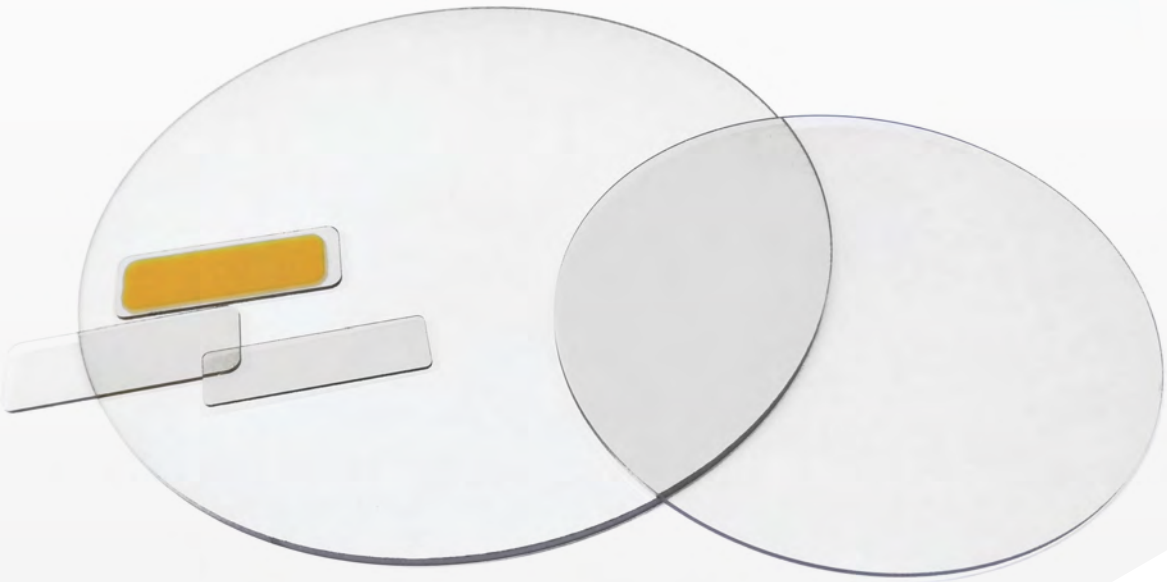
II-VI



Thermal Grade

Polycrystalline CVD DIAMOND

II-VI has developed processes to deliver wafers of polycrystalline CVD diamond at diameters of up to 145mm with exceptional thermal properties. With the ability to target a range of thermal conductivities from 1,500 W/mK to more than 2,200 W/mK, II-VI Advanced materials can meet the needs of even the most demanding thermal applications.

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Rev. 01

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II-VI has been producing production-level diamond for a world-wide customer base since 2010. We have established high repeatability and reliability in producing diamond materials at even the toughest specifications. We are prepared to handle high volume production requirements for thermal management applications.

Coupling our thermal management growth process with a world-class optical fabrication facility, II-VI Advanced materials can deliver laser machined, optically polished thermal materials to meet bow, warp, and surface roughness specifications to ensure optimal thermal contact to your high powered device.
In addition to growth and fabrication, our staff are ready to work with customers through the use of internal metrology such as lamp flash thermal diffusivity measurements and SEM as well as thermal models to engineer application specific solutions.

Diamond Thermal Management solutions

- Thermal conductivity tailored to suit both performance and cost requirements
- Custom sizes and shapes for your specific solution
- Optical transparency when needed
- Means to quantify bonding efficacy and stack performance

Our flagship T-2200 Diamond Thermal Management Material couples extraordinary thermal conductivity of better than 2,200 W/mK with high transparency in a wide range of wavelengths (e.g. 1um, 10.6um, IR, Microwave) making it ideal for high power optoelectronic applications. In addition state of the art, high performance optical coatings can be applied to further improve diamond's already superb optical properties.

The T-1500 Diamond Thermal Management Material, with thermal conductivity of better than 1,500 W/mK is the ideal thermal management solution for a wide array of applications. This high performance material may be used in more price sensitive applications with the same optical finishes from our world-class optical fabrication facility.

