LightPath Technologies

BLACK DIAMOND BD6™ Infrared Chalcogenide Glass

Infrared Chalcogenide Glass ($As_{40}Se_{60}$)

- Manufactured in Orlando, Florida
- Full IR spectrum transmission
- Lower density/Lighter weight than Germanium
- Provides optical athermalization
- Not susceptible to thermal runaway
- Space qualified
- Material available as a 120mm diameter boule or in select thicknesses

www.lightpath.com 800-472-3486 sales@lightpath.com

LightPath Technologies

Leverage our unique Chalcogenide glass portfolio

PROPERTIES

	-3dB Transmission window		SWIR (1-3µm)			MWIR (3-5µm)			LWIR (8-12µm)			Physical Properties			
Glass	λ short (µm)	λ long (µm)	Index	dn/dT (ppm/°C)	V(1-3)	Index	dn/dT (ppm/°C)	V(3-5)	Index	dn/dT (ppm/°C)	V(8-12)	Density (g/cm3)	Tg (°C)	CTE (ppm/°C)	Thermal power (1/°C)
BD6	0.83	17.5	2.81	pending	14.10	2.79	pending	169.20	2.781	30.50	159.40	4.63	185	22.50	-5.38

Wavelength (um)	Refractive index @ 20°C (+/- 0.001)
2	2.820
4	2.794
6	2.788
8	2.783
10	2.778
12	2.772
14	2.764

LightPath's Black Diamond BD6™ Chalcogenide glass is produced in standard size boules of 120mm diameter, however, we can use our proprietary molding technology to provide larger diameters as needed. Our Black Diamond BD6™ materials are designed specifically to have the same refractive index, whether fabricated by diamond turning into lenses, conventionally polished into lenses, or molded into its final form. Today, we produce our glass in quantities of up to 10 metric tons annually with near term plans to further expand our production capacity. In November of 2021, LightPath received from the US Naval Research Laboratories (NRL) an exclusive usage license for commercializing additional Chalcogenide glasses developed by NRL's scientists. LightPath is currently in the process of transitioning these materials into production. If interested in learning more, please contact us at sales@lightpath.com.

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LightPath Technologies

BDNL-4

Glass Datasheet

LightPath's BDNL-4 infrared glass is based on Naval Research lab's (NRL) NRL-4 licensed exclusively from NRL. The glass exhibits negative thermos-optic coefficients (dn/dT), making it ideal for a-thermalization of optical systems. LightPath produces the glass in boules with a diameter of 120mm, and the glass is available both for molded optics, as well as diamond turned or conventionally polished fabrication.

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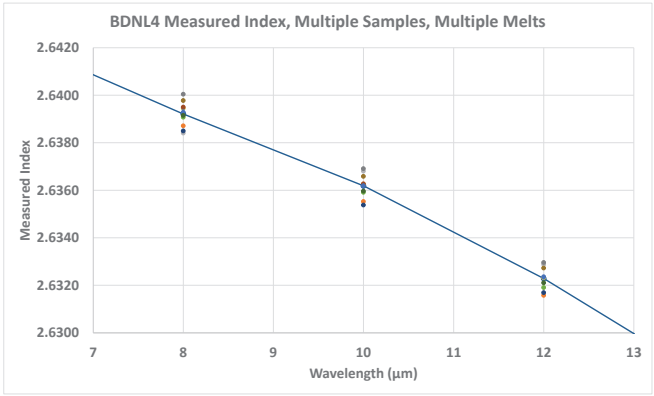
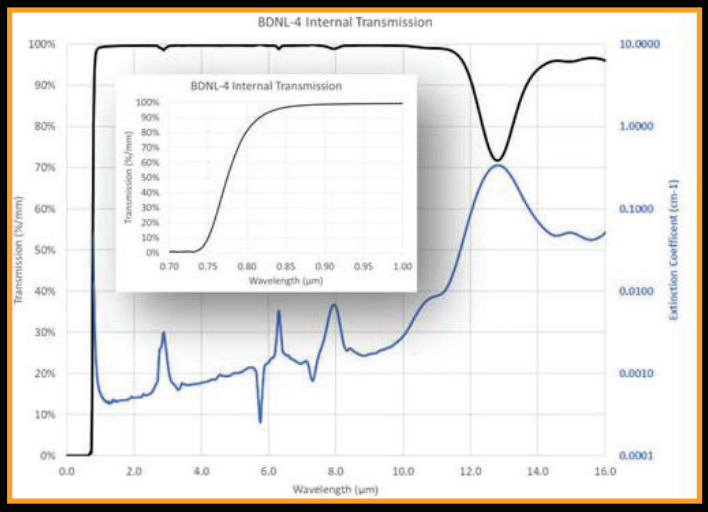
Wavelength (µm)	Refractive Index ± 0.001 (@20°C)
1	2.754
2	2.667
4	2.647
6	2.643
8	2.639
10	2.636
12	2.632
14	2.628

