When every photon counts®

Hellma® Materials
CVD Ceramics

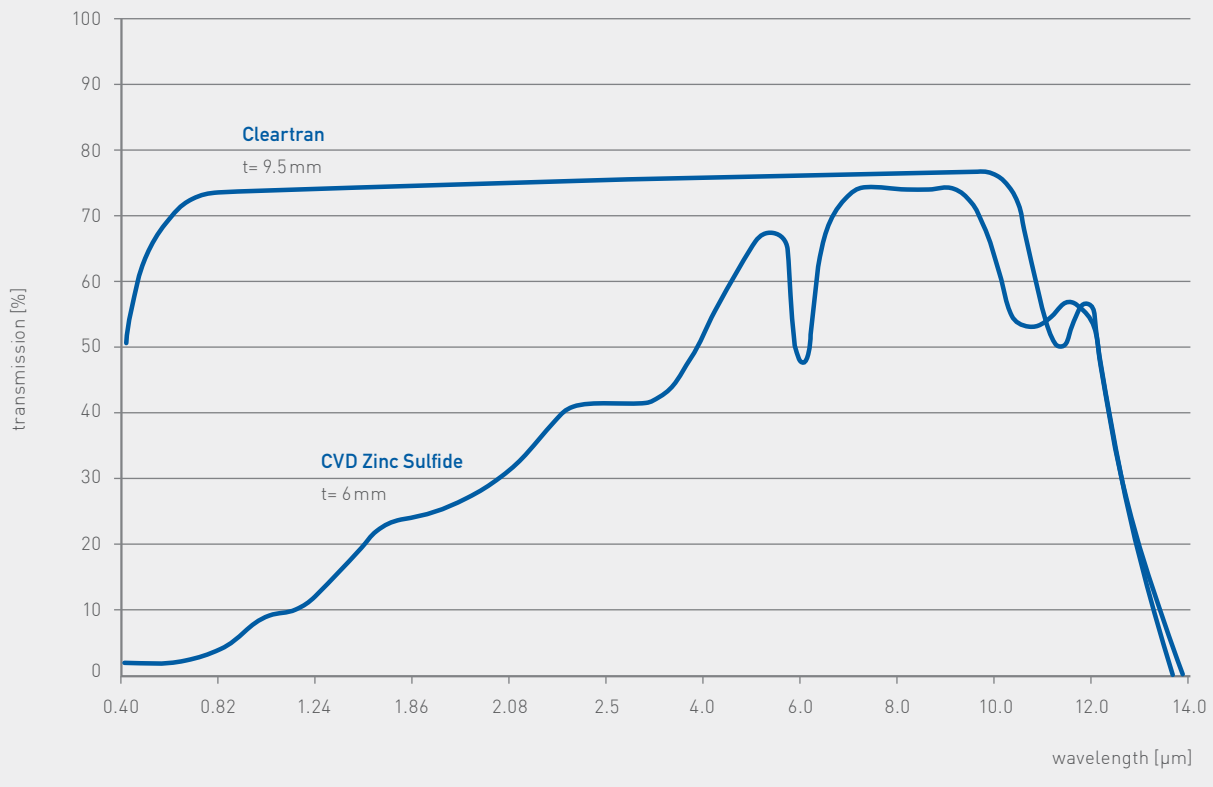
CVD Zinc Sulfide® | Cleartran®

VIS/IR applications

CVD Zinc Sulfide® | Cleartran®

CVD Ceramics' chemically vapor deposited CVD Zinc Sulfide® is the low cost alternative for infrared windows, domes and optical elements. With a fracture strength double that of zinc selenide and high hardness, zinc sulfide has been used successfully in many military applications requiring mechanical resistance to hostile environments. Cleartran® is a form of CVD Zinc Sulfide® material that is modified by a post-deposition hot isostatic process. This process removes zinc hydrides from the crystal lattice, normalizes crystal structure and purifies the material, all contributing to single crystal-like transmittance in the visible through far infrared ranges (0.35 -14 microns). With its low absorption and scatter throughout its broad transmitting range and high optical quality, it is particularly well-suited for multi-spectral applications that require a single aperture for beam path for several wavebands.
CVD Zinc Sulfide® and Cleartran® are chemically inert, non-hygroscopic, highly pure, theoretically dense and easily machined.
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 Sulfide® and Cleartran®



