MATERIAL PROPERTIES & SPECIFICATIONS

Zinc Sulfide (ZnS)

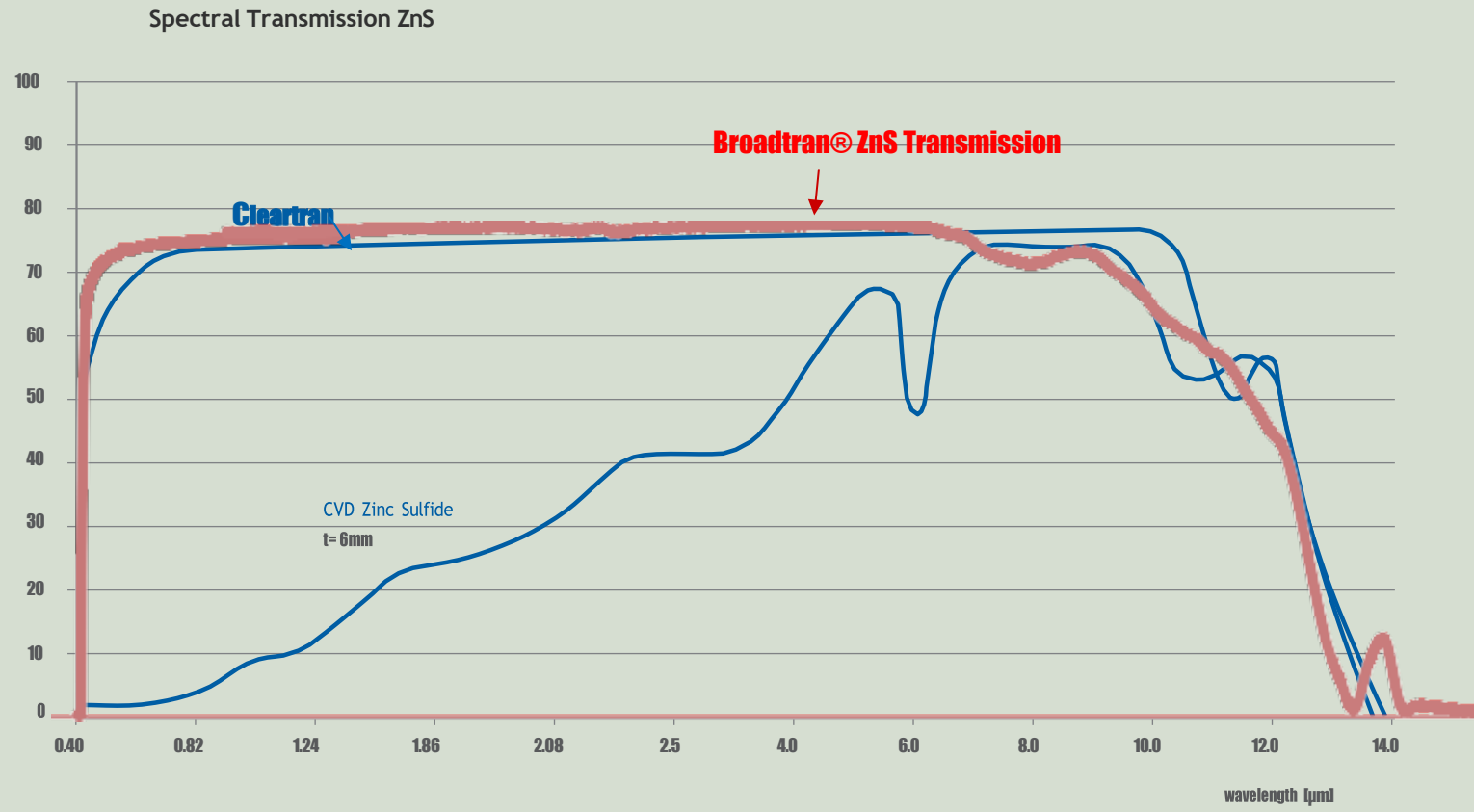
Zinc Sulfide exists in two main crystalline forms; more stable cubic form, known as zinc blende or sphalerite and hexagonal form, known as the mineral wurtzite.
The wurtzite form crystals can be produced synthetically at temperatures around 1200 C.
Zinc Sulfide is often used as an infrared optical material, transmitting from visible wavelengths to approx. 14 micrometers. ZnS is also an intrinsic, wide-bandgap semiconductor material. ZnS can be doped as either an n-type of p-type semiconductor.
The phosphorescence of ZnS makes it useful in scintillation detectors, and because ZnS emits light upon excitation by X-rays an electron beam the material is being used in x-ray screens and cathode tubes. Our ZnS (Broadtran) crystals have a list of unique properties that allow for extending the areas where ZnS has been typically used in the past.

