

## KO | BRINGING QUALITY INTO FOCUS

[www.knighthoptical.com](http://www.knighthoptical.com) | Tel: +1 401 583 7846 | Fax: +1 401 583 7851  
Knight Optical (USA) LLC | 1130 Ten Rod Road, Suite D102 | North Kingsdown RI 02852 USA  
[www.knighthoptical.com](http://www.knighthoptical.com) | Tel: +44 (0) 1622 859444 | Fax +44 (0) 1622 859555  
Knight Optical (UK) Ltd | Roebuck Business Park | Harrietsham | Kent ME17 1SB UK

### C-cut/Z-cut sapphire windows

Sapphire (Al<sub>2</sub>O<sub>3</sub>) is one of the hardest minerals and optical materials available for use in the range from UV up to about 5µm. Sapphire is birefringent and if its use is for critical optical application, for example, windows, then the crystal might have to be cut along the zero degree plane, or C-Cut. Random cut is usually cut along a plane that is 60° off-axis as the growth in this direction is the easiest to grow. Random cut is anyone that is not the C-Cut angle. Sapphire can fluoresce and that depends upon the concentration of other minerals within the lattice, for example Iron (Fe) or Chromium (Cr). Clear Sapphire might fluoresce orange when illuminated by UV light if impurities are in the crystal. Fluorescent free Sapphire has to be grown from 'pure' feedstock and seed and in an environment that cannot place impurities into the lattice.

**Sapphire** is grown by various methods from seed samples. Sapphire material can be polished to a high standard, but as it is the second hardest mineral on Earth it must be subject to high forces to get the polish. Therefore, windows made from Sapphire must have a thickness to diameter ratio of at least 10:1, that is, greater than 10mm thick for a 100mm diameter disk. Sapphire is inert and resistant to attack from most processing environments, such as hydrofluoric acid. Sapphire has a melting point over 2000°C with a high thermal conductivity makes it suitable for use in harsh environments.

Sapphire optics are ideal for use as windows where high radiation resistance is required from the UV to about 5µm. It can be used to form doublet lenses with Silicon and Zinc Selenide for the MWIR (3 to 5µm). These optics can be used to, for example, detect missile plumes that emit the 3-5 µm range and shorter, wavelengths. The detection of muzzle flash from a sniper can be 'seen' by use of optics in this MWIR waveband. The detection of snipers is of great importance in, for example, Afghanistan, as many military lives are being lost to snipers. The gun flash from a rifle has a distinct spectral distribution from the hot gases that are emitted. These gasses are, for example, CO and H<sub>2</sub> together with CO<sub>2</sub>, N<sub>2</sub> and H<sub>2</sub>O that produce distinct emissions in the 3 to 5µm band.

The range of Stock Sapphire Windows listed here are C-Cut grade. Stock windows can be edged to small diameters or machined to square and rectangular shapes at short notice. Please enquire

<b>Material:</b>	<a href="#">C-Cut Sapphire</a>
<b>Diameter:</b>	+0.0 / -0.20 mm
<b>Length,width:</b>	±0.1 mm
<b>Thickness:</b>	±0.1 mm
<b>Flatness:</b>	<2-5λ
<b>Surface quality:</b>	<a href="#">&lt;60-40 scratch/dig</a>
<b>Parallelism:</b>	5 arc min

**All our BK7 Windows are fully inspected on their quality in our ISO 9001 certified, state-of-the-art Metrology laboratory,** This allows us to work to the highest [QA standards](#) and meet the tolerance specifications on these **precision components**.

[Contact our technical sales team](#) to discover how Knight Optical's high quality N-BK7 or equivalent window and superior service can improve your instrumentation and supply chain experience.

UK, Europe, Asia & RoW: E-Mail [info@knightoptical.co.uk](mailto:info@knightoptical.co.uk) Tel +44 (0)1622 859444

USA & Canada: E-Mail [usasales@knightoptical.com](mailto:usasales@knightoptical.com) Tel +001 401-583-7846

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