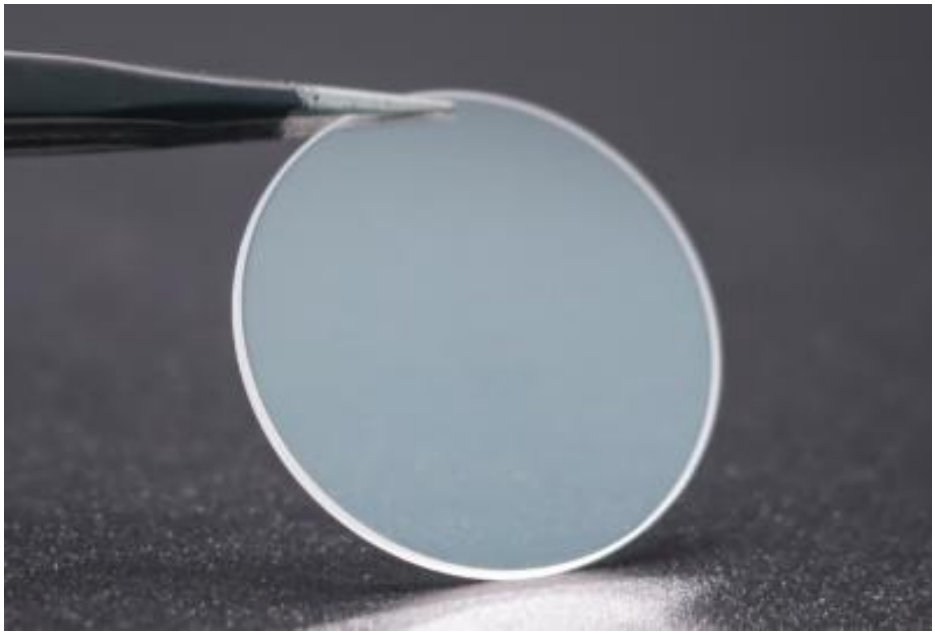
IR Polished Al2O3 Circular Sapphire Window

0.17-5.5µm 25.4x1.0m



Product Description

Sapphire (Al2O3) is highly regarded for its extreme toughness and strength, making it an ideal material for optical windows across the UV, VIS, and NIR spectral ranges. Sapphire can be grown using different methods. The Verneuil and Czochralski processes are commonly used for standard-grade sapphire materials. Higher-quality sapphire, used for electronic substrates, is typically grown by the Kyropulos method, offering exceptionally high purity and excellent UV transmission properties. In the IR spectrum,

sapphire's use is generally limited to around 5 μ m, with few issues encountered at optical grades. In the UV range, care must be taken when observing its transmission from 140nm to 240nm, as it is highly sensitive to impurities and voids. Large sapphire crystals can be made by color-band growth. Sapphire exhibits slight birefringence, and IR windows are typically cut randomly from the crystal. For specific birefringence applications, an orientation can be selected, where the optical axis is at a 90-degree angle to the surface, referred to as "zero-degree" material. Synthetic optical sapphire is colorless. *Note: Actual thermal expansion values may vary across manufacturers.

Product features

Ultraviolet to mid-infrared transparency; ultra-high hardness; heat-resistant; corrosion-resistant; low thermal expansion

Part Number

MP-OPW-Al2O3-C25.4-1-IR

Application area

Extreme environmental sensing | High power lasers | Aerospace | Semiconductor equipment | Military optics

