

AgGaS₂ crystals

AGS is transparent from 0.50 to 13.2 μm . Although its nonlinear optical coefficient is the lowest among the mentioned infrared crystals, high short wavelength transparency edging at 550 nm is made use of in OPOs pumped by Nd:YAG laser; in numerous difference frequency mixing experiments with diode, Ti:Sapphire, Nd:YAG and IR dye lasers covering 3–12 μm range; in direct infrared countermeasure systems, and for SHG of CO₂ laser. Thin AgGaS₂ (AGS) crystal plates are popular for ultrashort pulse generation in mid IR range by difference frequency generation employing NIR wavelength pulses.



Dimensions:

Standard cross sections are 8x 8mm, 5 x 5mm, Crystal length range from 1 to 30 mm. Custom sizes are also available on request.

Orientation:

The standard AGS crystal orientation an angle of $\theta=39^\circ$; $\Phi=45^\circ$ Custom orientations are available on request.

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Applications:

- Generation second harmonics on CO and CO₂ - lasers
- Optical parametric oscillator
- Different frequency generator to middle infrared regions up to 12 mkm.
- Frequency mixing in the middle IR region from 4.0 to 18.3 μm
- Tuneable solid state lasers (OPO pumped by Nd:YAG and others lasers operating in 1200 to 10000 nm region with efficiency 0.1 to 10 %)
- Optical narrow-band filters in the region near isotropic point (0.4974 m at 300 °K), transmission band being tuned at temperature variation
 - Up-conversion of CO₂ laser radiation image into near-IR or visible region by using/ or use of Nd:YAG, ruby or dye lasers with efficiency up to 30 %

Linear Optical Properties

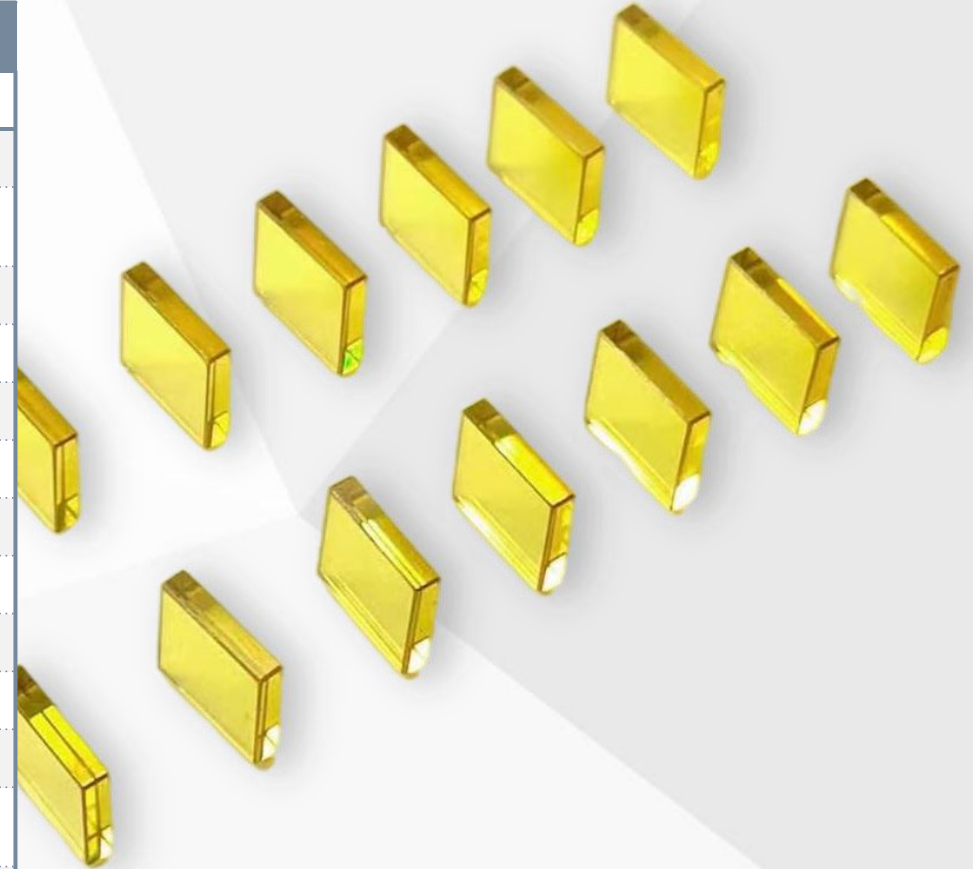
Transparency Range	0.50-13.2 um	
Refractive Indices@ 1.064 um@ 5.300 um@ 10.60um	no2.45212.39452.3472	ne2.39902.34082.2934
Thermo-Optic Coefficients	dno/dt=15.4 x 10 ⁻⁵ /°C dne/dt=15.5 x 10 ⁻⁵ /°C	
Sellmeier Equations(λ in um)	no ² =3.3970+2.3982/(1-0.09311/λ ²)+2.1640/(1-950/λ ²) ne ² =3.5873+1.9533/(1-0.11066/λ ²)+2.3391/(1-1030.7/λ ²)	

