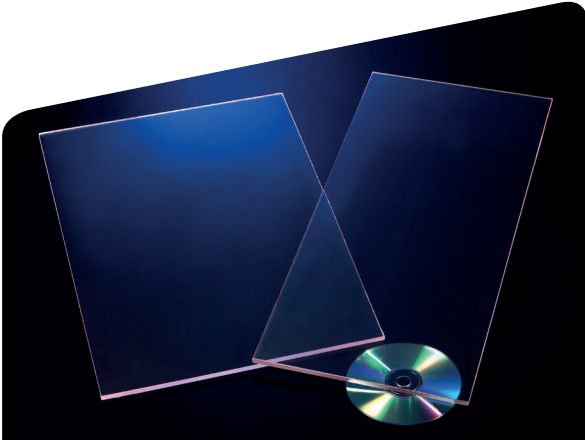


Saint-Gobain Crystals Sapphire

The Clear Advantage for EO-IR Window Solutions



- ◇ Largest area optical sapphire in the world
- ◇ Extremely hard, durable and scratch resistant
- ◇ Broadband transmission from UV to visible to IR wavelengths up to 5 microns
- ◇ AR Coatings, Heater & EMI Grids readily available

Sapphire aerospace window applications:

- Forward Looking Infra-Red (FLIR) systems
- Weapons targeting systems
- Reconnaissance and surveillance systems
- Tank sight window



CRYSTALS

The Saint-Gobain logo features a stylized, colorful bar chart with five bars of increasing height from left to right, followed by the text "SAINT-GOBAIN" in a bold, blue, sans-serif font.

SAINT-GOBAIN

Sapphire The Clear Advantage for EO-IR Window Solutions

Sapphire windows protect onboard imaging, sensing and targeting systems while allowing broadband transmission

Saint-Gobain Sapphire Windows:

- Currently used in both commercial and military applications
- Configured in an external pod / helicopter turret / optics shroud on fuselage
- Sapphire desired for impact resistance and high strength to thickness ratio, for a durable, lighter weight window structure when compared to alternative materials

Finishing Capabilities:

- Surface Quality: Down to 10-5 Scratch-Dig
- Surface Flatness: High Precision up to $1/20\lambda$
- Parallelism: Down to 1 arc second

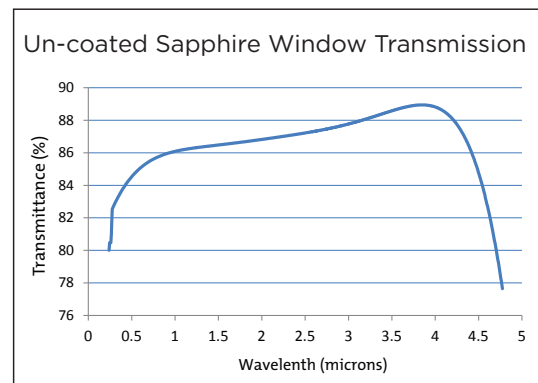
Window Solution Options:

- Metal grid for de-icing
- Electromagnetic Interference (EMI) shielding
- Anti reflective (AR) coating for improved transmission
 - Transmission >90% easily achieved



Example of window with metal grid

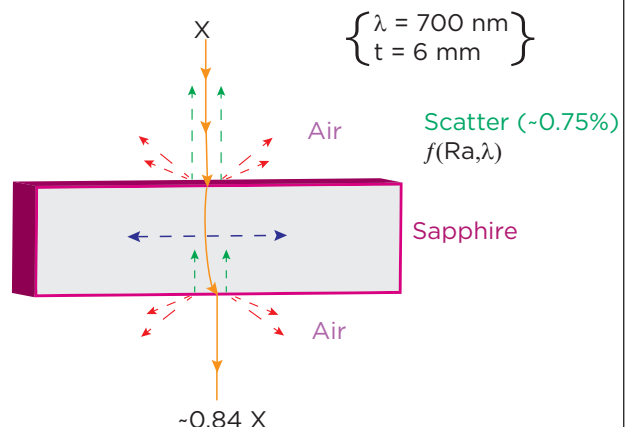
Mechanical Properties	Sapphire	ZnS
Density (g/mL)	3.98	4.08
Hardness (Knoop, GPa)	22	2.5
Fracture Toughness (MPa*m ^{1.5})	2	1
Flexural Strength (MPa, 20°C)	300-1000	100
Young's Modulus (Gpa, 20°C, parallel C-axis)	435	74



Light Transmission Through Sapphire

Reflection (~7%)
 $f(\eta, \lambda)$

Absorption (~0.1%)
 $f(\text{Impurities})$




SAINT-GOBAIN

Saint-Gobain Crystals

www.crystals.saint-gobain.com

ISO 9001:2008 and ISO14001:2004 Certified

Manufacturer reserves the right to alter specifications.

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(06-16)