Luxium Solutions Sapphire Products

Sapphire (Al2O3) sheets, tubes & rods have a variety of industrial uses. Its optical, electrical, chemical, mechanical, and nuclear properties make it an ideal material for hundreds of applications. Frequently it is the combination of two or more properties that make sapphire the only material available to solve complex engineering design problems.

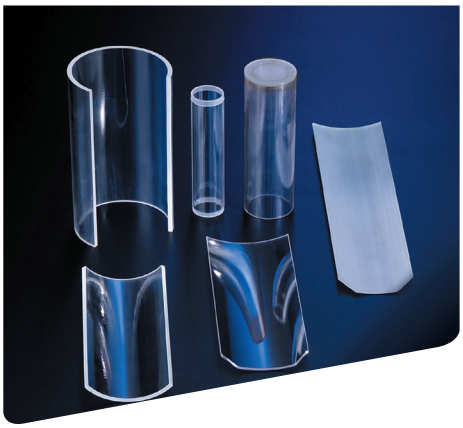
Features and Benefits

- Withstands temperatures up to 2000°C
- Transmits in the UV - visible - IR wavelengths
- Significant Abrasion Resistance: 2nd in hardness to diamond
- Chemically inert and insoluble (Biocompatible material)
- High thermal conductivity
- Complex shapes through machining, bonding, lamination

Innovative Solutions include:

Sheet Products

- Disks and windows
- Bonded assemblies
- Complex shape
- Curved sheets
- Viewports and sight windows
- End effectors
- Gas diffusion plates



Tube Products

- Open-end tubes
- Plugged tubes
- Capillary tubes
- Shaped tubes
- Plasma containment tubes
- Process gas injectors
- Thermocouple protection assemblies

Rod Products

- Structural rod
- Plugged rod
- Optical rod
- Stiffeners
- Lift pins
- Sensor rod

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Sapphire Properties

Standard Sizes

Sheet		Tube			Rods/Pins	
Length x Width	**Thickness Range**	**Outer Diameter Range**	**Standard Wall Thickness**	**MAX part Length**	**Diameter Range**	**MAX part Length**
9 x 26	.100 - .300	.060 -.090	.010 - .025	10	.050 - .125	12
12 x 20	.100 - .300	.091 - .275	.025 - .040	60	.125 - .290	18
≤6 x 6	.025 - .300	.276 - .750	.030 - .060	60		
		.751 - 1.250	.050 - .090	60		
		1.260 -1.750	.060 - .090	25		

Note: All dimensions listed are in inches **** Note: Custom sizes available upon request ****

Physical/Mechanical

Density	3.97 gm/cm³ (0.143 lb/in³) (25°C)
Young's Modulus	435 GPa (63 x 10^6 psi) parallel to C-axis (25°C) 386 GPa (56 x 10^6 psi) parallel to C-axis (1000°C)
Modulus of Rigidity (Shear Modulus)	175 GPa (26 x 10^6 psi)
Poisson's Ratio	0.27 – 0.30 orientation dependent
Flexural Strength	1035 MPa (150 kpsi) parallel to C-axis (25°) 760 MPa (110 kpsi) perpendicular to C-axis (25°)
Compressive Strength	≈2 GPa (300 kpsi) 25°
Hardness 9 Moh's scale (between 20° and 25°C)	1900 Knoop Parallel to C-axis 2200 Knoop Perpendicular to C-axis

Optical

Transmission	UV through midwave IR (~200-5000nm)
Uniaxial Negative Refractive Index	Ordinary ray (C-axis) N_o = 1.768 Extraordinary ray N_e-1.760 Birefringence: 0.008
Temperature Coefficient of Refractive Index	13 X 10^{-6}/°C (visible range)
Spectral Emittance	0.1 (1600°C)
Spectral Absorption Coefficient	0.1 – 0.2cm^{-1} (0.66 μm, 1600°C)

Thermal

Melting Point	2053°C (3727°F)
Specific Heat	0.181 cal/gm°K (25°C) 0.300 cal/gm°K (1000°C)
Thermal Conductivity	0.4 watts/cm°K (25°C) 0.1 watts/cm°K (1000°C)
Thermal Expansion Coefficient	(25 – 1000°C) 8.8 x 10^{-6}; parallel to C-axis 7.9 x 10^{-6}; perpendicular to C-axis

Chemical

Weathering Resistance	Unaffected by atmospheric exposure
Sea Water Resistance	Unaffected by marine exposure
Biological Resistance	Unaffected by in-vivo exposure Non-thrombogenic Non-reactive with body fluids

Electrical

Volume Resistivity (ohm-cm)	10^{16} (25°) 10^{11} (500°) 10^6 (1000°)
Dielectric Strength	480,000 volts/cm (1,200 volts/mil)
Dielectric Constant	11.5 (10^3 – 10^9Hz, 25°C) parallel to C-axis 9.3 (10^3 – 10^9Hz, 25°C) perpendicular to C-axis
Loss Tangent	8.6 X 10^{-5} (@10^{10}Hz, 25°C) parallel to C-axis 3.0 X 10^{-5} (@10^{10}Hz, 25°C) perpendicular to C-axis
Magnetic Susceptibility	-0.21 X 10^{-6} parallel to C-axis -0.25 X 10^{-6} perpendicular to C-axis

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