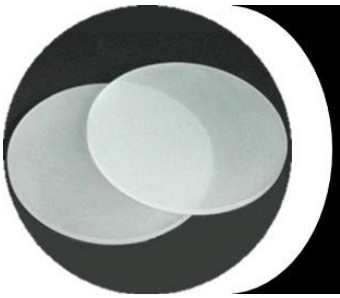
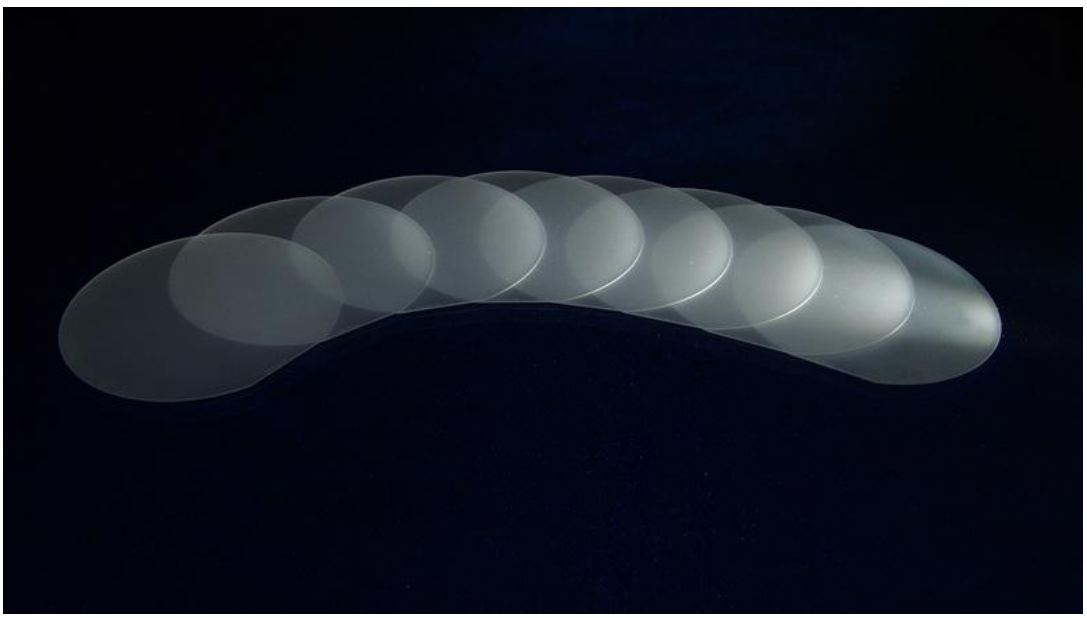


**Wafer**

By use of own production and machining capability, we can fabricate standardized sapphire wafer of 2", 4" and 6". Different orientations and thicknesses as well as the custom specifications are also available upon request. At present, we are mainly focusing on 2" and 4" blank pieces of wafers with C-plane, A-plane, M-plane and random sapphire material with tight geometric and dimensional tolerances.

## Wafer

| Item | Specification | | |
|---|---|---|---|
| Product Name | 2" Standard Sapphire Wafer | 4" Standard Sapphire Wafer | 6" Standard Sapphire Wafer |
| Substrate Materials | High Purity $Al_2O_3$ | | Per Customers' Request |
| Surface Plane Orientataion | C-axis tilted toward M-axis 0.20 +/- 0.10 deg. | | |
| | C-axis tilted toward A-axis 0.00 +/- 0.10 deg. | | |
| Primary Flat Orientation | A-axis 0.00 +/- 0.20 deg. | | |
| Diameter | 50.8 +/- 0.1 mm | 100 +/- 0.1 mm | |
| Thickness | 430 +/- 15 µm | 650 +/- 15 µm | |
| Flat Length | 16.0 +/- 1.0 mm | 30.0 +/- 1.0 mm | |
| TTV | < 10 µm | < 20 µm | |
| Bow | -10 ~ 0 µm | -20 ~ 0 µm | |
| Warp | < 15 µm | < 30 µm | |
| Front-side Roughness (Ra) | < 3 Å | < 3 Å | |
| Back-side Roughness (Ra) | 1 +/- 0.2 µm | 1 +/- 0.2µm | |
| Wafer Edge | T type | | |
| Remarks:<br>Customised thickness and flat length are available upon customers' requirement. | | | |



# MATERIAL SAFETY DATA SHEET

***SAPPHIRE OPTICAL CRYSTAL***

## 1. IDENTIFICATION OF THE SUBSTANCE

**CHEMICAL NAME:** Sapphire
**SYNONYMS, TRADE NAMES:** $Al_2O_3$ ; Aluminium Oxide; Alumina; Corundum
**DESCRIPTION:** Inorganic Crystalline pieces
**USAGE:** Optical Material
**APPEARANCE:** Clear transparent solid. No odour

## 2. COMPOSITION/INFORMATION ON INGREDIENTS

| COMPONENT NAME | CAS No. | % | CLASS | HEALTH | RISK | UN No. |
|---|---|---|---|---|---|---|
| Sapphire | 1344-28-1 | 99.995% | NR | NR | None | NR |

## 3. HAZARDS INFORMATION

Not classified as dangerous according to EC directives

## 4. FIRST AID MEASURES

**GENERAL:** Consult a Physician for specific advice
**EYES:** Irrigate thoroughly with water. If discomfort persists obtain medical attention.
**SKIN:** Wash off thoroughly with soap and water.
**INHALATION:** Remove from exposure. Seek medical advice.
**INGESTION:** Wash out mouth thoroughly with water. In severe cases obtain Medical Attention.

