

# CVD-ZnSe

ZnSe is used as a material for production of optical elements (windows, lenses, prisms) for IR range including the passive laser optics elements. CVD - ZnSe is extremely uniform in structure, it has superior optical transmission with extremely low bulk losses from scatter and absorption. CVD - ZnSe is the first choice for high power laser windows and multispectral application with useful transmitting range of 0.5 - 19  $\mu\text{m}$ . It offers excellent imaging characteristics, high resistance to thermal shock, and is stable in virtually all operating environments. This material is soft and non-hygroscopic.

## Physical properties of ZnSe

Density @ 300K, $\text{g/cm}^3$		5.27
Melting point, K		1798
Thermal conductivity @ 298K, $\text{J}/(\text{K} \times \text{m} \times \text{c})$		18.0
Thermal expansion 1/K	@ 273 K	$7.1 \times 10^{-6}$
	@ 373 K	$7.8 \times 10^{-6}$
	@ 473 K	$8.3 \times 10^{-6}$
Heat capacity @ 298 K, $\text{J}/(\text{g} \times \text{K})$		0.339
Hardness	Knoop, with 50g indenter, $\text{Kg/mm}^2$	120
	Vickers, with 1 kg indenter, $\text{Kg/mm}^2$	112
Youngs modulus (E), GPa		67.2
Bulk modulus (K), GPa		40
Apparent elastic limit, MPa		55.1
Fracture toughness $\text{MN m}^{-1.5}$ , Vickers, 100g		0.5
Poisson's ratio		0.28
Solubility		Insoluble in water
Resistivity, Ohm x cm		$10^{12}$

## Optical properties

Thermo-optic coefficient, $(\text{dn}/\text{dT})$ @10.6 $\mu\text{m}$ @ 298-358 K, 1/K	$6.1 \times 10^{-5}$
Reststrahlen peak, $\mu\text{m}$	45.7
Reflection loss @ 10.6 $\mu\text{m}$ (2 surfaces), %	29.1
Reflection inhomogeneity $(\text{dn}/\text{n})$ @ 0.633 $\mu\text{m}$ , less than	3

CVD - ZnSe blanks are available in diameters 2 - 200 mm with thickness up to 15 - 20 mm.



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### ZnSe refractive index vs wavelength

$\lambda$ , $\mu\text{m}$	$n(\lambda)$	$\lambda$ , $\mu\text{m}$	$n(\lambda)$	$\lambda$ , $\mu\text{m}$	$n(\lambda)$
0.54	2.6754	3.00	2.4376	10.60	2.4028
0.58	2.6312	3.40	2.4356	11.40	2.3974
0.62	2.5994	3.80	2.4339	11.80	2.3945
0.66	2.5755	4.20	2.4324	12.20	2.3915
0.70	2.5568	4.60	2.4309	12.60	2.3883
0.74	2.5418	5.00	2.4295	13.00	2.3850
0.78	2.5295	5.40	2.4281	13.40	2.3816
0.82	2.5193	5.80	2.4266	13.80	2.3781
0.86	2.5107	6.20	2.4251	14.20	2.3744
0.90	2.5034	6.60	2.4235	14.60	2.3705
0.94	2.4971	7.00	2.4218	15.00	2.3665
0.98	2.4916	7.40	2.4201	15.40	2.3623
1.00	2.4892	7.80	2.4183	15.80	2.3579
1.40	2.4609	8.20	2.4163	16.20	2.3534
1.50	2.4560	8.60	2.4143	16.60	2.3487
1.80	2.4496	9.00	2.4122	17.00	2.3438
2.00	2.4460	9.40	2.4100	17.40	2.3387
2.20	2.4437	9.80	2.4077	17.80	2.3333
2.60	2.4401	10.20	2.4053	18.20	2.3278

Depending on application we use two grades of CVD - ZnSe with different optical properties. There is no difference in transmission at 8 $\mu\text{m}$  and above (see fig.1).

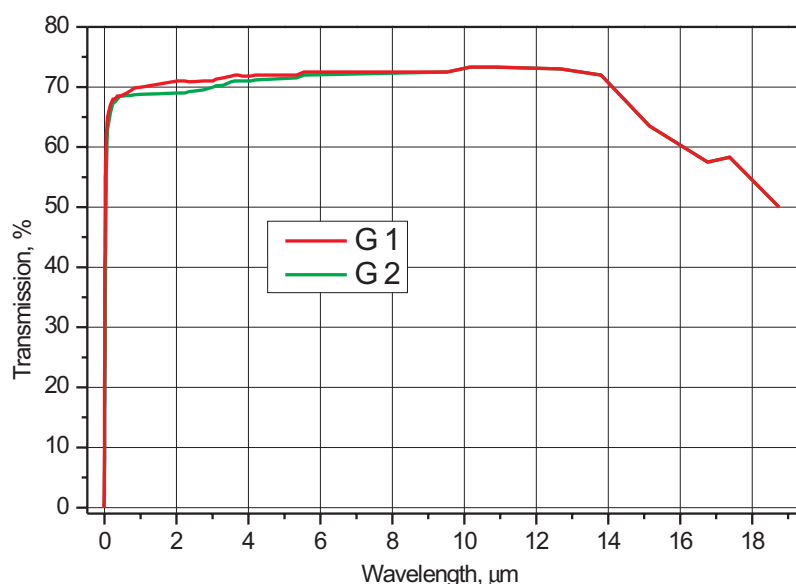


Fig.1 Transmission spectrum of CVD - ZnSe window thickness of 10 mm.

	G 1	G 2
Absorption index @ 10.6 $\mu\text{m}$ , less than, 1/cm	$(5 - 8) \times 10^{-4}$	$1 \times 10^{-3}$
Damage threshold, not less than, kW/cm <sup>2</sup>	2 - 3	-



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