

Cadmium Selenide

Cadmium selenide is a hexagonal crystal with wurtzite structure. Synthetic crystals of such kind are grown from vapor-phase phase and are black in color.

Cadmium selenide is transparent in the range between 0.75 μm and 24.5 – 25.5 μm . Due to that, parts made of cadmium selenide can be used in near and mid-IR. Upper limit of the transparency range is determined by the lattice absorption of the material.

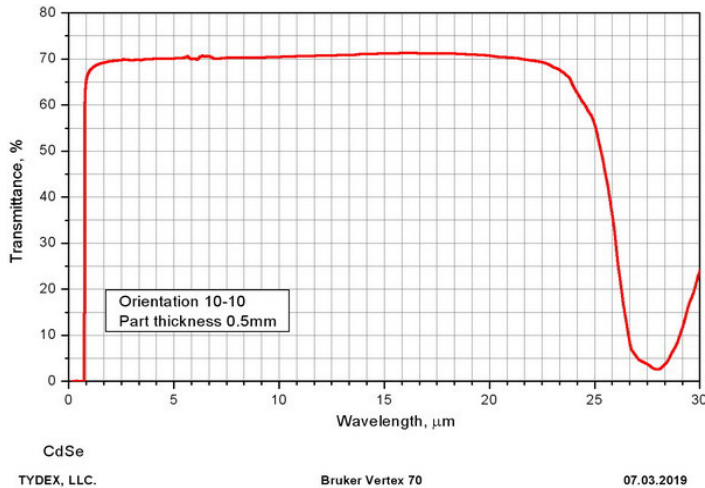


Fig. 1. Transmission spectrum of monocrystalline cadmium selenide.

For some crystallographic orientations, the hexagonal structure of the crystal exhibits natural birefringence. Therefore, these crystals can be used to produce waveplates of various orders.

Moreover, cadmium selenide is virtually the only material that is birefringent in the range between 16-24 μm .

Cadmium selenide has low absorption coefficient. Therefore, its crystals can be used in non-linear optical transformers and parametric oscillators where the radiation load is high.

Table 1. Key physical properties of optical-grade monocrystalline cadmium selenide.

Crystal structure	Hexagonal, space group $P6_3mc$, point group $6mm$
Primitive cell dimensions, \AA	$a=4.298, b=7.013$
Refractive indices	$n_o=2.339, n_e=2.351$ @22 μm $n_o=2.399, n_e=2.419$ @16 μm $n_o=2.431, n_e=2.452$ @10 μm $n_o=2.446, n_e=2.466$ @5 μm $n_o=2.461, n_e=2.479$ @2.4 μm $n_o=2.482, n_e=2.501$ @1.6 μm $n_o=2.645, n_e=2.661$ @0.8 μm
Optical homogeneity, cm^{-1} (@ 10.6 μm)	$<1 \times 10^{-2}$
Dislocation density, cm^{-2}	$<5 \times 10^4$
Density, g/cm^3	5.81
Curie temperature, $^\circ\text{C}$	503
Melting point, $^\circ\text{C}$	1537
Mohs hardness	3.25
Thermal expansion coefficients (@ 25 $^\circ\text{C}$), K^{-1}	$\parallel c=2.45 \times 10^{-6}, \perp c=4.4 \times 10^{-6}$
Thermal conductivity, $\text{W}/(\text{m} \times \text{K})$	$\parallel c=6.9, \perp c=6.2$

Specific heat capacity, $\text{J}/(\text{kg} \times \text{K})$	258
Elastic constants, GPa (@298 K)	$C_{11}^E=74.1, C_{33}^E=83.6, C_{44}^E=13.17,$ $C_{12}^E=45.2, C_{13}^E=39.3$
Piezoelectric constants, C/N	$D_{33}=7.81 \times 10^{-12}, D_{15}=-10.1 \times 10^{-12},$ $D_{31}=3.8 \times 10^{-12}$
Dielectric constants (@300 K)	$\epsilon_{11/\epsilon 0}^T=9.7, \epsilon_{33/\epsilon 0}^T=10.65,$ $\epsilon_{11/\epsilon 0}^S=9.53, \epsilon_{33/\epsilon 0}^S=10.2$
Linear electrooptic coefficients, m/V	$r_{13}^S=1.8 \times 10^{-12}, r_{33}^S=4.8 \times 10^{-12}$
Nonlinear optic coefficients, m/V (@ 10.6 μm)	$d_{33}=55 \times 10^{-12}, d_{31}=-28 \times 10^{-12},$ $d_{15}=31 \times 10^{-12}$
Sellmeier equation coefficients (λ in μm)	$n_o^2=4.1321+1.8587 \lambda^2/(\lambda^2-0.2187)+3.0461 \lambda^2/(\lambda^2-3380)$ $n_e^2=4.0829+2.0038 \lambda^2/(\lambda^2-0.2075)+3.554 \lambda^2/(\lambda^2-3629)$
Solubility	Soluble in hot nitric and phosphoric acid. Insoluble in water

The properties of CdSe optical parts produced by our company are listed below:

- Operating wavelength range – 0.8-24 μm ;
- Crystal orientation – per request;
- Orientation tolerance – ± 10 arcminutes;
- Surface quality – 40/20 scr/dig;
- Surface parallelism – 5-20 arcseconds;
- Perpendicularity – 5 arcminutes;
- Waveplate order – per request.

Please pay attention that this article is only for your information. We do not supply raw cadmium selenide as well as semi-finished products. Our standard products are finished (polished, coated) parts.