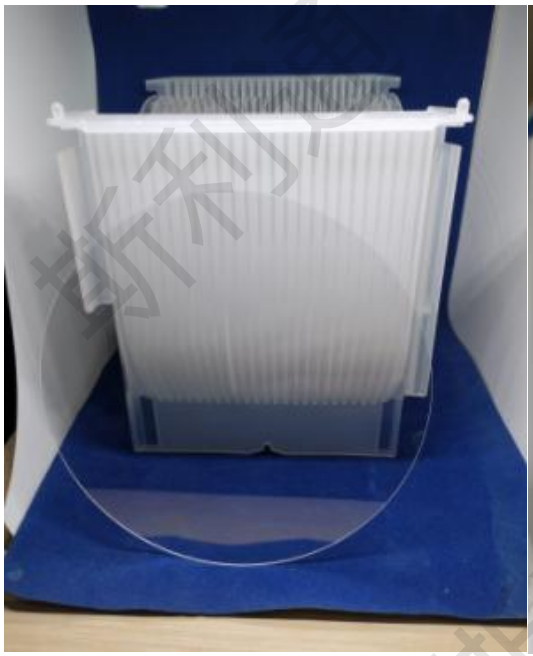
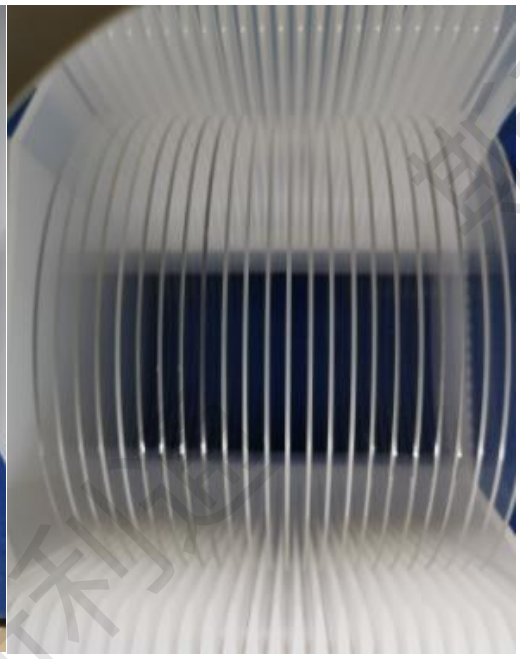
The role that sapphire ceramic PCB play in MEMS devices

Fuli Tiansheng Electronics, its ceramic panel —— Slitong

Basic introduction:

Sapphire ceramic substrate is a kind of ceramic material with high hardness, high strength and high melting point, and its main component is alumina (Al2O3). The preparation method of sapphire ceramic substrate is made by sintering at high temperature and high pressure. The crystal structure of the sapphire ceramic substrate has a hexagonal crystal system with a crystal density of 3.98 g / cm³ and a melting point of 2,040℃.





project	Processing indicators	remarks
outline dimension	6 in (150 / 159mm) / 4 in (100 / 104mm)	Diameter tolerances ± 0.05mm
thickness	1mm/0.7mm	Thickness tolerances are ± 0.002mm
depth of parallelism	10″	
Thickness consistency	＜2μm@25pcs	
finish	80/50	
surface evenness	PV：RMS≤1/4λ@632.8mm	
coating film	No coating	

Performance features:

Sapphire ceramic substrate has excellent physical and chemical stability, enables working in high temperatures and harsh environments, but also has good mechanical and thermal properties. Its high hardness and corrosion resistance make it an ideal substrate material in MEMS devices.

For example, the sapphire ceramic substrate has the following performance characteristics:

High hardness: Sapphire ceramic substrate hardness can reach 9.0 Mohs hardness, higher than glass and quartz substrate, so it has better scratch resistance and wear resistance.

Corrosion resistance: sapphire ceramic substrate has extremely high chemical stability and will not be corroded by chemicals such as acid and base.

