FREUDIGER

VERNEUIL SAPPHIRE

Verneuil method was developed in 1902 by Auguste Verneuil and is the first commercially successful method for manufacturing synthetic gemstones.

Growth Process

- Flame fusion melting
- Boules are typically small (<100mm)

Chemical Composition

- Minimum 99.99% Al_2O_3 (Aluminum oxide)
- Verneuil Sapphire is chemically identical to natural Sapphire, consisting of pure aluminum oxide with minimal impurities.

Physical Properties

- Crystal structure: Hexagonal rhombohedral single crystal
- Hardness: 9 on the Mohs scale, only second to diamond
- Density: Approximately 3.99 g/cm^3

Optical Properties

- Clarity: Often has fewer inclusions compared to natural Sapphire, but can have curved striae (growth lines) that are characteristic of the Verneuil process.
- Refractive Index: 1.762 - 1.770
- Birefringence: 0.008 - 0.011
- Fluorescence: May fluoresce under ultraviolet light, depending on the impurities.
- Transmission range: 0.15 to 5.5 micron (from UV to mid-IR)

Mechanical Properties

- Similar to Kyropoulos, although less expensive
- Annealing is necessary to reduce internal stress

Thermal Properties

- Melting Point: Around 2,050°C.
- Thermal Conductivity: 25 W/mK at 300K

Applications

- Industrial Applications: Used in various industrial applications, including watch faces, scientific instruments, and semiconductors, due to its hardness and thermal stability.
- Jewelry: Often used as a gemstone in rings, necklaces, and other jewelry due to its durability and variety of colors.

Market Value

- Verneuil is faster and more affordable than other sapphire growth methods
- Allows color variation adding dopant elements