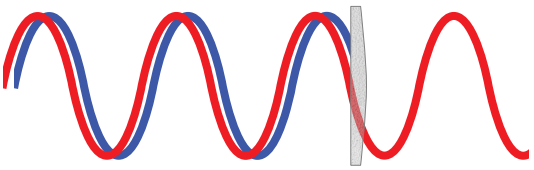
# HARD MATERIALS
# Sapphire ($AlO^2$)



Sapphire, a crystalline form of aluminum oxide (Al2O3), 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:

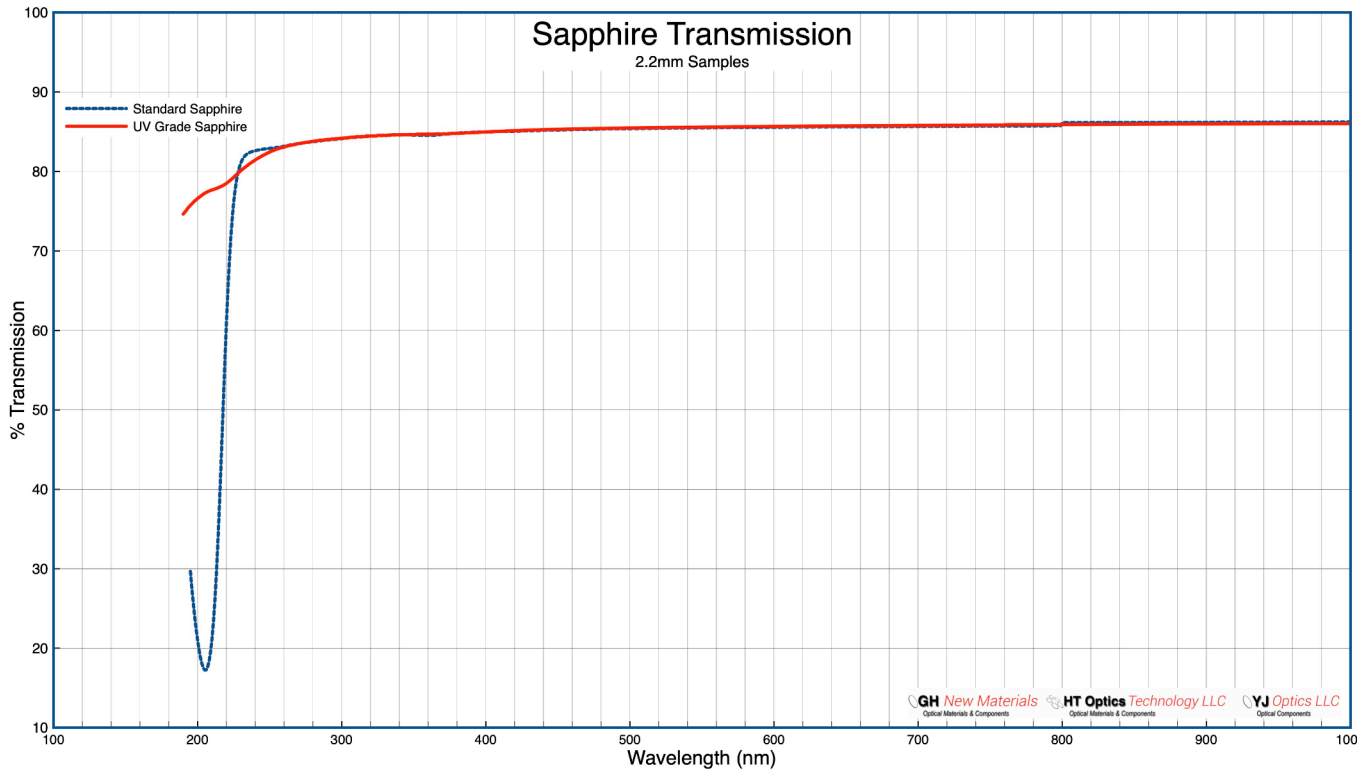
ruggedized optics, scratch-resistant windows, durable displays, infrared instrumentation, high-performance optics, screens for consumer electronics, sensors and detectors for industrial and aerospace systems, high-end timepieces.

### 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





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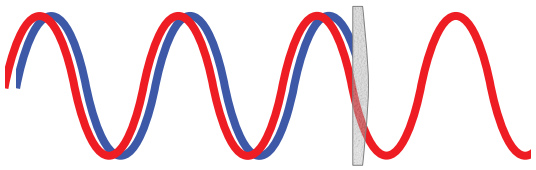
# Sapphire ($AlO^2$) Data



| Sapphire Properties | |
|---|---|
| **Mechanical Properties** | |
| Density | 3.97g/cm³ |
| 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℃＞1018ohm cm |
| | @500℃＞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℃ |
| Thermal Conductivity | 32W/Mk (@258℃) |
| Specific Heat | 1.99J/cm³℃ |

| Item | Parameter | Testing Equipment |
|---|---|---|
| EPD | ＜1000/cm² | Leatz Polarizing microscope |
| Rocking Curve (FWHM) | ＜15" | X' TRA |
| Purity | ＞99.999% | GDMS |

| Sapphire Crystal's Orientation Difference | | | |
|---|---|---|---|
| Sapphire Crystal Orientation | Hardness (kg/mm2) | Flexural Strength (MPa) | Orientation Performance |
| C | 2200 | 350 | Isomorphism |
| A | 1800 | 500 | Isomerism |
| M | 1800 | 500 | Isomerism |



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