GLOBAL OPTICS

Sapphire Al_2O_3

🔷 Key Properties of Sapphire (Al_2O_3)

🌈 Wide UV–Mid-IR Transmission: Excellent optical clarity from ~150 nm to 5.5 µm.

🔍 High Refractive Index: ~1.76 at 589 nm with strong optical stability and low absorption.

🪨 Extreme Mechanical Strength: Highly scratch-resistant, impact-resistant, and one of the hardest optical materials.

🔥 Exceptional Thermal Resistance: Operates at very high temperatures with excellent thermal-shock tolerance.

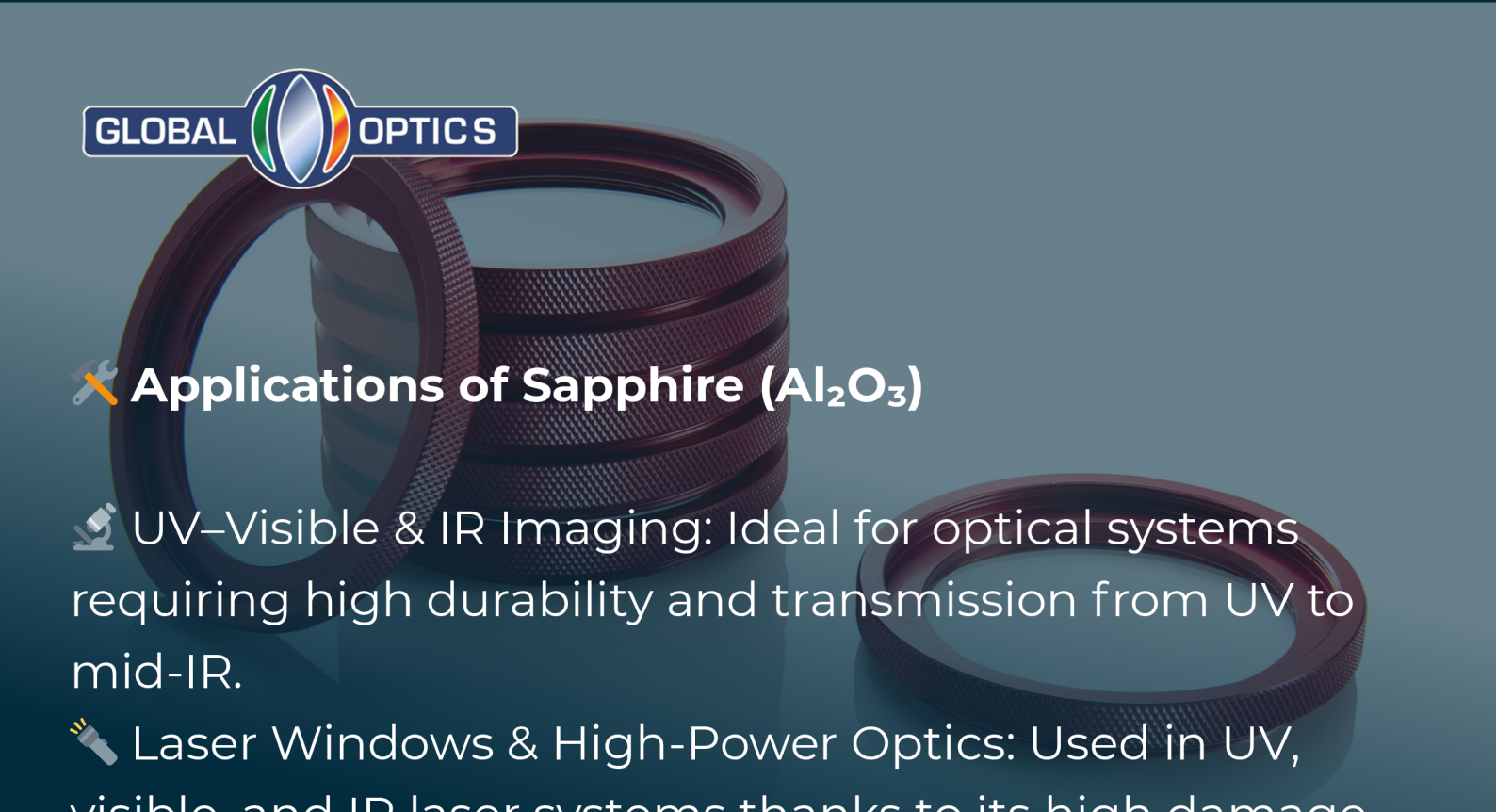
🧪 Chemically Inert: Resistant to acids, solvents, moisture, and environmental exposure.

