When every photon counts®

Hellma® Materials
CVD Ceramics

CVD Zinc Selenide®

CO_2 Laser Optics | IR applications

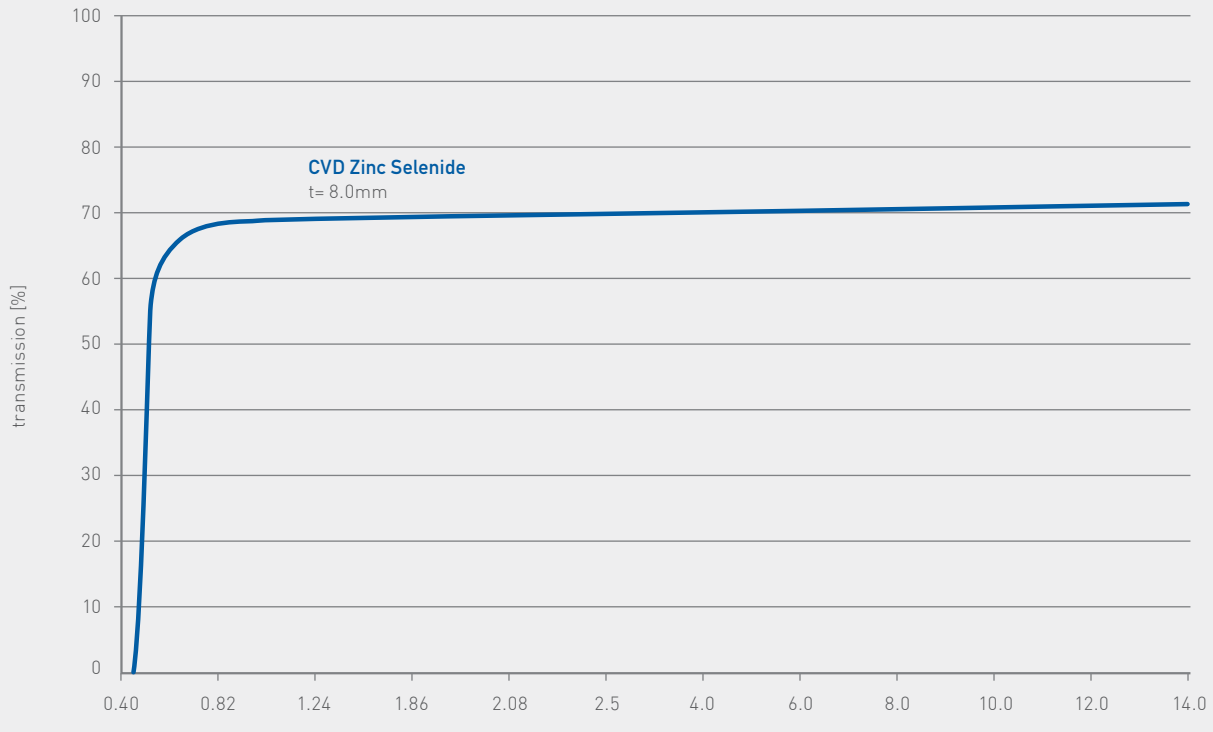
CVD Zinc Selenide®

Chemically vapor deposited CVD Zinc Selenide® is the material of choice for use as optical components in high powered CO_2 lasers due to its low bulk absorption at 10.6 microns. Its index of refraction homogeneity and uniformity offers excellent optical performance for use as protective windows or optical elements in high resolution forward looking (FLIR) thermal imaging equipment. This material has also been used as small windows and lenses in medical and industrial applications, such as thermometry and spectroscopy.

CVD Zinc Selenide® is chemically inert, non-hygroscopic, highly pure, theoretically dense and easily machined. It has extremely low bulk losses due to absorption and scatter, has a high resistance to thermal shock and is stable in virtually all environments.

Custom diameters, rectangles, CNC-profiled blanks, generated lens blanks, prisms and near-net shape domes can be made to your specifications.

Spectral Transmission CVD Zinc Selenide®



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Properties of CVD Zinc Selenide®

	Zinc Selenide
Optical properties	
10% transmission limits (t=6mm)	0.5µm – 22µm
Index of refraction inhomogeneity (Δn/n)	<3ppm @ 633nm
Thermo-optic coefficient dn/dT (298-358K)	
K^{-1} @ 0.6328µm	1.07×10^{-4}
K^{-1} @ 1.15µm	7.0×10^{-5}
K^{-1} @ 3.39µm	6.2×10^{-5}
K^{-1} @ 10.6µm	6.1×10^{-5}
Bulk absorption coefficient	
cm^{-1} @ 1.3µm	5.0×10^{-3}
cm^{-1} @ 2.7µm	7.0×10^{-4}
cm^{-1} @ 3.8µm	4.0×10^{-4}
cm^{-1} @ 5.25µm	4.0×10^{-4}
cm^{-1} @ 10.6µm	5.0×10^{-4}
Thermal properties	
Coefficient of Thermal Expansion	
[K^{-1}] @273K	7.1×10^{-6}
[K^{-1}] @373K	7.8×10^{-6}
[K^{-1}] @473K	8.3×10^{-6}
Thermal conductivity [$JK^{-1}m^{-1}s^{-1}$] @298K	18.0
Heat capacity [$Jg^{-1}K^{-1}$] @298K	0.339

Pulse Laser Damage

@ 10.6µm, pulse width 15µs, 1 pulse

Angle of incidence	Fluence [Jcm^{-2}]	Plasma at surface	Surface damage
Normal	20	no	no damage
Normal	25	yes	failure
Brewster	15	no	no damage
Brewster	20	no	rear surface damage

	Zinc Selenide
Mechanical properties	
Hardness:	
Knoop, 50g load [$kg\ mm^{-2}$]	110
Vickers, 1kg load [$kg\ mm^{-2}$]	112
Flexural strength (modulus of rupture)	
4pt. loading [psi]	8×10^{3}
4pt. loading [MPa]	55
Fracture toughness (critical stress intensity factor, K_{IC} values)	
[MPa $\sqrt{m}$, Vickers, 100g]	0.5
Young's modulus	
[psi]	9.75×10^{6}
[GPa]	67.2
Poisson's ratio	0.28
Physical properties	
Crystal structure	cubic
Grain size	50-70µm
Density [$g\ cm^{-3}$] @298K	5.27
Resistivity [Ω cm]	$\sim 10^{12}$
Chemical purity [%]	99.9996

Indices of refraction [at 20°C]

Wavelength [µm]	n
0.54	2.6754
0.62	2.5994
1.00	2.4892
3.00	2.4376
5.00	2.4295
7.00	2.4218
9.00	2.4122
11.00	2.4001
13.00	2.3850
15.00	2.3665
17.00	2.3438

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