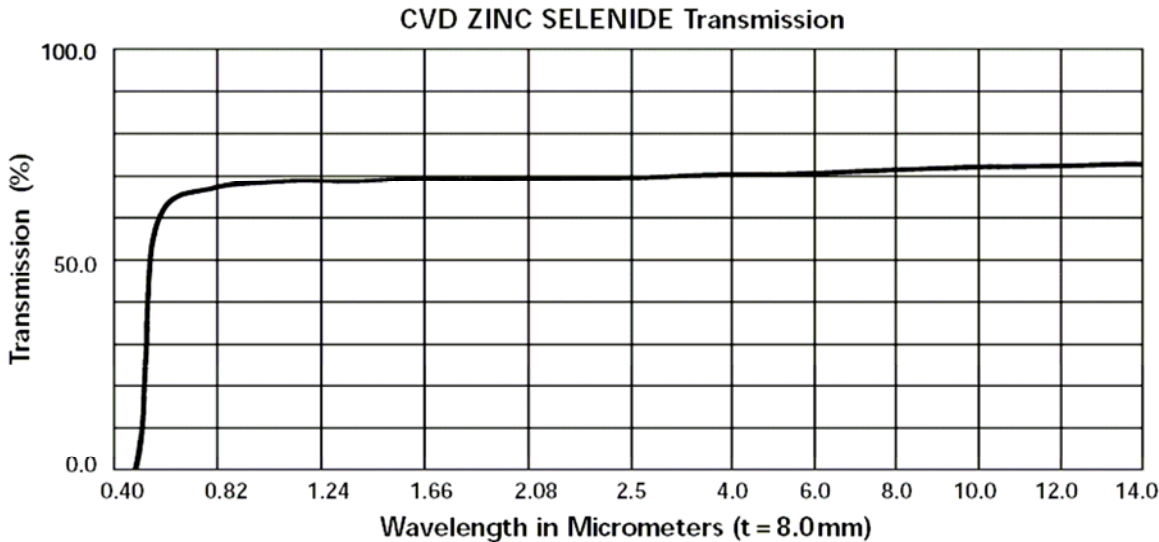


CVD ZINC SELENIDE®



Application

Chemically vapor deposited zinc selenide (CVD ZnSe) is the material of choice for use as optical components in high powered CO₂ 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 infrared (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.

Advanced Materials' 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.

Circular blanks and sheet material are available in stock to meet your most urgent delivery requirements. Custom diameters, rectangles, CNC-profiled blanks, generated lens blanks, prisms and near-net shape domes can also be made to your specifications.

Advanced Materials' CVD ZINC SELENIDE is also available as an evaporative source material. It is supplied in specified lump sizes (2-20mm), which to minimize surface contamination, are hand selected to be free from saw cut, abraded or polished edges.

Optical Properties

10% transmission limits (t=6mm)	0.5 - 22 μm
Index of refraction inhomogeneity (Δn/n) (ppm @ 0.6328 μm)	<3
Thermo-optic coefficient, dn/dT(298-358K) (avg. values, see back page for more details)	
(K ⁻¹ @ 0.6328 μm)	1.07 x 10 ⁻⁴
(K ⁻¹ @ 1.15 μm)	7.0 x 10 ⁻⁵
(K ⁻¹ @ 3.39 μm)	6.2 x 10 ⁻⁵
(K ⁻¹ @ 10.6 μm)	6.1 x 10 ⁻⁵
Bulk absorption coefficient	
(cm ⁻¹ @ 1.3 μm)	5.0 x 10 ⁻³
(cm ⁻¹ @ 2.7 μm)	7.0 x 10 ⁻⁴
(cm ⁻¹ @ 3.8 μm)	4.0 x 10 ⁻⁴
(cm ⁻¹ @ 5.25 μm)	4.0 x 10 ⁻⁴
(cm ⁻¹ @ 10.6 μm)	5.0 x 10 ⁻⁴

Physical Properties

Crystal structure	cubic
Grain size (diameter)	50 - 70 μm
Density (g cm ⁻³ @ 298 K)	5.27
Resistivity (Ωcm)	~ 10 ¹²
Chemical purity (%)	99.9996

For dielectric constant data, please request the Dielectric Properties bulletin.

