

# HARD MATERIALS

## Sapphire (Al<sub>2</sub>O<sub>3</sub>)

Sapphire, a crystalline form of aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), is renowned for its exceptional hardness (9 on the Mohs scale), wide optical transmission range (0.15-5.5 μm), and superior physical properties.

Sapphires characteristics and its strength and scratch resistance makes it the material of choice for a variety of demanding applications

Applications:

ruggedized optics, scratch-resistant windows, durable displays, infrared instrumentation, high-performance optics, screens for consumer electronics, sensors and detectors for industrial and aerospace systems, high-end timepieces.

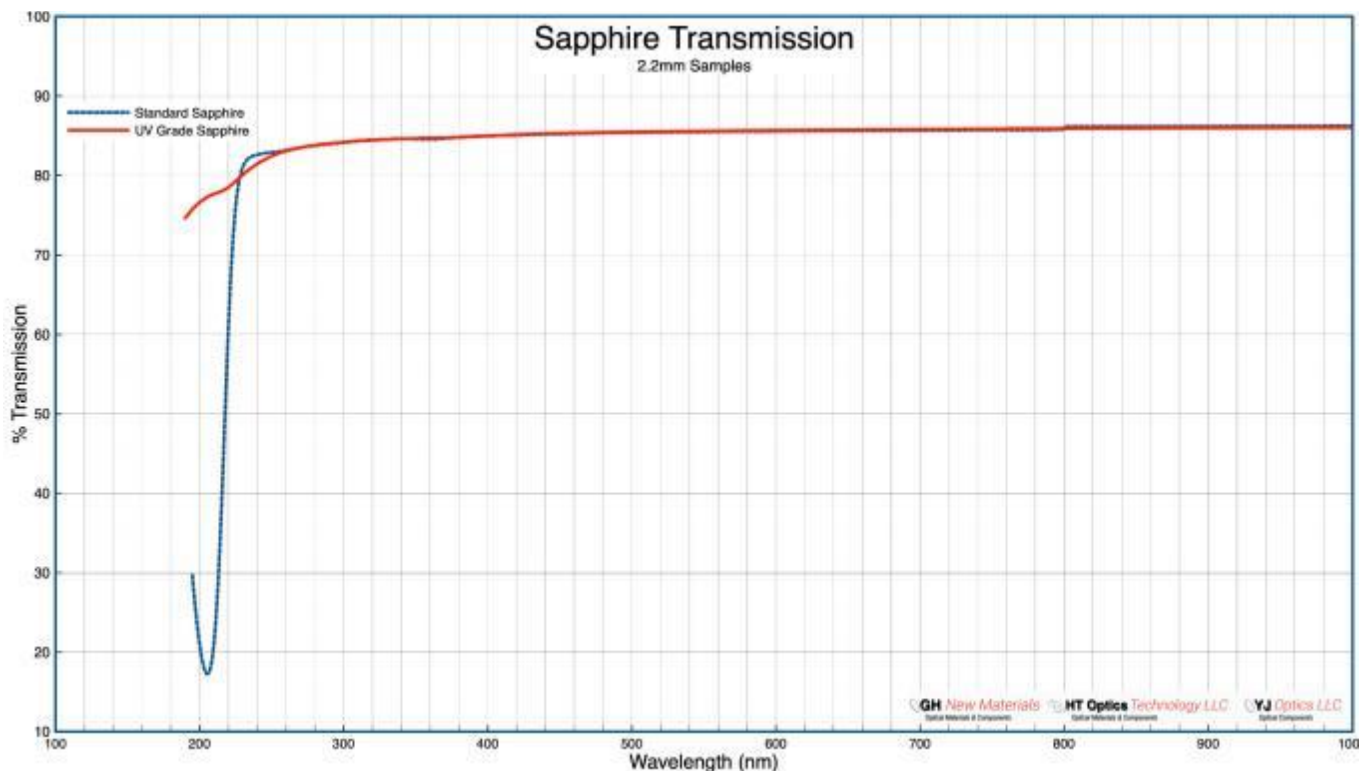


### Key Optical Properties:

- Wide transparency: UV to mid-IR (0.15-5.5 μm)
- High refractive index (1.768 at 589 nm)
- Low birefringence (0.008 at 589 nm)
- Excellent optical homogeneity

### Other Notable Properties:

- High melting point 2,030°C
- High thermal conductivity (42 W/m-K)
- Excellent dielectric strength (480 kV/cm)
- Exceptional chemical inertness
- Biocompatible



# HARD MATERIALS

## Sapphire (AlO<sup>2</sup>) Data

Sapphire Properties			
Mechanical Properties			
Density	3.97g/cm <sup>3</sup>		
Vickers hardness	22GPa		
Tensile strength	413.79MPa		
Compressive strength	2068.97MPa		
Young's Modulus	74×106psi		
Poisson's Ratio	0.28		
Optical Properties			
UV	>70%		
Visible~near mid-infrared	>87%		
Refractive index	1.83@255nm		
	1.76@630nm		
	1.58@5570nm		
Electrical Properties			
Conductivity	@25°C>1018ohm cm		
	@500°C>1012ohm cm		
Dielectric Constant	(⊥)C 9.3 ( KHz-I GHz,25°)		
	(  )C 11.5 ( KHz-I GHz,25°)		
Dielectric Strength	480,000v/cm		
Thermal Properties			
Melting Point	2050°C		
Thermal Conductivity	32W/Mk (@258°C)		
Specific Heat	1.99J/cm <sup>3</sup> C		
Item	Parameter	Testing Equipment	
EPD	< 1000/cm <sup>2</sup>	Leatz Polarizing microscope	
Rocking Curve (FWHM)	< 15"	X' TRA	
Purity	>99.999%	GDMS	
Sapphire Crystal's Orientation Difference			
Sapphire Crystal Orientation	Hardness (kg/mm <sup>2</sup> )	Flexural Strength (MPa)	Orientation Performance
C	2200	350	Isomorphism
A	1800	500	Isomerism
M	1800	500	Isomerism