⚡ Laser-Compatible: High laser-damage threshold for UV, visible, and IR laser systems.

🛰️ Ideal for Harsh Environments: Suitable for aerospace, defence, industrial sensors, and protective viewports.

Unit 6, Branksome Business Park,
Bourne Valley Rd, Poole BH12 1DW

+44 (0) 1202 767476
info@globalopticsuk.com
www.globalopticsuk.com



🛠️ Applications of Sapphire (Al_2O_3)

🔬 UV–Visible & IR Imaging: Ideal for optical systems requiring high durability and transmission from UV to mid-IR.

🔦 Laser Windows & High-Power Optics: Used in UV, visible, and IR laser systems thanks to its high damage threshold.

🛡️ Protective Viewports: Perfect for harsh-environment windows in industrial, aerospace, and defence systems.

🛰️ Aerospace & Space Optics: Resistant to radiation, extreme temperatures, and mechanical stress.

🔍 Precision Imaging & Metrology: Excellent optical uniformity for scientific instruments and high-accuracy systems.

🌡️ High-Temperature Applications: Used for furnace windows, thermal sensors, and high-heat monitoring systems.

🧪 Chemical & Industrial Processing: Chemically inert and ideal for corrosive or moisture-rich environments.

⚙️ General UV/Visible/IR Optics: Common for lenses, domes, prisms, and rugged optical assemblies.

Unit 6, Branksome Business Park,
Bourne Valley Rd, Poole BH12 1DW

+44 (0) 1202 767476
info@globalopticsuk.com
www.globalopticsuk.com

Technical Parameters of Sapphire (Al_2O_3)

Property	Typical Value
Transmission Range	150 nm – 5.5 µm
Refractive Index	1.76 @ 589 nm
Density	3.98 g/cm³
Melting Point	~2040 °C
Hardness (Knoop)	~2200 kg/mm² (very hard)
Thermal Expansion	5.0 × 10^{-6} /°C (average)
Crystal Type	Single crystal (hexagonal/trigonal)
Hygroscopic	No (non-hygroscopic)
Chemical Formula	Al_2O_3
Applications	Laser windows, protective viewports, aerospace optics, high-temperature sensors, imaging systems, rugged UV–IR optical components

Sapphire (Al_2O_3) is an exceptionally tough optical material with a wide transmission range from 0.20–5.5 µm, making it ideal for UV–visible–IR optics, laser windows, protective viewports, aerospace systems, thermal sensors, and high-performance imaging applications. Its higher refractive index (~1.76) and low absorption enable excellent optical performance across demanding wavelength ranges.

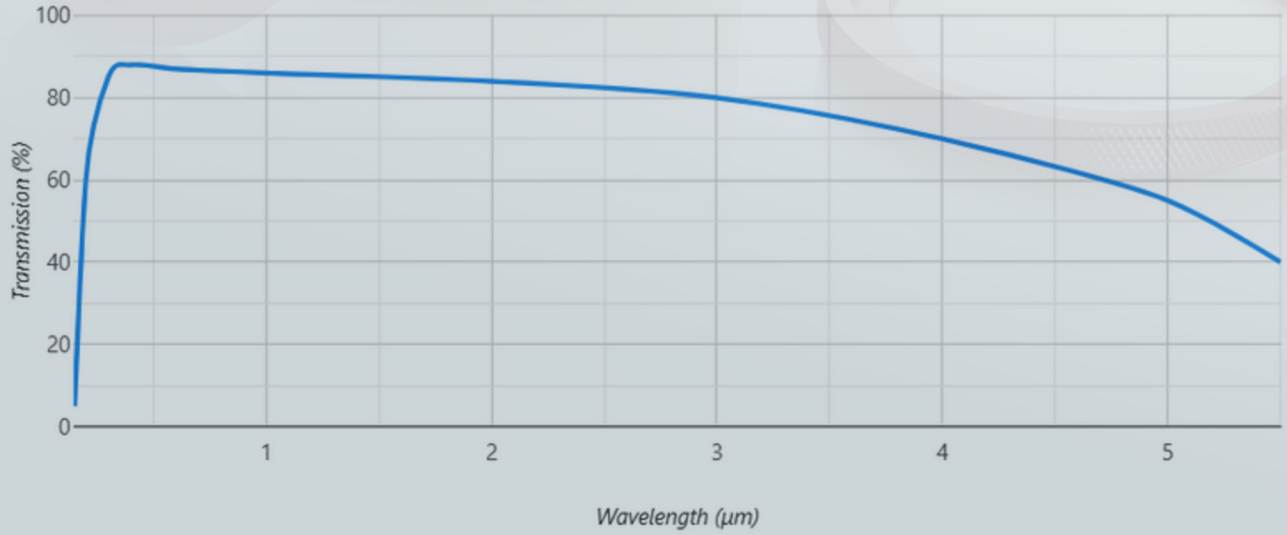
Sapphire is non-hygroscopic, highly scratch-resistant, and exceptionally resistant to heat, pressure, and chemical attack, allowing it to operate reliably in harsh industrial, laboratory, and defence environments. As one of the hardest optical materials available, sapphire is widely used for windows, lenses, domes, prisms, and IR components, offering outstanding durability, thermal stability, and long-term optical clarity for precision optical systems.

