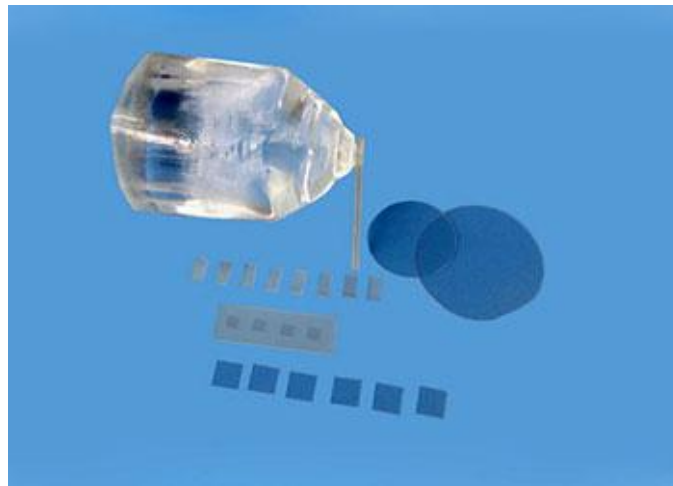


Magnesium Aluminate (MgAl₂O₄ or Spinel) crystals and Substrates

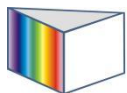
Magnesium Aluminate (MgAl₂O₄ or spinel) single crystals are widely used for bulk acoustic wave and microwave devices and fast IC epitaxial substrates. It is also found that MgAl₂O₄ is a good substrate for III-V nitrides device. Spinel (MgAl₂O₄) is one candidate for such GaN LDs substrate. The crystallographic structure of MgAl₂O₄ is a spinel type (Fd3m), and its lattice constant is 8.083 Å. MgAl₂O₄ is a relatively low-cost substrate material, which has been successfully applied to the growth of high quality GaN films. MgAl₂O₄ is cleaved on the (100) plane. GaN LD cavities have been obtained by simply cleaving MgAl₂O₄ substrates along the (100) direction, which will also work well for ZnO. MgAl₂O₄ crystal is very difficult to grow, due to the difficulty in maintaining a single phase structure.



SPECIFICATIONS

Specifications	
Materials	MgAl ₂ O ₄ single crystals
Standard size(mm)	5x5,10x10,15x15,20x20, φ25.4; φ50.8
Thickness	0.5mm, 1.0mm
Thickness tolerance	±0.05mm
Dimension tolerance	±0.1mm or ±0.05mm
Orientations	<111>, <100>, <110>
Orientation error	6 arc seconds
Perpendicularity	6 arc minutes

Note: The boules, blanks and polished substrates are available.



Physical properties	
Crystal Structure	Cubic: $a = 8.083 \text{ \AA}$
Growth Method	Czochralski
Density	3.64 g/cm^3
Melt Point	2130°C
Hardness	8.0 (Mohs)
Thermal Expansion	$7.45 (x10^{-6}/^\circ\text{C})$
Phase Velocity	6500 m/s at (100> shear wave)
Propagation Loss	6.5 dB/ms
Typical growth direction	<100> and <110>