

# POLYCRYSTALLINE CVD DIAMOND

Polycrystalline CVD diamond has been long recognized as the ultimate material in a wide variety of applications due to its extreme qualities. Its unmatched hardness is needed for sophisticated tooling and machining processes worldwide. The high thermal conductivity of diamond has made it useful in thermal management applications. Its wide optical transmission range has allowed diamond windows to make their way into cutting edge future generation lithography systems for semiconductor manufacturing. In addition, its transparency in the microwave band has opened up an entire world of application development in microwave engineering. In its purest form, polycrystalline CVD diamond is free of electronic traps, making it an ideal material for ultra-sensitive nuclear detectors used in high energy physics.

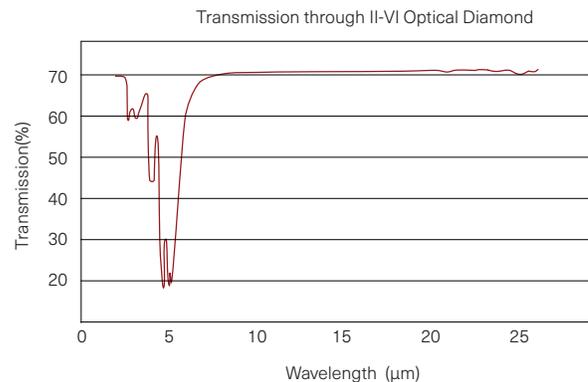
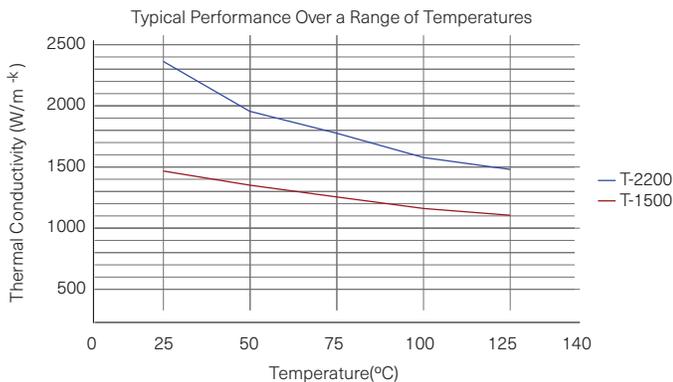


# POLYCRYSTALLINE CVD DIAMOND

Grown through Plasma Chemical Vapor Deposition, Coherent’s diamond products have been optimized to leverage the qualities that make diamond a super material. Combining crystal growth with state of the art optical grade processing through shaping and polishing, quality assurance and coatings, Coherent is the world’s leader in optical grade materials, as well as generating highly transparent microwave windows and the highest sensitivity diamond-based nuclear detectors. Coherent’s strong dedication to research and development, including more than 50 combined years in diamond materials development, allows us to work closely with customers in all markets looking to leverage the amazing qualities of polycrystalline CVD diamond.

Growth Method	Plasma Chemical Vapor Deposition
<b>Physical Characteristics</b>	
Structure	Cubic, Polycrystalline
Grain Size	Thickness and process dependent (0.05 - 1 mm)
Grades	Optical, Thermal, Microwave, Detector, Mechanical, Customer Specific
Thickness*	up to 2 mm
<b>Fabrication Capability*</b>	
Size	Laser-cut to customer specification, maximum diameter 145mm
Dimensional Tolerance	+/- 50 µm
Polishing Aspect Ratio	Up to 50:1 for diameters up to 145 mm
Power	<0.5 fr/cm
Irregularity	<0.5 fr/cm
Transmitted Wavefront	<0.5 fr/cm
Surface Roughness	<15nm
<b>Thermal Properties (Thermal Grade Materials)</b>	
Thermal Conductivity	up to >2,200 (W/mK) at Room Temperature
Thermal Expansion Coefficient	1 (10-6 K <sup>-1</sup> )
Specific Heat (25°C)	0.536 (J g <sup>-1</sup> K <sup>-1</sup> )
<b>Optical Properties (Optical Grade Materials)*</b>	
Bulk Absorption @ 10.6 µm	<0.07 (cm <sup>-1</sup> )
Bulk Absorption @ 1 µm	<1 (cm <sup>-1</sup> )
Scatter @ 1 µm	<0.7 (cm <sup>-1</sup> )
<b>Microwave Grade Materials</b>	
Microwave Loss Tangent(Tan δ)	<2e <sup>-5</sup>

\*This represents standard production. Product data sheets and specifications are available upon request.



## Market Segments

### Transparent Windows and Optics

Optical diamond is in large volume production, consistently producing material of premium optical quality (low 1  $\mu\text{m}$  scatter, low 10.6  $\mu\text{m}$  bulk absorption, low birefringence at 632.8nm) in a wide range of cross-sectional sizes and thicknesses.

By leveraging core technologies both in fabrication and coating, Coherent has become the world leader in extreme UV optical diamond windows, which are essential for the next generation of advanced lithography tools for semiconductor manufacturing.

### Microwave Transparent Optics

Coherent manufactures high quality diamond optical products that are transparent in the microwave region. Combining this with in-house capability to polish and coat windows and lenses at diameters as large as 145mm, Coherent is poised to meet the needs of microwave transparent materials in fields such as fusion research.

### Nuclear Detector Solutions

Using a finely tuned, ultra-high purity growth process, Coherent grows polycrystalline diamond films exhibiting industry leading charge collection distances. Consistent results are obtained for 500  $\mu\text{m}$  thick finished parts.

### Thermal Management Solutions

Through tuning of our growth process, Coherent has the capability of generating polycrystalline CVD diamond for a variety of high performance temperature management applications. Specifications for thermal conductivity range up to more than 2200 W/m-K. Using our world class fabrication facility, we are able to create parts based on customer specifications with shapes as large as 145mm in diameter and thicknesses of up to 2mm and more that are ultra-flat and ultra-smooth to ensure optimum thermal contact to your device.

### Machining Solutions

Coherent has developed a diamond film that possesses exemplary hardness and wear rates when machining even the toughest materials. By combining our state of the art polishing and fabrication techniques with in-house laser fabrication facilities, we are able to generate a world-class product at competitive prices.