Unit 6, Branksome Business Park,
Bourne Valley Rd, Poole BH12 1DW

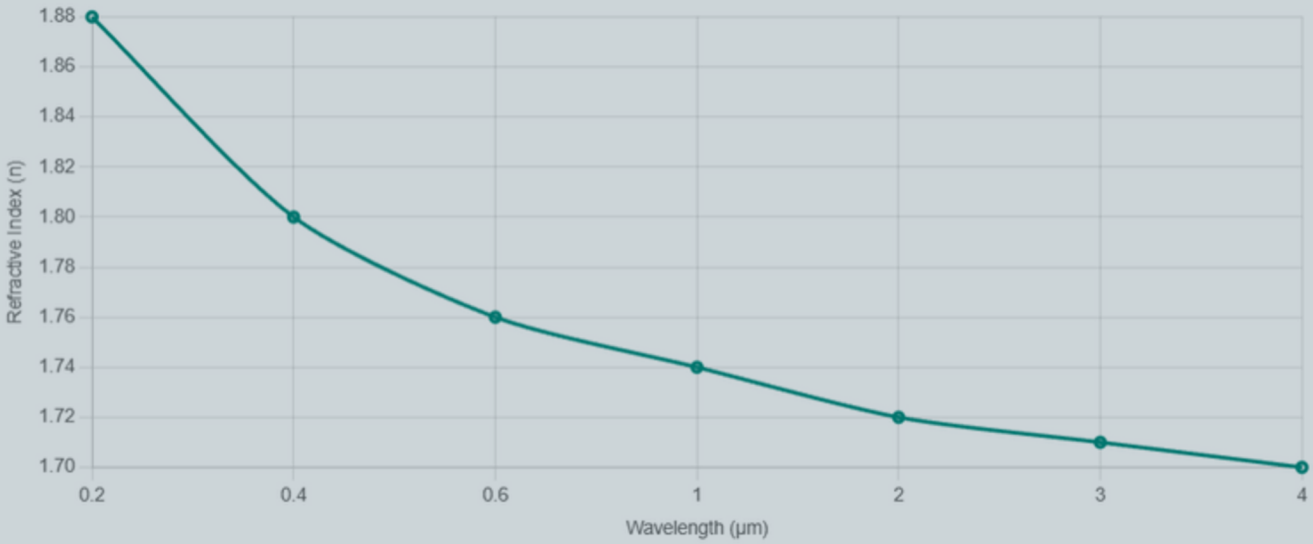
+44 (0) 1202 767476
info@globalopticsuk.com
www.globalopticsuk.com

Sapphire (Al_2O_3) – Optical & Thermal Graphs

Sapphire Transmission (0.15–5.5 µm)