	Zinc Sulfide	Broadtran
Optical properties		
10% transmission limits (t=6mm)	1.0µm–14µm	0.37µm–14µm
Index of refraction inhomogeneity (Δn/n)	<100ppm @10.6µm	<20ppm @633nm
Thermo-optic coefficient dn/dT (298-358K)		
K^{-1} @ 0.6328µm		5.43×10^{-5}
K^{-1} @ 1.15 µm	4.6×10^{-5}	4.21×10^{-5}
K^{-1} @ 3.39µm	4.3×10^{-5}	3.87×10^{-5}
K^{-1} @ 10.6µm	4.1×10^{-5}	
Bulk absorption coefficient		
cm^{-1} @ 10.6 µm	$< 2 \times 10^{-2}$	
cm^{-1} @ 2.7µm		1.0×10^{-3}
cm^{-1} @ 3.8µm	2×10^{-3}	6.0×10^{-4}
cm^{-1} @ 9.27µm		6.0×10^{-3}
Thermal properties		
Coefficient of Thermal Expansion		
[K^{-1}] @273K	6.6×10^{-6}	6.3×10^{-6}
[K^{-1}] @373K	7.3×10^{-6}	7.0×10^{-6}
[K^{-1}] @473K	7.7×10^{-6}	7.5×10^{-6}
[K^{-1}] @208-573K		6.5×10^{-6}
Thermal conductivity [$JK^{-1}m^{-1}s^{-1}$] @298K	16.7	28.4
Heat capacity		
[$Jg^{-1}K^{-1}$] @298K	0.469	
[$Jg^{-1}K^{-1}$] @273K		0.474
[$Jg^{-1}K^{-1}$] @323K		0.489
[$Jg^{-1}K^{-1}$] @373K		0.504

Physical properties		
Crystal structure	cubic	cubic
Grain size	2-8µm	Up to 35mm
Density [g cm^{-3}] @298K	4.09	4.09
Resistivity [cm]	$\sim 10^{12}$	$\sim 10^{13}$
Chemical purity [%]	99.996	99.9996

Mechanical properties		
Hardness:		
Knoop, 50g load [kg mm^{-2}]	200-235	160
Vickers, 1kg load [kg mm^{-2}]	230	150
Flexural strength (modulus of rupture)		
4pt. loading [psi]	15×10^3	1.09×10^4
4pt. loading [MPa]	103	75
Disc bursting [MPa]	84	50
Fracture toughness (critical stress intensity factor, K_{IC} values) [MPa m, Vickers,1kg]	0.8	1.0
Young's modulus		
[psi]	10.8×10^6	10.8×10^6
[GPa]	74.5	74.5
Poisson's ratio	0.29	0.28

Natural ZnS crystals usually have hydrothermal or metamorphic origin. In the context of synthetic ZnS, a variety of techniques have been developed to obtain large, well-formed, high-purity crystals. These include different evaporation or sublimation techniques, the high-pressure growth from molten ZnS, hydrothermal techniques, and growth from solution. Fairfield Crystal Technology uses a proprietary process developed based on commonly used PVT crystal growth method. As a result, we are able to produce multispectral 20mm x 76mm ZnS boules that consist of large single crystal grains reaching sizes up to 35mm in dia. The high purity of the crystal and its unique qualities allow for its' use in a development of new products in optics, optoelectronics, as well as semiconductor industries.



Substance	Form	Diameter Range of Single Crystal Grain	Thickness Range	Transmission Range (µm)	Finish
Zink Sulfide CVD	polycrystalline	6-20 µm	Up to 30 mm*	0.3 -13	Fine Ground**

Substance	Form	Diameter Range	Thickness Range	Transmission Range (µm)	Finish
Broadtran®	Single Crystal	5 to 35mm	1 to 5 mm*	0.36 -12	Fine Ground**

* Special orders available **
Standard finish – other finish available upon request

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