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Properties of CVD Zinc Sulfide® and Cleartran®

	Zinc Sulfide	Cleartran
Optical properties		
10% transmission limits (t=6mm)	1.0µm – 14µm	0.37µm – 14µm
Index of refraction inhomogeneity ($\Delta n/n$)	<100ppm @10.6µm	<20ppm @633nm
Thermo-optic coefficient dn/dT (298-358K) K^{-1} @ 0.6328µm K^{-1} @ 1.15 µm K^{-1} @ 3.39µm K^{-1} @ 10.6µm	 4.6×10^{-5} 4.3×10^{-5} 4.1×10^{-5}	 5.43×10^{-5} 4.21×10^{-5} 3.87×10^{-5}
Bulk absorption coefficient cm^{-1} @ 1.3µm cm^{-1} @ 2.7µm cm^{-1} @ 3.8µm cm^{-1} @ 9.27µm cm^{-1} @ 10.6µm	 2.0×10^{-1}	 6.0×10^{-4} 1.0×10^{-3} 6.0×10^{-4} 6.0×10^{-3} 2.0×10^{-1}
Mechanical properties		
Hardness: Knoop, 50g load [kg mm^{-2}] Vickers, 1kg load [kg mm^{-2}]	 200-235 230	 160 150
Flexural strength (modulus of rupture) 4pt. loading [psi] 4pt. loading [MPa] Disc bursting [MPa]	 15×10^3 103 84	 1.09×10^4 75 50
Fracture toughness (critical stress intensity factor, K_{IC} values) [MPa $\sqrt{m}$, Vickers, 1kg]	0.8	1.0
Young's modulus [psi] [GPa]	 10.8×10^6 74.5	 10.8×10^6 74.5
Poisson's ratio	0.29	0.28

	Zinc Sulfide	Cleartran
Physical properties		
Crystal structure	cubic	cubic
Grain size	2-8µm	20-35µm
Density [g cm^{-3}] @298K	4.09	4.09
Resistivity [Ω cm]	~10^{12}	~10^{13}
Chemical purity [%]	99.996	99.9996
Thermal properties		
Coefficient of Thermal Expansion [K^{-1}] @273K [K^{-1}] @373K [K^{-1}] @473K [K^{-1}] @208-573K	 6.6×10^{-6} 7.3×10^{-6} 7.7×10^{-6}	 6.3×10^{-6} 7.0×10^{-6} 7.5×10^{-6} 6.5×10^{-6}
Thermal conductivity [$JK^{-1}m^{-1}s^{-1}$] @298K	 16.7	 28.4
Heat capacity [$Jg^{-1}K^{-1}$] @298K [$Jg^{-1}K^{-1}$] @273K [$Jg^{-1}K^{-1}$] @323K [$Jg^{-1}K^{-1}$] @373K	 0.469	 0.474 0.489 0.504
Thermal diffusivity [m^2s^{-1}]		 1.46×10^{-5}

Indices of refraction		
Wavelength [µm]	n	n
0.4358	2.48918	2.48918
0.6438	2.34731	2.34731
1.0140	2.29165	2.29165
2.0581	2.26442	2.26442
3.0	2.25772	2.25772
4.0	2.25231	2.25231
5.0	2.24661	2.24661
8.0	2.22334	2.22334
9.0	2.21290	2.21290
10.0	2.20084	2.20084
12.0	2.17101	2.17101
13.0	2.15252	2.15252

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