Core parameters

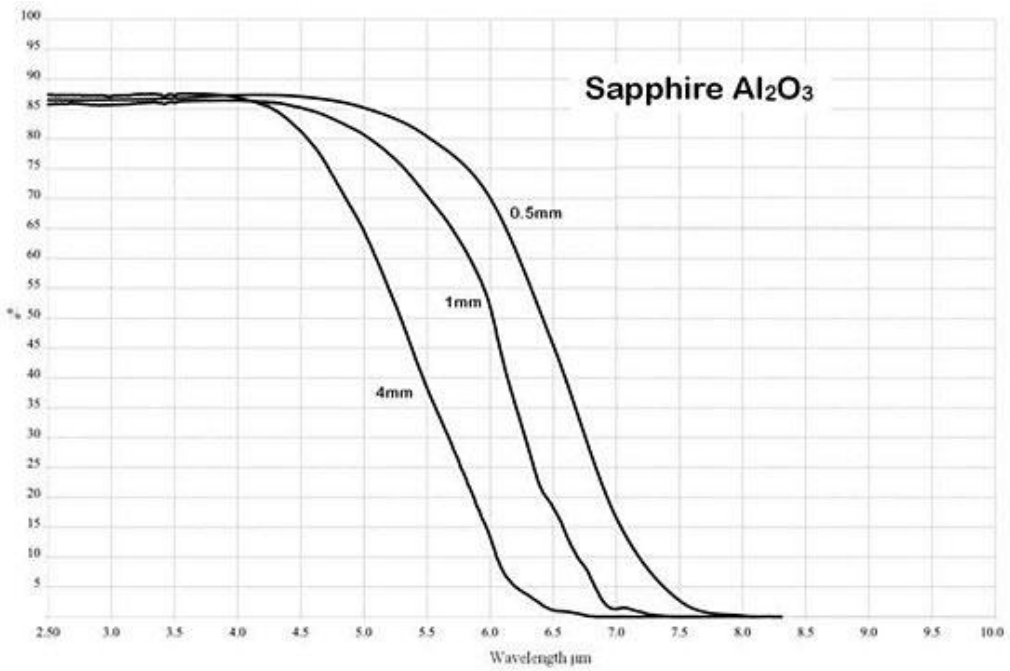
Wavelength	Size
0.17-5.5um	25.4x1 mm

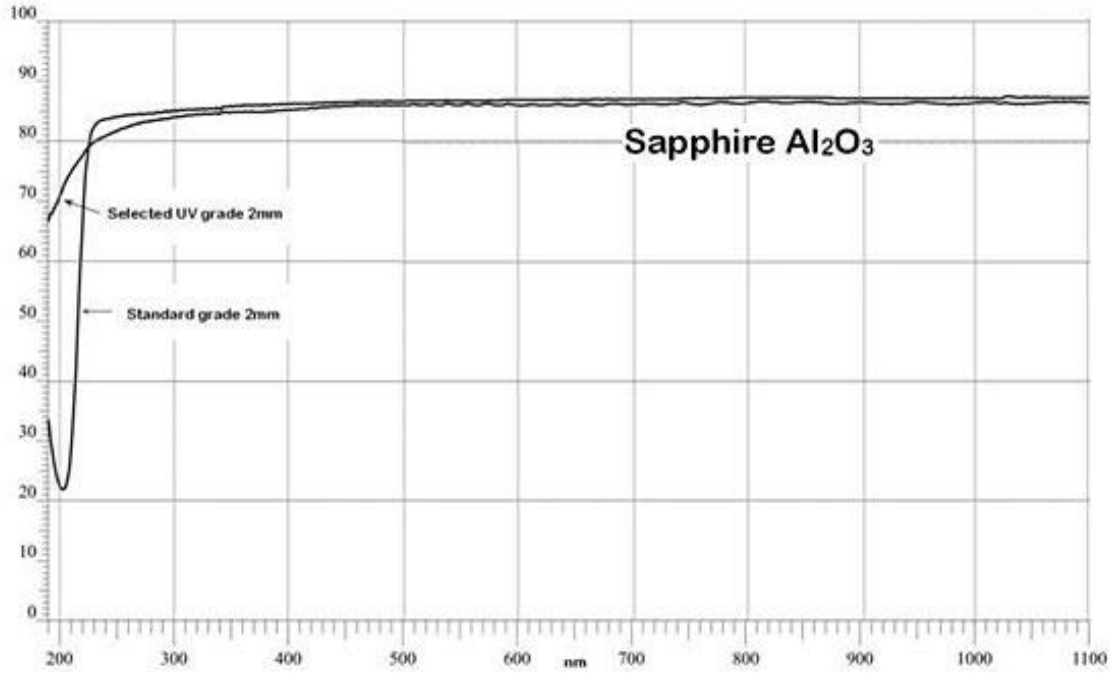
General Parameters

Transmission Range	0.17~5.5μm
Refractive Index	No 1.75449; Ne 1.74663 (1.06μm) (1)
Reflection Loss	14% at 1.06μm
Absorption Coefficient	$0.3\times10^{-3}cm^{-1}$ at 2.4μm (2)
Absorption Peak	13.5μm
dn/dT:	13.4×10^{-6} (0.546μm) (3)
dn/dμ=0:	1.5μm
Density	$3.97g/cm^3$
Melting Point	2040°C
Thermal Conductivity	$27.21Wm^{-1}K^{-1}$ at 300K
Thermal Expansion	5.6 (para) &5.0 (perp) $\times10^{-6}/K$*
Hardness	Knoop 2000 with 2000g indenter
Specific Heat Capacity	$763JKg^{-1}K^{-1}$ (293K) (4)
Dielectric Constant	11.5 (para) 9.4 (perp) at 1MHz

Young's Modulus (E)	335GPa
Shear Modulus (G)	148.1GPa
Bulk Modulus (K)	240GPa
Elastic Modulus	$C_{11}=496$ $C_{12}=164$ $C_{13}=115$ $C_{33}=498$ $C_{44}=148$
Apparent Elastic Limit	300 MPa（45,000 psi）
Poisson’ s Ratio	0.25
Solubility	98×10^{-6}g / 100g water
Molecular Weight	101.96
Class/Structure：（hex），R3c	Trigonal（hex），R3c