Thermal Properties

Coefficient of Thermal Expansion	
(K ⁻¹ @ 273 K)	7.1 x 10 ⁻⁶
(K ⁻¹ @ 373 K)	7.8 x 10 ⁻⁶
(K ⁻¹ @ 473 K)	8.3 x 10 ⁻⁶
Thermal conductivity	
(JK ⁻¹ m ⁻¹ s ⁻¹ @ 298 K)	18.0
Heat capacity (Jg ⁻¹ K ⁻¹ @ 298K)	0.339

Maximum operating temperature will depend on the environment.



**Indices of Refraction (n) of
CVD ZINC SELENIDE¹**

as a function of wavelength at room temperature (20°C)

Wavelength (μm)	n	Wavelength (μm)	n
0.54	2.6754	7.40	2.4201
0.58	2.6312	7.80	2.4183
0.62	2.5994	8.20	2.4163
0.66	2.5755	8.60	2.4143
0.70	2.5568	9.00	2.4122
0.74	2.5418	9.40	2.4100
0.78	2.5295	9.80	2.4077
0.82	2.5193	10.20	2.4053
0.86	2.5107	10.60	2.4028
0.90	2.5034	11.00	2.4001
0.94	2.4971	11.40	2.3974
0.98	2.4916	11.80	2.3945
1.00	2.4892	12.20	2.3915
1.40	2.4609	12.60	2.3883
1.80	2.4496	13.00	2.3850
2.20	2.4437	13.40	2.3816
2.60	2.4401	13.80	2.3781
3.00	2.4376	14.20	2.3744
3.40	2.4356	14.60	2.3705
3.80	2.4339	15.00	2.3665
4.20	2.4324	15.40	2.3623
4.60	2.4309	15.80	2.3579
5.00	2.4295	16.20	2.3534
5.40	2.4281	16.60	2.3487
5.80	2.4266	17.00	2.3438
6.20	2.4251	17.40	2.3387
6.60	2.4235	17.80	2.3333
7.00	2.4218	18.20	2.3278

**Thermo-optic Coefficient,
CVD ZINC SELENIDE¹**

dn/dT (10⁻⁵K⁻¹)

Temp °C	Wavelength (μm)			
	0.6328	1.15	3.39	10.6
-180	7.6	5.4	5.0	4.9
-160	8.2	5.7	5.2	5.1
-140	8.7	6.0	5.4	5.4
-120	9.1	6.3	5.6	5.5
-100	9.4	6.5	5.8	5.7
-80	9.7	6.6	5.9	5.8
-60	10.0	6.7	6.0	5.9
-40	10.2	6.8	6.1	6.0
-20	10.3	6.9	6.1	6.0
0	10.5	7.0	6.2	6.1
20	10.6	7.0	6.2	6.1
40	10.7	7.0	6.2	6.1
60	10.8	7.1	6.3	6.1
80	10.9	7.1	6.3	6.2
100	11.0	7.2	6.3	6.2
120	11.1	7.2	6.4	6.3
140	11.3	7.3	6.4	6.3
160	11.5	7.4	6.5	6.4
180	11.8	7.6	6.6	6.6
200	12.1	7.8	6.7	6.7
σ ²	0.1	0.1	0.1	0.1

¹Standard deviation from a third degree polynomial fit.

¹A. Feldman et al. Final Technical Report Feb. 1, 1978 - Sept 30, 1978, National Bureau of Standards Technical Note 933, 53-54

Mechanical Properties

Hardness:	Knoop, 50 gm load(kg mm ⁻²)	110
	Vickers, 1kg load (kg mm ⁻²)	112
Flexural Strength (modulus of rupture)	4 pt. loading (psi)	8.0 x 10 ³
	4 pt. loading (MPa)	55
Fracture toughness (critical stress intensity factor, K _{IC} values)	(MPa√m, Vickers, 100g)	0.5
Young's modulus (elastic modulus)	(psi)	9.75 x 10 ⁶
	(GPa)	67.2
Poisson's ratio		0.28
Rain erosion resistance will depend on the environment.		

Pulse Laser Damage

Pulse Laser Damage @ 10.6 μm, pulse width 15 μs

Angle of Incidence	Conditions		Results	
	Fluence (Jcm ⁻²)	Pulses (20Hz)	Plasma At Surface	Surface Damage
Normal	20	1	no	no damage
Normal	25	1	yes	failure
Brewster	15	1	no	no damage
Brewster	20	1	no	rear surface damage