Photonics On Crystals

POC-OC-122480-Sapphire Cyrstal Datasheet

1 Main Features

- Exceptional hardness (9 on the Moh's scale) and durability for harsh environments.
- High transmission rates across UV, visible, and IR spectrums.
- Superior thermal conductivity and temperature resistance up to 2000°C.
- Highly resistant to scratches, abrasion, and chemical corrosion.
- Unaffected by atmospheric, marine, or biological exposures.

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2. Material General Description

Sapphire Crystal, scientifically known as single-crystal aluminum oxide (Al2O3), is one of the hardest and most durable materials available for advanced photonics applications. Its unique combination of chemical, thermal, and optical properties makes it a top choice for extreme environments and precision optics. Sapphire exhibits high transmission from the ultraviolet (UV) through to the infrared (IR) range, with remarkable resistance to mechanical wear, chemical reactions, and thermal expansion. Its hexagonal crystal structure (trigonal system) ensures excellent anisotropic properties, enhancing its performance across diverse industrial applications.

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3. General Applications and Examples

Sapphire Crystals are extensively used in the following industries due to their extraordinary properties:

1. **Aerospace:**
    - Scratch-resistant windows for satellites and aircraft sensors.
    - Protective covers for high-velocity environments.
2. **Medical Technology:**
    - Endoscopic lens covers.
    - Dental tool tips for precision and durability.
3. **Semiconductors:**
    - Plasma tubes and LED fabrication substrates.
    - Sapphire wafers for integrated circuits.
4. **Military Applications:**
    - High-power laser windows and rangefinders.
    - Optical sensors for advanced weaponry systems.
5. **Oil and Gas:**
    - Sapphire sight windows for high-pressure environments.
    - Diffusion plates for precise chemical analysis.
6. **Research and Development:**
    - Sapphire cuvettes for spectrophotometry.
    - Containment tubes for chemical experiments.

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4. Chemical, Physical, or Structural Properties

Property	Value
Chemical Formula	Al2O3
Density	3.97 g/cm³ (25°C)
Hardness	9 (Moh's scale)
Melting Point	2053°C
Flexural Strength	1035 MPa (parallel to C-axis, 25°C)
Thermal Expansion Coefficient	8.8 × 10^-6 /°C (parallel to C-axis)
Young's Modulus	435 GPa (parallel to C-axis, 25°C)

Dielectric Constant	11.5 (parallel to C-axis, 25°C)
Refractive Index	1.768 (ordinary ray); 1.760 (extraordinary ray)
Birefringence	0.008
Crystal System	Trigonal

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5. Optical, Laser, or Nonlinear Optical Properties

Property	**Value**
Transparency Range	0.15–5.5 µm
Optical Anisotropy	Uniaxial Negative
Refractive Index (Visible Range)	No = 1.768; Ne = 1.760
Absorption Coefficient	0.1–0.2 cm^-1 (0.66 µm, 1600°C)
Spectral Emittance	0.1 (at 1600°C)

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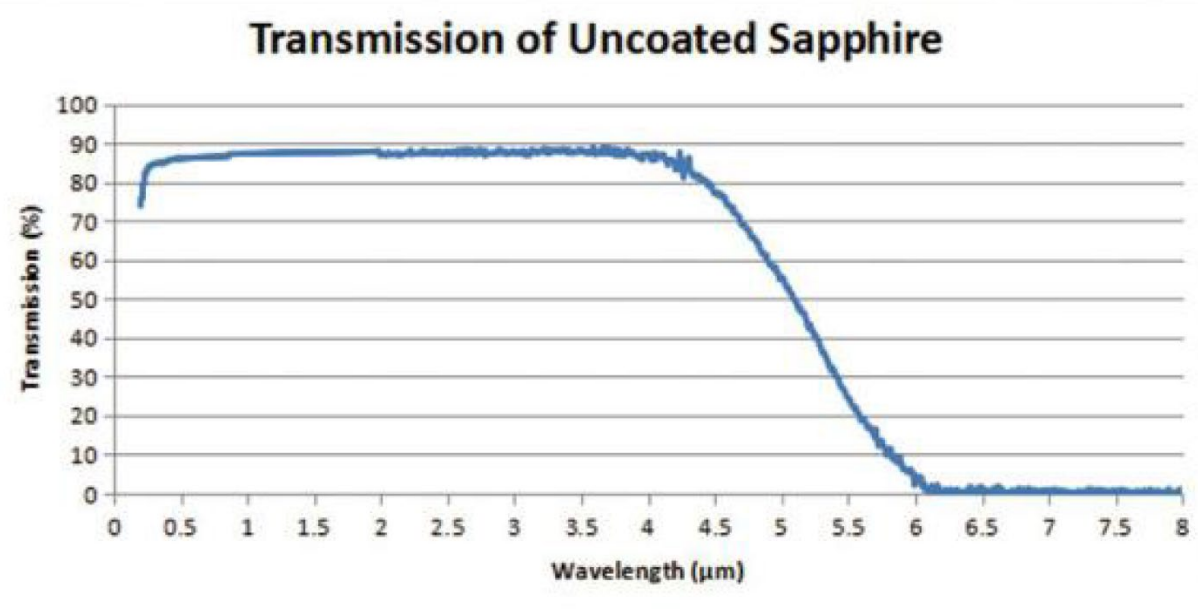
6. Spectrum Transmission Curves

Sapphire exhibits high transmission rates over a broad wavelength range. Detailed spectral transmission curves can be supplied on request, highlighting the transparency from UV to IR wavelengths.



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7. Coating Specification

- **Anti-Reflective Coatings:** Enhances optical performance across UV, visible, and IR ranges.
- **Dielectric Coatings:** Improves laser damage thresholds.

- **Protective Coatings:** Increases durability in chemically reactive environments.

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8. Standard Fabrication Specifications

Specification	Value
Orientation	C-axis preferred
Surface Quality	40/20 to 10/5 (scratch-dig rating)
Surface Finish	Polished or fine-ground
Dimensional Tolerances	±0.01 mm
Maximum Size	Up to 300 mm diameter

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9. POC Strength and Capabilities

Photonics On Crystals (POC) is a leader in sapphire crystal manufacturing, offering unparalleled expertise in custom fabrication. Our state-of-the-art facilities and a dedicated engineering team ensure precision and quality across all applications. With over two decades of industry experience, POC is committed to meeting the most stringent performance standards while delivering cost-effective solutions.

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10. Standard Products

Product	Dimension Range	Price (USD)
Sapphire Windows	Up to 300 mm diameter	$500–$5,000
Sapphire Rods	10–50 mm diameter	$300–$1,500
Sapphire Tubes	Custom dimensions	$700–$3,000
Sapphire Lenses	20–100 mm diameter	$1,000–$10,000
Customization Options	Available on request	Contact for quote

For more details or customization, contact Photonics On Crystals (POC).