Spectral Transmission Curve





Refractive Index No = Ordinary Ray，Ne = Extraordinary Ray)

um	No	Ne	um	No	Ne	um	No	Ne
0.193	1.9288	1.9174	0.213	1.8890	1.8784	0.222	1.8754	1.8650
0.226	1.8702	1.8599	0.244	1.8506	1.8407	0.248	1.8470	1.8372
0.257	1.8393	1.8297	0.266	1.8330	1.8236	0.280	1.8244	1.8151
0.308	1.8110	1.8020	0.325	1.8047	1.7958	0.337	1.8001	1.7921
0.351	1.7969	1.7882	0.355	1.7960	1.7883	0.442	1.7804	1.7721
0.458	1.7784	1.7702	0.488	1.7753	1.7671	0.515	1.7730	1.7649
0.532	1.7717	1.7636	0.590	1.7680	1.7600	0.633	1.7659	1.7579
0.670	1.7643	1.7563	0.694	1.7634	1.7554	0.755	1.7614	1.7535

0.780	1.7607	1.7527	0.800	1.7601	1.7522	0.820	1.7596	1.7517
0.980	1.7561	1.7482	1.064	1.7545	1.7466	1.320	1.7501	1.7423
1.550	1.7462	1.7384	2.010	1.7375	1.7297	2.249	1.7323	1.7243
2.703	1.719	1.711	2.941	1.712	1.711	3.333	1.701	1.693
3.704	1.687	1.679	4.000	1.674	1.666	4.348	1.658	1.65
4.762	1.636	1.628	5.000	1.623	1.615	5.263	1.607	1.599

Ordering Info

PN#	Specifications（D×L）	Orientation	Application Range
MP-OPW-Al2O3-C10-2-IR	10.0×2.0mm	Random	IR
MP-OPW-Al2O3-C12-1-IR	12.0×1.0mm	Random	IR
MP-OPW-Al2O3-C12-2-IR	12.0×2.0mm	Random	IR
MP-OPW-Al2O3-C12-4-IR	12.0×4.0mm	Random	IR
MP-OPW-Al2O3-C15-2-IR	15.0×2.0mm	Random	IR

MP-OPW-Al2O3-C18-4-IR	18.0×4.0mm	Random	IR
MP-OPW-Al2O3-C20-2-IR	20.0×2.0mm	Random	IR
MP-OPW-Al2O3-C25-0.5-IR	25.0×0.5mm	Random	IR
MP-OPW-Al2O3-C25-1-IR	25.0×1.0mm	Random	IR
MP-OPW-Al2O3-C25-2-IR	25.0×2.0mm	Random	IR
MP-OPW-Al2O3-C25.4-1-IR	25.4×1.0mm	Random	IR
MP-OPW-Al2O3-C26-1-IR	26.0×1.0mm	Random	IR
MP-OPW-Al2O3-C35-2-IR	35.0×2.0mm	Random	IR

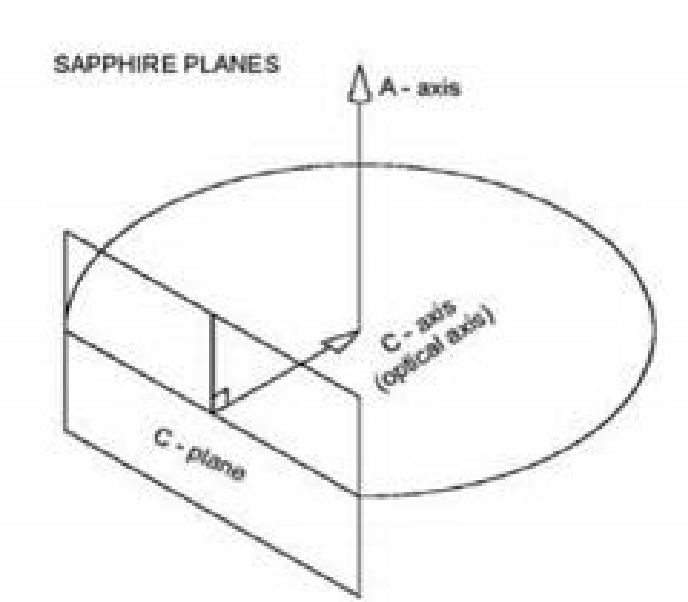
About Crystal Cutting

Sapphire is slightly birefringent and so for critical optical or mechanical applications, the windows should be specifi

ed as 'zero degree', or 'c-cut', meaning that the optical axis of the material should be perpendicular to the plane of the window. If unspecified, the component will be of 'random' cut, but its worth noting that this is nearly always 60° to

the optic axis as this is the 'softest' direction for the saw. Note that all sapphir

e is always single crystal, sub-grains are always avoided in the cut.



C-plane (0,0,0,1) = Z-cut

A-plane (1,1,-2,0) = Y-cut

M-Plane (1,0,-1,0) = X-cut R-Plane (1,0,-1,0)

Manufacturers seem unable to agree on the thermal expansion coefficient of sapphire, figures from 5.6 to 8.4 x 10-6 K are given. While there may be some variation due

to the method of growth, and certainly due to the axis of cut, this variation is inexplicable.