

## EFG SAPPHIRE (Edge-Fed Growth)

This method allows production of pre-shaped crystals.

It is commonly used to grow large, high-quality Sapphire crystals.

It is widely used in industrial applications requiring durability, transparency, and thermal stability.

### Growth Process

---

- EFG Method: The Edge-Defined Film-Fed Growth method involves pulling a crystal from molten Sapphire through a die that defines the shape of the crystal. The Sapphire crystal is grown along the desired axis as it solidifies.
- Shape and Size: EFG allows for the production of Sapphire crystals in specific shapes and sizes, such as rods, tubes, or ribbons. This is useful for various industrial applications where specific dimensions are required.
- Efficiency: The process is efficient and can produce large quantities of Sapphire, making it cost-effective for industrial purposes.

### Chemical Composition

---

- Formula:  $\text{Al}_2\text{O}_3$  (Aluminum oxide)
- EFG Sapphire is chemically identical to natural Sapphire, consisting of pure aluminum oxide with minimal impurities.

### Physical Properties

---

- Hardness: 9 on the Mohs scale, the same as natural Sapphire, making it extremely durable.
- Density: Approximately  $3.98 \text{ g/cm}^3$ .

### Optical Properties

---

- Clarity: High clarity with few inclusions, making it suitable for optical applications.
- Refractive Index: 1.762 - 1.770
- Transparency: EFG Sapphire is highly transparent, which is essential for its use in optics and electronics.
- Birefringence: Low birefringence, which is desirable in applications requiring consistent optical properties.

## Mechanical Properties

---

- **Strength:** High mechanical strength, making it suitable for use in environments where it might be subjected to high loads
- **Wear Resistance:** Exceptional wear resistance due to its hardness.

## Thermal Properties

---

- **Melting Point:** Around 2,050°C, similar to other forms of Sapphire.
- **Thermal Shock Resistance:** Excellent, allowing it to withstand rapid temperature changes without damage.
- **Thermal Conductivity:** High thermal conductivity, useful in heat dissipation applications.

## Applications

---

- **Semiconductors:** Used as a substrate for LED manufacturing and other semiconductor applications due to its excellent thermal and electrical properties.
- **Watch Crystals:** EFG Sapphire is used for watch faces and other precision instruments due to its scratch resistance and clarity.

## Market Value

---

- The process is efficient and can produce large quantities of Sapphire
- Cost effective production of shaped crystals