

Polycrystalline  
**CVD DIAMOND**



# 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.

Grown through Plasma Chemical Vapor Deposition, II-VI Advanced Materials' 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, II-VI Incorporated 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. II-VI Incorporated'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
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## Physical Characteristics

Structure	Cubic, Polycrystalline
Grain Size	Thickness and process dependent (0.05 - 1mm)
Grades	Optical, Thermal, Microwave, Detector, Mechanical, Customer Specific
Thickness*	up to 2mm

## Fabrication Capability\*

Size	Laser-cut to customer specification, maximum diameter 145mm
Dimensional Tolerance	+/- 50µm
Polishing Aspect Ratio	Up to 50:1 for diameters up to 145mm
Power	≤0.5 fr/cm
Irregularity	≤0.5 fr/cm
Transmitted Wavefront	≤0.5 fr/cm
Surface Roughness	<15nm

## Thermal Properties (Thermal Grade Materials)

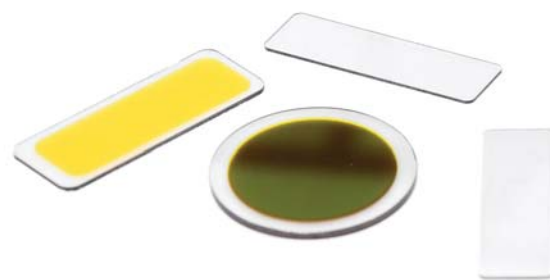
Thermal Conductivity	up to >2,200 (W/mK) at Room Temperature
Thermal Expansion Coefficient	1 (10 <sup>-6</sup> K <sup>-1</sup> )
Specific Heat (25°C)	0.536 (J g <sup>-1</sup> K <sup>-1</sup> )

## Optical Properties (Optical Grade Materials)\*

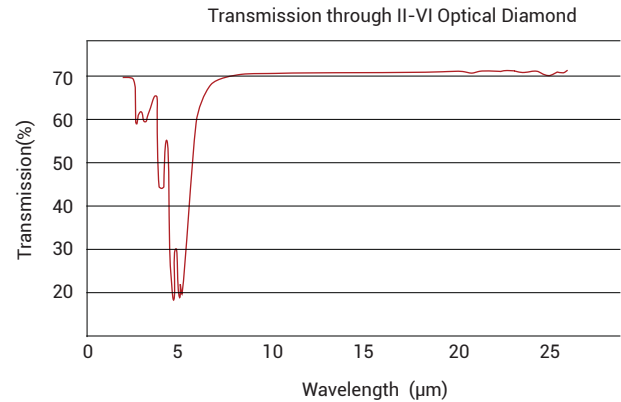
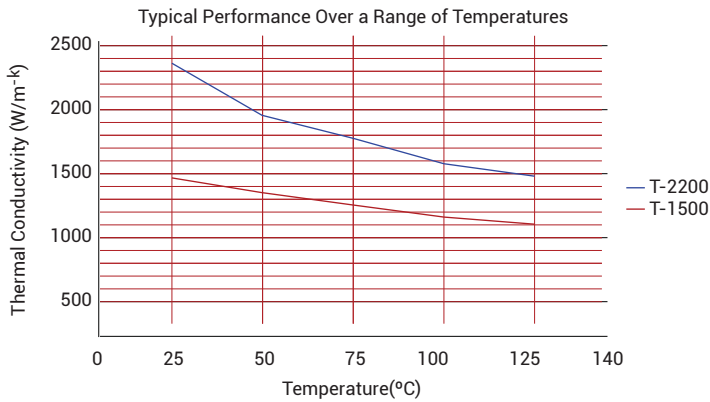
Bulk Absorption @ 10.6µm	<0.07 (cm <sup>-1</sup> )
Bulk Absorption @ 1µm	<1 (cm <sup>-1</sup> )
Scatter @ 1µm	<0.7 (cm <sup>-1</sup> )

## Microwave Grade Materials

Microwave Loss Tangent(Tan δ)	<2e <sup>-5</sup>
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\*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 µm scatter, low 10.6µm 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, II-VI 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

II-VI Advanced Materials 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, II-VI Advanced Materials 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, II-VI Advanced Materials grows polycrystalline diamond films exhibiting industry leading charge collection distances. Consistent results are obtained for 500µm thick finished parts.

### Thermal Management Solutions

Through tuning of our growth process, II-VI Advanced Materials 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

II-VI Advanced Materials 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.





## WORLDWIDE LOCATIONS



### About II-VI Incorporated

II-VI Incorporated, a global leader in engineered materials and opto-electronic components, is a vertically-integrated manufacturing company that creates and markets products for diversified markets including industrial manufacturing, optical communications, military and aerospace, high-power electronics, semiconductor laser and thermoelectronics applications. Headquartered in Saxonburg, Pennsylvania, with manufacturing, sales and distribution facilities worldwide, the Company produces numerous crystalline compounds including zinc selenide for infrared laser optics, silicon carbide for high-power electronics and microwave applications, and bismuth telluride for thermoelectric coolers.

### About II-VI Advanced Materials

We are a leading worldwide supplier of high quality single crystal SiC (silicon carbide) substrates and CVD-grown polycrystalline diamond materials. We have state-of-the-art product development and manufacturing facilities at three locations within the United States - Pine Brook (NJ), Saxonburg (PA) and Starkville (MS). Our continually evolving technology and IP portfolio are made possible by a comprehensive understanding of crystal growth and materials processing acquired over decades of sustained R&D and manufacturing. We are committed to excellence in all that we do and consider customers to be our partners with total satisfaction as our primary goal. This is achieved through innovation, teamwork and a dedication to quality in the development of leading-edge, highly specialized products and solutions focused on customer growth and success. We utilize our II-VI global network of technical and sales offices to facilitate timely communication, service and feedback. Our products are key components "Enabling Tomorrow's Technology" across a wide variety of fast growing markets including mobile communications, RF and high-power electronics and semiconductor equipment manufacturing.

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