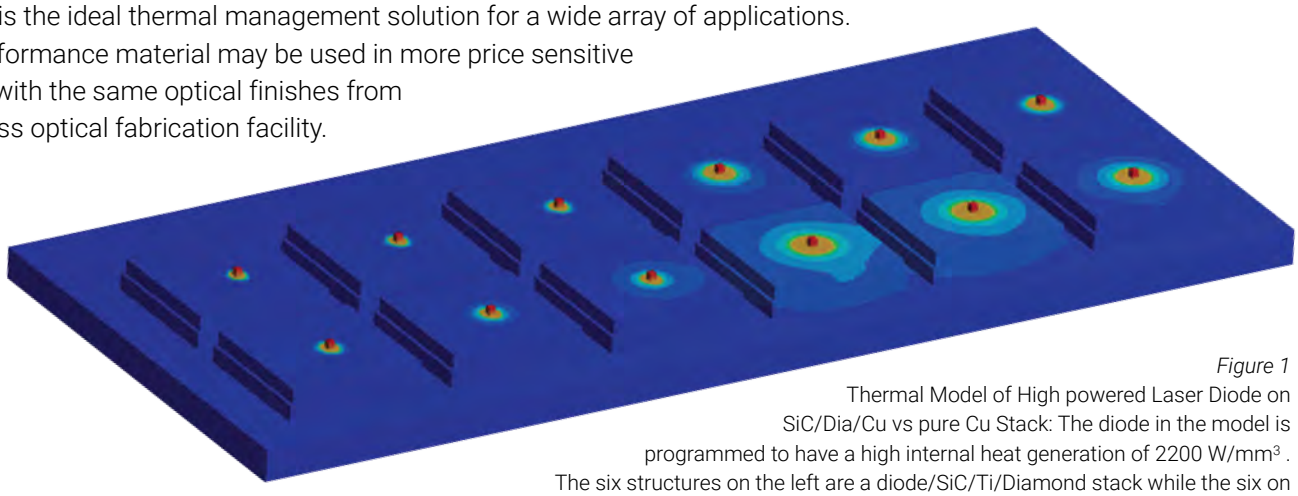
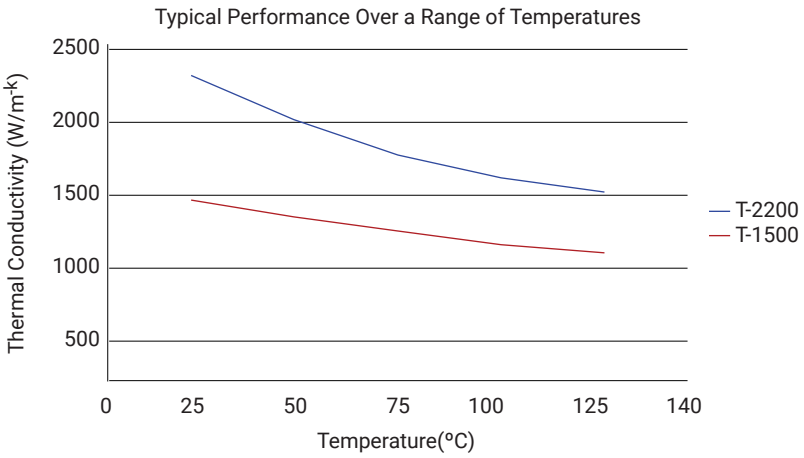
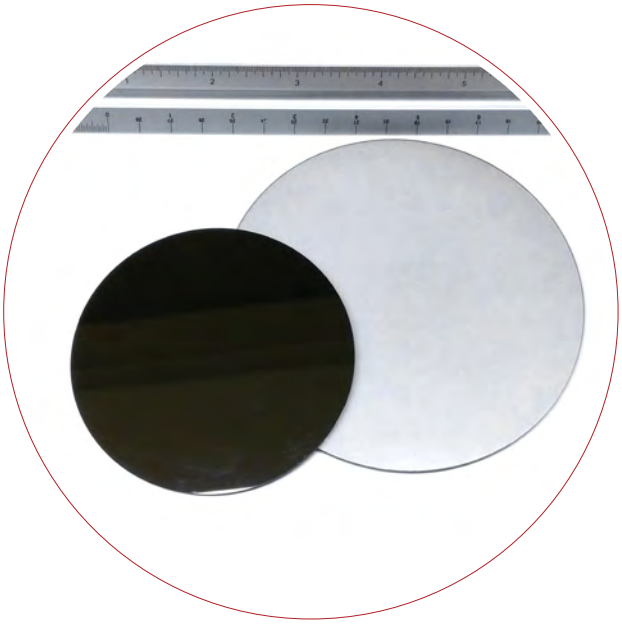


Figure 1
Thermal Model of High powered Laser Diode on SiC/Dia/Cu vs pure Cu Stack: The diode in the model is programmed to have a high internal heat generation of 2200 W/mm^3 . The six structures on the left are a diode/SiC/Ti/Diamond stack while the six on the right are a diode/Cu stack. All twelve structures are bonded onto a water-cooled copper plate.

Thermal Grade Polycrystalline CVD Diamond





Growth Method	Plasma Chemical Vapor Deposition

Physical Characteristics	
Structure	Cubic, Polycrystalline
Grain Size	Thickness and process dependent (0.05 - 1mm)
Grades	T-1500, T-2200
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
Bow	.15µm/cm diameter
Warp	.15µm/cm diameter
Surface Roughness	≤15nm

Thermal Properties	T-1500	T-2200
Thermal Conductivity	1,500 (W/mK)	>2,200 (W/mK)
Thermal Diffusivity	800(mm^{-2}/sec)	>1150(mm^{-2}/sec)
Thermal Expansion Coefficent	1 (10^{-6} K^{-1})	1 (10^{-6} K^{-1})
Specific Heat (25°C)	0.536 (J g^{-1} K^{-1})	0.536 (J g^{-1} K^{-1})

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