	@2 µm	@4 µm	@10 µm
dn/dT (ppm/°C) @22°C	-9.7	-14.3	-16.3

Material Properties	
Density	4.50 g/cm3
Thermal Expansion (20 – 100°C)	25.2 (ppm/°C)
Thermal Conductivity	0.17 (W/m*K)
Transition Temperature	205°C
Hardness (Vickers)	151 HV
Young's Modulus	14.2 GPa



To ensure consistency and repeatability, all data on this spec sheet is derived from measurements on multiple samples, from multiple production melts.



Wavelength	Transmission (%/mm)	Extinction Coefficient (cm-1)
1.0	99.29	0.00057
1.5	99.62	0.00046
2.0	99.68	0.00051
2.5	99.71	0.00058
3.0	99.44	0.00133
3.5	99.73	0.00074
4.0	99.76	0.00077
4.5	99.74	0.00091
5.0	99.75	0.00101
5.5	99.73	0.00118
6.0	99.72	0.00135
6.5	99.67	0.00172
7.0	99.76	0.00134
7.5	99.72	0.00169
8.0	98.95	0.00670
8.5	99.72	0.00187
9.0	99.76	0.00170
9.5	99.74	0.00198
10.0	99.64	0.00287
10.5	99.28	0.00608
11.0	99.01	0.00867
11.5	98.08	0.01775
12.0	91.59	0.08391
12.5	76.70	0.26351
13.0	73.92	0.31314
13.5	86.70	0.15332
14.0	93.69	0.07250
14.5	96.00	0.04711
15.0	95.81	0.05112
15.5	96.61	0.04249

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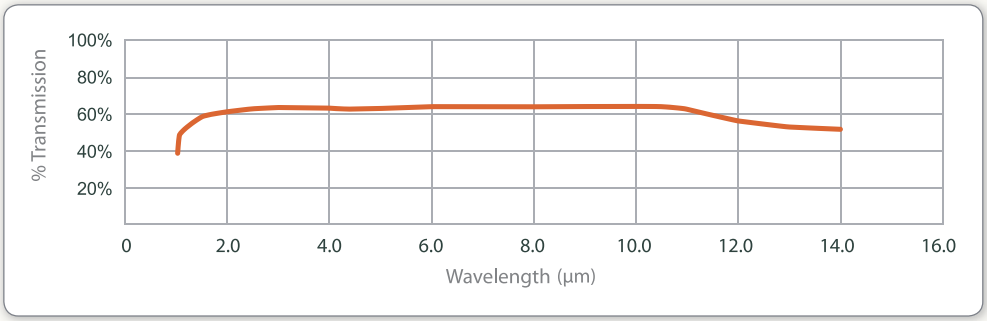
BD-2 Glass Datasheet

BD-2 Uncoated
Transmission Curve
(5mm thickness)



Optical Properties

Refractive Indices and Absorption Coefficient		
λ (µm)	Index	Absorption (cm^{-1})
3	2.6266	0.01
4	2.6210	0.01
5	2.6173	0.01
6	2.6142	0.01
7	2.6117	0.01
8	2.6088	0.01
9	2.6055	0.01
10	2.6023	0.01
11	2.5983	0.03
12	2.5942	0.13
13	2.5892	0.20
14	2.5843	0.20

Available Coatings		
Coating	λ Range (µm)	R_{AVG}
IR-1	8 - 12	< 1.0% per side
IR-3	3 - 5	< 1.0% per side
IR-4	1.8 - 3	< 1.0% per side

LightPath® lenses that have a 390xxx prefix use the BD-2 glass.

Other Properties

Composition	
Component	Percentage
Germanium (Ge)	28%
Antimony (Sb)	12%
Selenium (Se)	60%

Mechanical Properties	
Density	4.67 g/cm^3
Hardness	150 knoop
Young's Modulus	22.1 GPa

Thermal Properties	
T_g	278 °C
CTE	14 x 10^{-6} / °C
dn/dT	91 x 10^{-6} / °C

Equivalent Glasses	
Manufacturer	Glass
Amorphous Materials	AMTIR-3
Schott/Vitron	IG5

LightPath® TECHNOLOGIES

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All values represent glass characteristics after molding

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