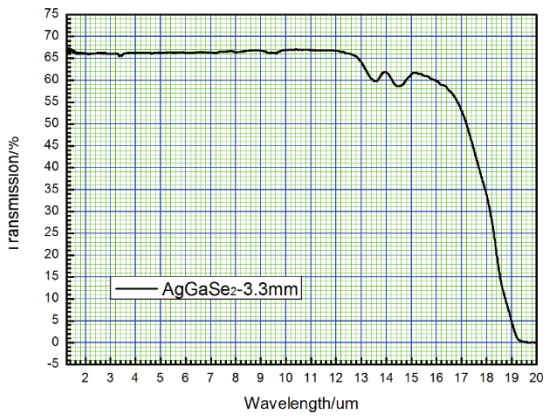
6. Spectrum Transmission Curves

The spectrum transmission range of $AgGaSe_2$ is characterized by high transparency between 0.73 and 18.3 µm. The crystal shows minimal losses across this range, making it suitable for mid-IR and far-IR applications. Key characteristics:

- **Peak Transmission**: Between 3 µm and 12 µm.
- **Lower Transparency**: Slight absorption below 0.73 µm and above 18 µm.



(*Note*: Graphical data can be generated or requested from POC's technical team.)

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7. Coating Specification

Coating Type	Specifications
Broadband AR Coating	BBAR at 1.7–2.7 µm and 5–18 µm
Custom Coatings	Available upon request

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8. Standard Fabrication Specifications

Specification	Value
Dimensions	5 × 5 × 1 mm (standard)
Surface Flatness	Lambda/6 @ 632.8 nm
Parallelism	< 30 arc seconds
Perpendicularity	< 10 arc minutes
Surface Quality	60-40 Scratch-Dig

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9. POC Strength and Capabilities

Photonics On Crystals (POC) is a premier supplier of high-quality nonlinear optical crystals. With state-of-the-art manufacturing facilities, POC provides:

- Customizable solutions tailored to specific applications in spectroscopy, lasers, and sensing.
- Expertise in optical coatings and precision crystal engineering.
- Global technical support and rapid prototyping for research and industry.

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10. Standard Products

Product Code	Dimensions (mm)	Coating	Price (USD)
AGSE-01	2 × 2 × 1	BBAR @ 1.7–2.7 µm	Request Quote
AGSE-02	5 × 5 × 1	BBAR @ 5–18 µm	Request Quote
AGSE-03	10 × 10 × 2	BBAR @ 1.7–18 µm	Request Quote
Custom-AGSE	Customizable	Customizable	Request Quote