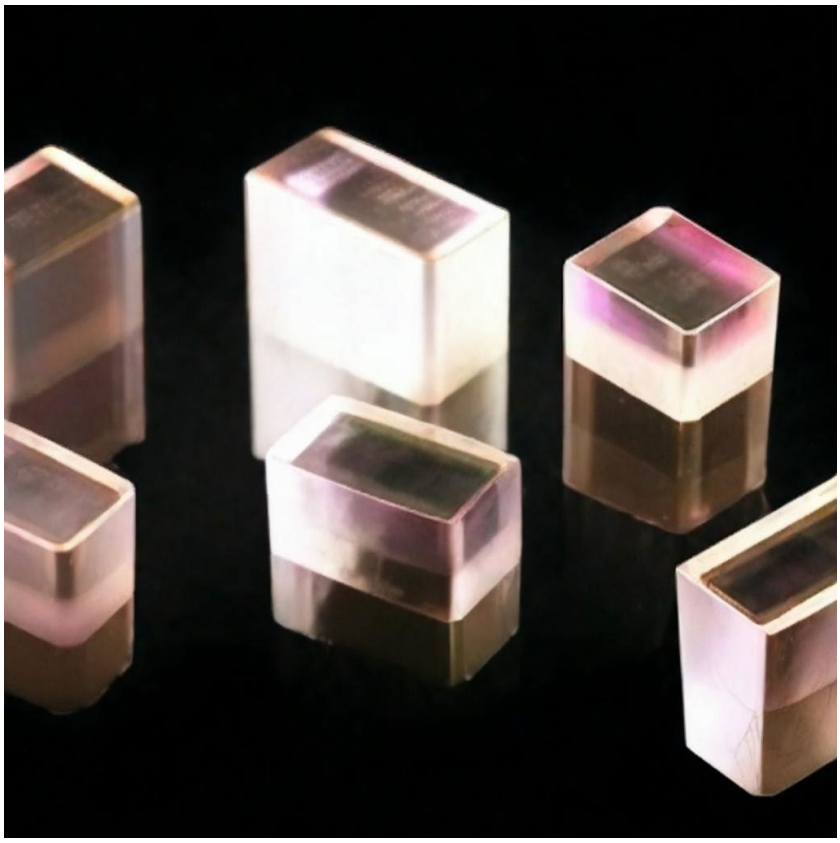
Photonics On Crystals

POC-OC-122505-Optical Grade Polycrystalline Diamond Crystal Datasheet

1 Main Features

1. Excellent optical transparency across UV, visible, and infrared wavelengths.
2. High thermal conductivity for efficient heat dissipation in high-power applications.
3. Exceptional mechanical strength and resistance to chemical corrosion.
4. Low optical absorption and scattering for improved laser performance.
5. Reliable performance in extreme environments with refractive index ~2.38 and transmission >99% with coating.



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2. Material General Description

Polycrystalline Diamond Crystal, produced using the Chemical Vapor Deposition (CVD) technique, is a robust synthetic diamond material known for its superior optical, thermal, and mechanical properties. It features outstanding transparency over ultraviolet (UV), visible, and infrared (IR) wavelengths, making it ideal for high-power laser systems and optical components. Its grain boundary structure ensures excellent heat resistance and chemical stability, outperforming traditional optical materials such as ZnSe. These crystals are characterized by low absorption loss and high refractive index, enabling efficient energy utilization. With high damage thresholds, they

are particularly suited for demanding industrial laser applications, aerospace optics, and spectroscopic systems.

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3. General Application and Examples

- **High-Power Laser Systems**: Used in cutting, welding, and drilling systems where high durability and low absorption are critical.
- **Infrared Optics**: Effective in spectrometers, imaging, and other IR optical systems.
- **Aerospace and Defense**: Ideal for missile guidance and reconnaissance optics due to their durability and radiation resistance.
- **Industrial Coating Windows**: Provide stable and reliable protection for optical systems in extreme conditions.
- **Biomedical Optics**: Effective in advanced diagnostic equipment due to high transparency and biocompatibility.

For example:

- Polycrystalline diamond windows used in high-power CO2 lasers outperform ZnSe counterparts due to reduced scattering and higher mechanical reliability.
- Large-diameter diamond optical windows (>100 mm) are deployed in industrial-grade cutting systems for superior transmission efficiency.

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4. Chemical, Physical, and Structural Properties

Property	**Value**
Chemical Formula	Diamond (C)
Density	3.5 g/cm³
Thermal Conductivity	2200 W/mK (25°C)
Refractive Index	2.38
Melting Point	~4000°C
Hardness (Mohs Scale)	10
Grain Size	Fine (<2 µm)
Transmission Range	0.25 µm to 10.6 µm
Absorption Coefficient (10.6 µm)	0.04–0.07 cm^-1

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5. Optical, Laser, and Nonlinear Optical Properties

Parameter	**Value**

Transmission Range	250 nm – 10.6 µm
Refractive Index (10.6 µm)	2.38
Laser Damage Threshold	>100 MW/cm² (10 ns, 10 Hz)
Scattering Loss	Negligible (<0.1%)
Absorption Coefficient (10.6 µm)	0.04–0.07 cm^-1

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6. Spectrum Transmission Curves

Polycrystalline Diamond Crystals exhibit high transmittance (>98%) across a broad spectrum, from ultraviolet to far-infrared, when enhanced coatings are applied. This property ensures maximum optical performance in applications like IR spectrometry and laser systems.

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7. Coating Specification

- Coatings: Anti-reflective (AR) coatings for 10.6 µm.
- Typical Materials: High durability dielectric materials for enhanced laser damage resistance.
- Transmission: >99% with AR coatings.

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8. Standard Fabrication Specifications

Parameter	**Value**
Clear Aperture	>90% of diameter
Thickness Tolerance	±0.05 mm
Surface Quality	20-10 (Scratch-Dig)
Parallelism	<10 arc seconds
Flatness	λ/10 @ 632.8 nm
Maximum Diameter	Up to 150 mm
Coating Options	AR/AR @ 10.6 µm

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9. POC Strength and Capabilities

Photonics On Crystals (POC) leverages advanced CVD techniques to manufacture polycrystalline diamond crystals with unmatched optical and mechanical qualities. With in-house capabilities for custom machining, coating, and testing, POC ensures that all products meet the highest standards for industrial, medical, and aerospace applications. POC's expertise in diamond fabrication enables customization of dimensions, coatings, and optical properties to meet customer-specific requirements, ensuring high satisfaction.

10. Standard Products

Face Dimensions	Thickness	Coating	SKU	Price (USD)
20 x 20 mm	1.0 mm	AR/AR @ 10.6 µm	8001	850
25 x 25 mm	1.0 mm	AR/AR @ 10.6 µm	8002	950
30 x 30 mm	1.5 mm	AR/AR @ 10.6 µm	8003	1050
Custom Dimensions	On request	Custom Coatings	N/A	Contact POC