## 5. FIRE FIGHTING MEASURES

**FLASH POINT:** Not Ignitable. Not Applicable
**AUTO IGNITION TEMP:** Not Applicable
**EXTINGUISHING MEDIA:** No specific agents recommended.
**UNUSUAL FIRE HAZARDS:** None known.

## 6. ACCIDENTAL RELEASE MEASURES

**CONTAMINATION CLEANUP:** Wear suitable protective clothing & equipment as listed under Exposure / Personal protection. Take up and containerize and return to manufacturer for proper disposal. Avoid making dust.

## 7. HANDLING AND STORAGE

**USAGE PRECAUTIONS:** Protect against physical damage. Avoid generating dust.
**STORAGE PRECAUTIONS:** No special precautions needed.

## 8. EXPOSURE CONTROL AND PERSONAL PROTECTION

Protective gloves made of polyvinyl alcohol (PVA) are required. Use of a laboratory coat is suggested. Safety goggles or safety glasses with side shields are required if there is any possibility of chipping or dust creation. Respirators must be worn when the threshold limit is exceeded. Provide adequate general mechanical ventilation, and local exhaust ventilation.

**EXPOSURE LIMITS OES, 10mg/M$^3$, Long-term 8 hour TWA**

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**APPEARANCE:** Clear glassy geometric shapes, no odour.
**pH IN AQUEOUS SOLUTION:** Not determined
**BOILING POINT (760mm Hg):** 2977 °C
**MELTING POINT:** 2053 °C
**FLASH POINT:** Not Applicable
**FLAMMABILITY:** Not Applicable
**EXPLOSIVE PROPERTIES:** Not Applicable
**SPECIFIC GRAVITY:** 3.97 g/cc
**VAPOUR PRESSURE:** 1mm Hg @ 2158 °C
**SOLUBILITY IN WATER:** 98 x $10^{-6}$ g/100g

## 10. STABILITY AND REACTIVITY

**STABILITY:** Stable under normal conditions of storage and use.
**HAZARDOUS DECOMPOSITION:** Should not occur under normal conditions.
**MATERIALS TO AVOID:** Ethylene Oxide, Chlorine Trifluoride

# MATERIAL SAFETY DATA SHEET

***SAPPHIRE OPTICAL CRYSTAL***

## 11. TOXICOLOGICAL INFORMATION

| | |
|---|---|
| **TOXIC DOSE - LD50** | No Data |
| **CARCINOGENICITY** | No evidence of carcinogenic properties. |
| **MUTAGENICITY/TERATOGENICITY** | No evidence of effects. |
| **TOXICOLOGICAL FINDINGS** | No Data |

## 12. ECOLOGICAL INFORMATION

No environmental hazard is anticipated provided that the material is handled and disposed of with due care and attention.

## 13. DISPOSAL CONSIDERATIONS

**DISPOSAL METHODS:** Chemical residues are generally classified as special waste, and as such are covered by regulations which vary according to location.
Contact your local waste disposal authority for advice, or pass to a chemical disposal company.

## 14. TRANSPORT INFORMATION

Not subject to transport regulations

## 15. REGULATORY INFORMATION

**CLASSIFICATION:** Not classified as dangerous according to EC Directives. EC-No.:
**LABEL FOR SUPPLY:** None

**RISK PHRASES:** None
**SAFETY PHRASES:** None

## 16. OTHER INFORMATION

**REVISION DATE:** January, 2013

*The above information is believed to be correct but does not purport to be all inclusive and must be used only as a guide.*

## Sapphire Properties

Sapphire is a kind of unique material which is commonly utilized in industries nowadays. Sapphire is the hardest substance that only precedes diamond with a 9 on the Mohs scale. It is significantly stronger than other optical materials in view of its characteristics of highly resistant to not only scratching and abrasion, but also other chemical such as acid and alkaline. Therefore it is ideal for both semiconductor and chemical processing. Sapphire can also be used in high-temperature application up to 1800℃ since its melting point is around 2050℃, its thermal stability is also higher than any other optical materials. In addition, sapphire is transparent from 180nm to 5500nm, this wide optical transparency feature makes sapphire the best materials in IR and UV optical systems. Last but not least, sapphire is also a prevalent material of jewelry business with its exceptional features of high purity, transmittance as well as hardness. The color of sapphire can be changed subject to different requirement which offers a variety of choices to customers.

## Method

Kyropoulos method was developed by S.Kyropoulos for growing large single crystals. This method requires a seed crystal which is mounted on a seed holder and sapphire melts in the crucible below. Crystallization happens when the seed crystal is lowered and touches the melts below. The seed crystal then rises slowly as the sapphire crystalline forming below. This rising motion keeps the growing crystal from the wall of the crucible and gives the sapphire boule its circular shape.

## Products

Sapphire is an appreciated material for highly-durable products and optical applications. It is also used as a component in medical devices. We are bringing our customers the greatest process flexibility and production efficiencies to deliver the highest quality and performance at the most reasonable price. For the above-mentioned and other industries, we offer sapphire in various forms and shapes.

## Quality Commitment

Quality is the core element of commitment. We want our customers worldwide to feel assured that our products and services meet their diverse quality requirements. We strive to provide the best products and services to meet our goal of 100% customer satisfactory through enhancement of our quality control and assurance system.