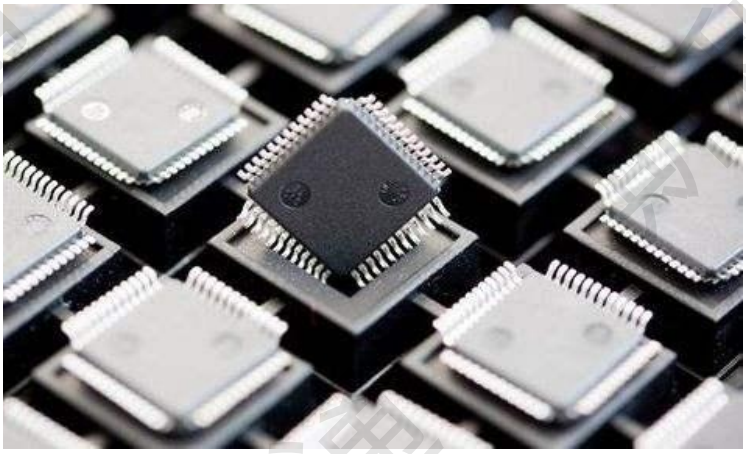
High melting point: The melting point of sapphire ceramic substrate is up to 2040℃, which can withstand the stress and thermal cycle in high temperature environment.

Low thermal expansion coefficient: The thermal expansion coefficient of sapphire ceramic substrate is very small, so it can achieve higher accuracy and stability.

Introduction to the application areas:

Sapphire ceramic substrate is widely used in the field of MEMS device manufacturing, such as accelerometer, pressure sensor, micro-motor, etc. Its high quality and excellent performance make it the preferred material in the manufacturing of microelectromechanical system (MEMS).

For example, in the application of accelerometer, sapphire ceramic substrate, as the carrier of inertial mass block, can withstand high-speed vibration and inertial forces, with better accuracy and stability. In the application of pressure sensor, making microstructures and films on sapphire ceramic substrate can achieve higher sensitivity and precision.



High purity and uniformity:

Sapphire ceramic substrate has a very high purity and uniformity, which can ensure the stability and consistency of the device during the manufacturing process. According to the market research data, the purity of sapphire ceramic substrate can reach 99.999%, and the internal stress and thermal expansion coefficient are very small, which can effectively avoid the device failure caused by thermal stress.

Good mechanical properties:

Sapphire ceramic substrate has very good mechanical properties, with a very high bending resistance and compressive strength. According to the market research data, the bending strength of sapphire ceramic substrate can reach more than 500MPa, and the compressive strength can reach more than 2 GPa. These excellent mechanical properties can ensure the stability and reliability of the device in the manufacturing and use process.

high temperature stability:

Sapphire ceramic substrate has very good high temperature stability and can maintain stable performance in high temperature environment. According to the market research data, the use temperature of sapphire ceramic substrate can reach more than 2000℃, and its thermal conductivity is very high, which can effectively improve the heat dissipation effect of the device.

High corrosion resistance:

Sapphire ceramic substrate has a very high corrosion resistance and can maintain stable performance in harsh environments such as acid, alkali and high temperatures. According to the market research data, the chemical stability of the sapphire ceramic substrate is very good, and it can be used in a variety of chemical media for a long time without being affected.

Comparison with the other materials:

Compared with other substrate materials, sapphire ceramic substrate has better performance and stability, which can meet the requirements of high precision, high stability, high corrosion resistance and high temperature stability in MEMS device manufacturing. In contrast, traditional glass and quartz substrates are susceptible to mechanical properties, and their thermal expansion coefficient is large, which is easy to produce thermal stress, thus affecting the stability and reliability of the device.

fabrication process:

The manufacturing process of sapphire ceramic substrate requires several process steps, such as powder processing, pressing molding, drying and sintering. Among them, powder treatment is the most critical step in the manufacturing process, requiring high purity Al2O3 raw materials, and strictly control the process parameters of each link to ensure the quality and stability of the manufactured substrate.

application area:

Sapphire ceramic substrate has a wide range of applications, especially in the field of MEMS device manufacturing. Sapphire ceramic substrates can be used in the manufacture of a variety of various MEMS devices such as accelerometers, pressure sensors, inertial navigation systems, etc. In addition, it can also be used to make high-power semiconductor devices, LED chips, solar cells and so on.

Application manufacturer:

At present, there are many well-known enterprises at home and abroad in the production of sapphire ceramic substrate and carry out related research and development work. Some well-known domestic manufacturers, such as Shenzhen Xunlei Technology Co., Ltd., Guangdong Holishi New Material Co., Ltd., have the research and production experience involved in this field. There are also some well-known foreign enterprises, such as American GT Advanced Technologies Company, Japan SUMCO Technology Research Institute, etc.

Combined with the above detailed introduction of the application and advantages of sapphire ceramic substrate in the field of MEMS device manufacturing, readers can have a more comprehensive and in-depth understanding of the application prospects and advantages of the material in this field, and promote the promotion and application of the material in the market.