Nonlinear Optical Properties

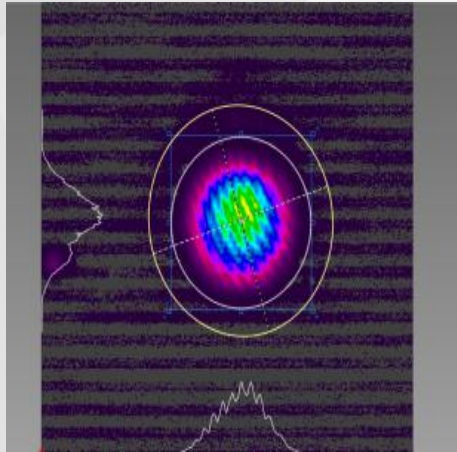
Phase-Matching SHG Range	1.8-11.2 um
NLO Coefficients @ 1.064 um	d ₃₆ =d ₂₄ =d ₁₅ =23.6 pm/V
Linear Electro-optic Coefficients	Y ₄₁ T=4.0 pm/V Y ₆₃ T=3.0 pm/V
Damage threshold@ ~ 10 ns, 1.064 um	25 MW/cm ² (surface),500 MW/cm ² (bulk)

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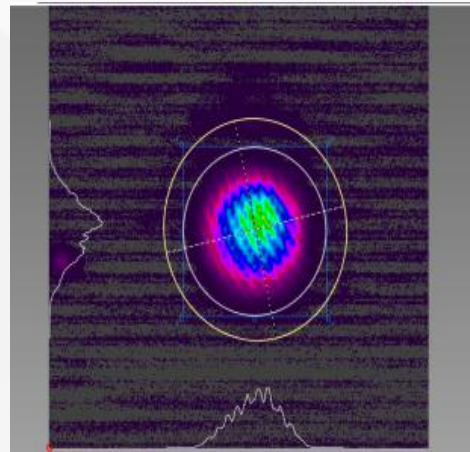
Basic Properties	
Lattice parameters	$a = 5.757, c = 10.311 \text{ \AA}$
Non-linear coefficient at 10.6 μm	$d_{36} = 12.5 \text{ pm/V}$
Optical damage threshold at 10.6 μm , 150 ns	10 - 20 MW/cm ²
parallel to c-axis	$12.5 \times 10^{-6} \text{ x } ^\circ\text{C}^{-1}$
perpendicular to c-axis	$-13.2 \times 10^{-6} \text{ x } ^\circ\text{C}^{-1}$
Crystal Structure	Tetragonal
Cell Parameters	$a=5.756 \text{ \AA}, c=10.301 \text{ \AA}$
Melting Point	997 $^\circ\text{C}$
Density	4.702 g/cm ³
Mohs Hardness	3-3.5
Absorption Coefficient	0.6 cm ⁻¹ @ 10.6 μm
Relative Dielectric Constant @ 25 MHz	$\epsilon_{11s}=10\epsilon_{11t}=14$
Thermal Expansion Coefficient	C: $-13.2 \times 10^{-6} /^\circ\text{C}$ \perp C: $+12.5 \times 10^{-6} /^\circ\text{C}$
Thermal Conductivity	1.5 W/M/ $^\circ\text{C}$



