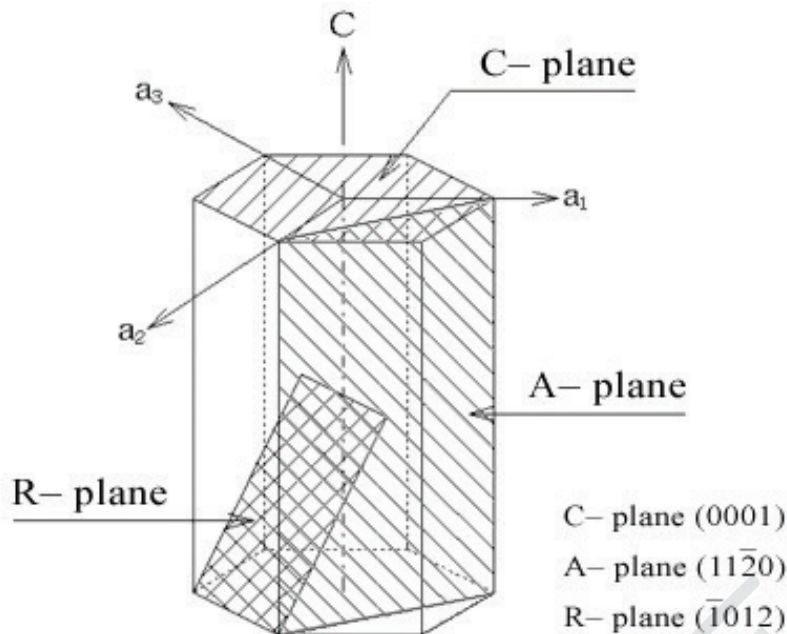


SAPPHIRE ORIENTATION DEFINITIONS & DRAWING



The structure of the primary planes of the sapphire crystal corresponding to the structure system of sapphire. Shown in this Figure, the C-plane is (0001), A-plane is (11 $\bar{2}$ 0) and R-plane (1012)

SINGLE CRYSTAL SAPPHIRE FACTS

Sapphire is a rhombohedral crystalline material. When a synthetic sapphire part is produced, the orientation of the part may affect the performance of that part. "Orientation" refers to the angle of the sapphire crystal from its optical axis, also known as the C-axis.

The C-axis of the sapphire crystal is the most commonly specified crystal orientation for sapphire windows. The primary reason for this is that sapphire is naturally slightly birefringent in all other axis, while C-axis (or 0 degree) cut sapphire windows eliminate the inherent birefringent properties of the crystal. The C-axis is also the strongest and most mechanically symmetric orientation when forces are applied parallel to the C axis, sometimes as high as 20% stronger.

If no orientation is specified by the customer, then the orientation can be what is called "random". Random orientation simply means that the part was cut with no regard to the crystal orientation, which is a costly process of constantly tracking the orientation during cutting, grinding and polishing. This orientation is common because of lower costs and acceptable if ideal optical or mechanical qualities are not required. It should be noted that because the mechanical performance of sapphire will vary depending on orientation, random orientation allows for unpredictable variability in the strength of the sapphire from part to part, and across a given part. Other orientations that are less frequently requested include M-Plane, R-Plane, and A-Plane.

TYPICAL CHOICES FOR PART ORIENTATION:

- Zero Degree: The direction of view is parallel to the optical axis of the crystal
- 90 Degree: The direction of view is perpendicular to the optical axis of the crystal
- C-Axis: In a rod, the direction along its length. In a window, the direction perpendicular to the face.
- M-Plane: The plane containing the optic axis (C) and inclined 30 degrees to the A-axis
- A-Plane: The plane that is perpendicular to the A-axis, containing the C-axis
- R-Plane: A plane inclined 57.5667 degrees to the optic axis in the same zone as the M-plane.
- Random: There is no specified relationship between the part and the crystalline orientation. The part is manufactured without concern about orientation.