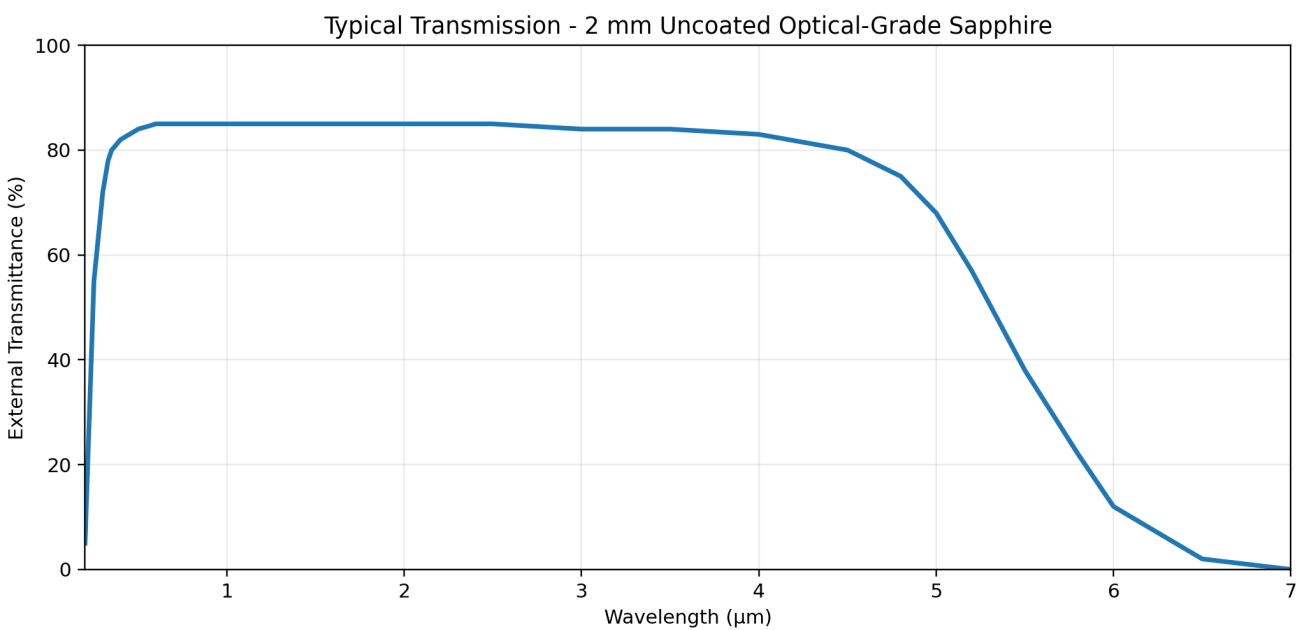


FELIX OPTICAL GLASS

Optical-Grade Sapphire (Al₂O₃) - Material Optical Spectrum & Engineering Data

1. Typical Spectral Transmission



Basis: representative external transmission behavior for a polished, 2 mm thick, uncoated optical-grade sapphire window at near-normal incidence. The curve is intended for material/application evaluation; actual transmission varies with crystal quality, orientation, thickness, surface finish, temperature and coating.

Sapphire is a single-crystal aluminum oxide optical material used from the UV through the mid-IR. Published supplier data commonly places the useful uncoated range around 0.2/0.33 to 5.5 μm, with typical external transmission in the visible/NIR in the low-to-mid 80% range because of Fresnel surface reflection.

2. Representative Transmission Data - 2 mm Uncoated

Wavelength (μm)	Typical T (%)	Spectral Region
0.20	5	Deep UV / absorption edge
0.25	55	UV
0.30	72	UV
0.33	78	UV
0.40	82	Visible
0.50	84	Visible
0.60	85	Visible
0.80	85	VIS-NIR
1.00	85	NIR
1.50	85	NIR
2.00	85	SWIR
2.50	85	SWIR

Wavelength (μm)	Typical T (%)	Spectral Region
3.00	84	MWIR
3.50	84	MWIR
4.00	83	MWIR
4.50	80	MWIR
5.00	68	Mid-IR roll-off
5.50	38	Strong absorption onset
6.00	12	Absorption region

3. Sapphire Material & Optical Properties

Property	Typical / Published Value
Chemical composition	Single-crystal aluminum oxide, Al ₂ O ₃
Density	~3.97 g/cm ³
Mohs hardness	9
Knoop hardness	~1,900 kg/mm ²
Young's modulus	~435 GPa (published optical supplier value)
Refractive index	n ≈ 1.77 at the sodium d-line; wavelength/orientation dependent
Representative refractive index points	~1.83 @ 0.26 μm; ~1.76 @ 0.63 μm; ~1.58 @ 5.57 μm
Abbe number	~72.2
Birefringence	~0.008-0.0087 in visible, orientation dependent
Useful optical range	UV to mid-IR; commonly specified ~0.33-5.5 μm for commercial uncoated windows
Near/Mid-IR transmission	~85% nominal external transmission for uncoated polished sapphire (supplier typical)
Crystal orientations	C-plane, A-plane, R-plane and other orientations available by project
AR coating options	VIS, NIR, SWIR/MWIR and custom BBAR designs; performance is coating-specific

4. Engineering Notes

- Uncoated sapphire has high bulk transparency, but two air/sapphire interfaces produce Fresnel reflection. Appropriate AR/BBAR coatings can materially increase finished-window transmission over a specified band.
- Sapphire is birefringent. Refractive index and optical behavior depend on crystal orientation and polarization, so C-plane/A-plane/R-plane requirements should be stated on precision drawings.
- For customer qualification, the final acceptance document should be the measured spectrophotometer curve for the actual production lot and finished thickness/coating - not this representative material curve.

5. Reference Basis

Prepared from published optical-material information from Meller Optics and Edmund Optics. Published data include density ~3.97 g/cm³, Mohs hardness 9, refractive index around 1.77 in the visible, birefringence around 0.008, and UV-to-mid-IR transmission capability. This FELIX document is an engineering reference sheet and is not a Certificate of Analysis or lot-specific inspection report.

Custom Sapphire Window Manufacturer

Dongguan Felix Glass Co., Ltd.

Custom sizes, shapes, crystal orientations, optical polishing and AR/BBAR coatings available according to drawing.