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Original beam shape

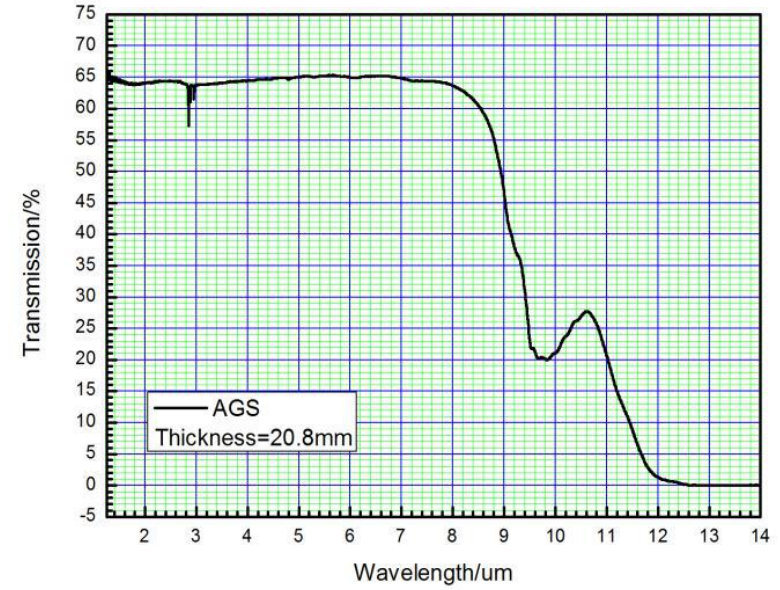
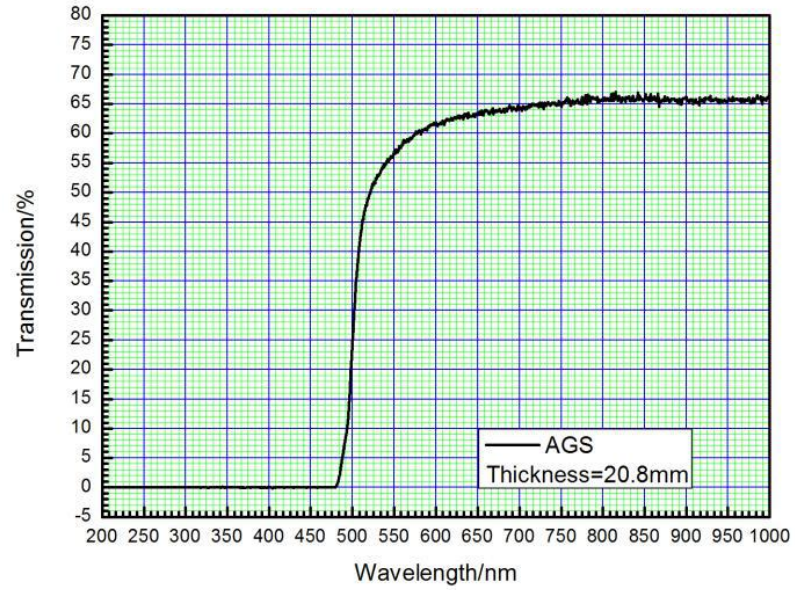


Transmittance beam shape

AgGaS₂ (AGS) crystal displays excellent bulk quality across the transmission range, expect for residual a ray absorption centered near 1.8um. Surface absorption may increase with time, but the behavior is now greatly improved over that earlier crystals. The phase matching and nonlinear optical properties of AGS allow various SFM/DFM interactions from the visible to Middle infrared.

Technical Parameters	
Wavefront distortion	less than $\lambda/6$ @ 633 nm
Dimension tolerance	(W +/-0.1 mm) x (H +/-0.1 mm) x (L +0.2 mm/-0.1 mm)
Clear aperture	> 90% central area
Flatness	$\lambda/6$ @ 633 nm for T>=1.0mm
Surface Quality	Scratch/dig 20/10 per MIL-O-13830A
Parallelism	better than 1 arc min
Perpendicularity	5 arc minutes
Angle tolerance	$\Delta\theta < +/-0.25^\circ$, $\Delta\phi < +/-0.25^\circ$

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Measured transmission curve of AgGaS₂ crystals