Sapphire Refractive Index



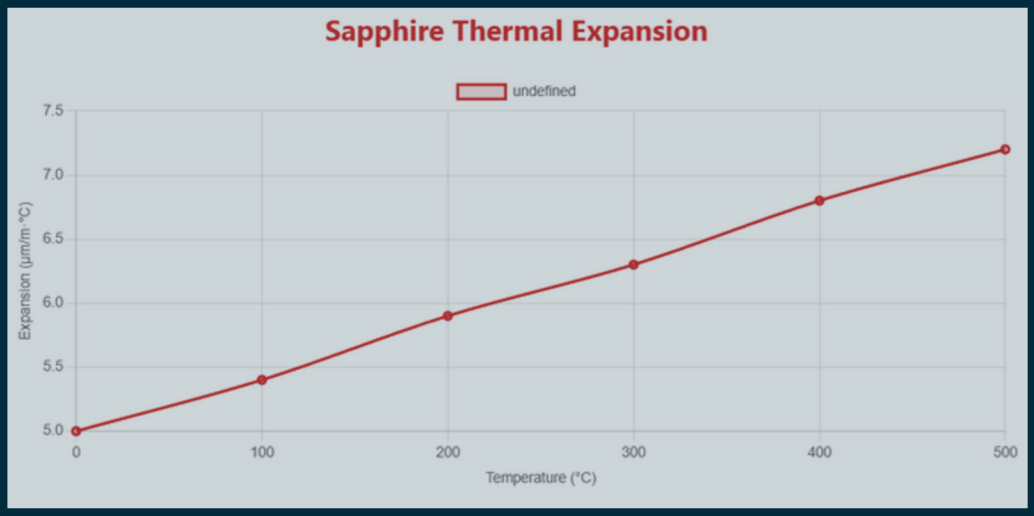
Unit 6, Branksome Business Park,
Bourne Valley Rd, Poole BH12 1DW

+44 (0) 1202 767476
info@globalopticsuk.com
www.globalopticsuk.com

Sapphire (Al_2O_3) provides broad optical transmission from 0.20 µm to 5.5 µm, covering the UV, visible, and mid-infrared regions. With its higher refractive index (~1.76) and excellent optical stability, sapphire is well suited for UV–VIS–IR imaging, laser systems, aerospace and defence optics, thermal sensors, and rugged broadband optical components.

Sapphire offers exceptional thermal, mechanical, and chemical stability, delivering reliable performance in the most demanding laboratory, industrial, and field environments. As one of the hardest crystalline optical materials, it can be fabricated into windows, lenses, domes, prisms, and laser optics, providing superb durability, optical clarity, and long-term resistance to abrasion and environmental stress.

Being non-hygroscopic, chemically inert, and highly resistant to heat and pressure, sapphire is easy to handle and ideal for high-power laser systems, protective viewports, precision imaging, and UV–IR instrumentation where maximum strength and reliability are essential.



Unit 6, Branksome Business Park,
Bourne Valley Rd, Poole BH12 1DW

+44 (0) 1202 767476
info@globalopticsuk.com
www.globalopticsuk.com

FAQ

Q: What is Sapphire used for in optical applications?
A: Sapphire is widely used for laser windows, protective viewports, aerospace optics, high-temperature sensors, imaging systems, and rugged UV–IR optical components due to its extreme hardness and broad 0.20–5.5 µm transmission range.

Q: What makes Sapphire different from other optical materials?
A: Sapphire is one of the hardest optical materials available (Knoop ~2000), offering exceptional scratch resistance, high thermal conductivity, excellent UV–IR transmission, and outstanding durability in harsh or abrasive environments.

Q: Is Sapphire hygroscopic?
A: No. Sapphire is completely non-hygroscopic and remains stable in humid, wet, or outdoor environments.

Q: Is Sapphire suitable for high-power lasers?
A: Yes. Sapphire has a very high laser-damage threshold and excellent thermal stability, making it ideal for high-power UV, visible, and IR laser windows and beam-delivery systems.

Q: What optical components can be made from Sapphire?
A: Common sapphire components include windows, viewports, lenses, domes, protective covers, IR sensor windows, and high-strength optical elements for defence, aerospace, and industrial systems.

Q: How durable is Sapphire compared to glass or fluoride crystals?
A: Sapphire is significantly harder and more scratch-resistant than quartz, MgF_2, CaF_2, ZnSe, and other infrared materials. It excels in abrasive, high-temperature, high-pressure, or chemically demanding environments.

Q: Can Sapphire optics be anti-reflection coated?
A: Yes. Sapphire can be supplied uncoated or with UV, visible, or IR AR coatings, as well as DLC (diamond-like carbon) for extreme durability.

Q: Is Sapphire safe and easy to handle?
A: Yes. Sapphire is non-toxic and chemically inert. Its extreme hardness prevents surface damage, but care should still be taken to avoid edge chipping.

Unit 6, Branksome Business Park,
Bourne Valley Rd, Poole BH12 1DW

+44 (0) 1202 767476
info@globalopticsuk.com
www.globalopticsuk.com