BIRD
PRECISION DATA SHEET

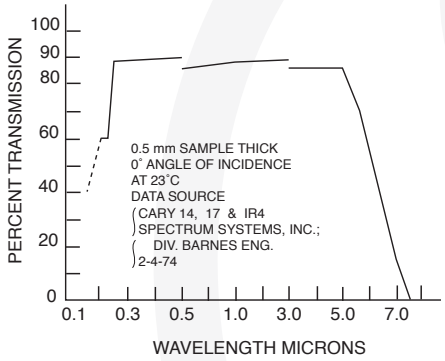
Optical Sapphire Products

Sapphire is unique when compared to optical materials within its transmission range. By far it is the strongest, thermal shock and chemically resistant material available, and can be used for higher temperatures than most optical materials as well as high pressure and vacuum applications. Its thermal conductivity is relatively high despite its extreme electrical non-conductivity. Moderate refractive index, transparency in the visible range, good transmission and relatively low emission at high temperature plus unusual stability combine to make it valuable as a component on commercial and military optical systems.

Properties

Transmission

Sapphire exhibits wide optical transmission in the Visible, UV and Near-Infrared bands.



Chemical Resistivity

Virtually inert to all reagents and alkalis at room temperature including HF and to a large variety of reagents at temperatures above 1000°C.

Strength and Stability

at elevated temperatures.

Scratch and Abrasion Resistance

Combined with close to diamond hardness (Knoop 1525-2000) makes it an indestructible wear surface achieving polish and finishes below 250 Angstroms where required.

High Thermal Conductivity

combined with LOWELECTRICAL CONDUCTIVITY.

Moderate Refractive Index (at 20°C)

.3 micron	1.814	2 micron	1.740
.4	1.785	3	1.713
.7	1.763	4	1.677
1.0	1.757	5	1.623

Sealing Characteristics

Sapphire can we wetted by glass, Titanium, Zirconium, or Molymanganese mixtures. It can be matched to Titanium, Molybdenum, high Nickel-iron alloys such as Carpenter 49, Kovar and Corning glass 7520. With good technique, bonds can also be made directly to Corning 7520.

Porosity

0%

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Infrared

The outstanding applications of synthetic sapphire have been as components in the near infrared equipment where sapphire has founded use in systems involving lead sulfide, lead selenide and indium antimonide detectors because of the “match” between transmission of sapphire and sensitivity of the detector material. Flat and curved windows are used in detector cells because of transmission, low cost and ease of sealing to glasses such as Corning 7520.

Lenses are also made of sapphire in place of windows in detector cells where the same properties including the intermediate refractive index of sapphire apply. IR domes made of sapphire offer the important advantages of high resistance to thermal shock, abrasion and other difficult environmental conditions.

Sapphire is an excellent substrate for filters and recticles because of its transmissivity, chemical stability, ability to take deposits well and very high strength which allows for very thin sections where needed. In many cases, sapphire has become the commonly used material because of comparatively low cost and availability.

Lamp Envelopes

Sapphire has found use as a lamp envelope in discharge lamps because of its excellence transmission in the UV and Near Infrared regions coupled with extreme chemical stability which prevents it from breaking down under high temperatures and strong radiation conditions.

Solar Cell Coverplates

Recent work has indicated sapphire to be quite stable under radiation conditions encountered in the UV and Near Infrared regions coupled with extreme chemical stability which prevents it from breaking down under high temperatures and strong radiation conditions.

Light Pipes

Sapphire rods act as an excellent IR light pipe under high temperatures.

High Pressure and Vacuum Windows

High compressive strength, thermal resistivity, dimensional stability and resistance to etching under high temperatures and excellent sealing characteristics make sapphire one of the most sought after materials in this field. Currently sapphire is being utilized in combustion chambers, vacuum furnaces, nuclear windows and underwater pressure apparatus.

Optical Flats, Prisms and Optical Insulators

Extreme abrasive resistance to wear and its inherent potentials in achieving close tolerance and super smooth finishes make sapphire a material unequaled in this field.

Available Forms and Sizes

Bird windows and substrates are available in round, rectangular. square or rod forms in either sapphire or ruby red optical material. Sizes are available from .010” dia. rod up 6.00” dia. windows. Thickness can be obtained in most common fractional sizes up to 3.00”. Polishes are standard at 80-20 as per MIL-SPEC-0-13830. Special polishes down to 250 Angstroms are available upon request.

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