Easybom: Speculation about The Third Generation of Semiconductors to Large Silicon Wafers

HONGKONG, CHINA, CHINA, March 20, 2023 /EINPresswire.com/ -- According to Easybom, the third-generation semiconductors represented by SiC and GaN are gradually demonstrating their benefits in high-voltage, high-temperature, and high-frequency applications as a result of the quick growth of new energy vehicles, power grids, and 5G communications. One significant development path for the semiconductor industry is thought to be the replacement of base semiconductors.

Silicon wafers are currently being upgraded from 8 inches to 12 inches. A single wafer can produce more chips when it is larger, which also reduces waste at the wafer's edge and lowers chip costs. As their predecessors, third-generation semiconductors are also moving very quickly toward large-size wafers.

High breakdown electric field, high saturation electron velocity, high thermal conductivity, high electron density, and high mobility are some of the properties of SiC. It is a reliable semiconductor material and is frequently used in industrial semiconductors, automobile electronics, and other industries.

It is important to note that the majority of the present SiC device production lines are still 6-inch production lines, despite the fact that the introduction of 8-inch SiC may cause certain changes in the industry.

Although the procedures of ion implantation, film deposition, dielectric etching, and metallization in the production of power semiconductors do not significantly differ between 8-inch and 6-inch SiC, there are numerous manufacturing challenges in the process and other factors for 8-inch SiC. Among these, increasing the diameter to 8 inches will make it twice as tough to develop a substrate; while processing a substrate's size during cutting, there will be greater cutting stress and warpage issues; and the oxidation process will constantly provide challenges. The main challenge in the silicon carbide process is that the 8 and 6 inch processes need to be individually designed since they have different needs for controlling the airflow and temperature field. Leading manufacturers are currently working together with upstream and downstream technology suppliers to create their own manufacturing tools and production procedures. As a result, in order to update SiC wafers to 8 inches, it is necessary to likewise upgrade and replace the manufacturing machinery as well as the entire support ecosystem.

High pressure resistance, high temperature resistance, and minimal energy loss are features of GaN. It performs different tasks than SiC. GaN concentrates on high frequency, while SiC concentrates on high voltage. GaN is more expensive and challenging to etch than SiC, and its industrialisation is progressing more slowly. The GaN market is now small—less than 1%—and its wafers are in a phase of transition from 4 to 6 inches.

Domestically produced GaN substrates are typically 2 inches in size, while limited quantities of 4 inches can be shipped. It is anticipated that 6-inch substrate mass production will be finished and the product will launch before 2025. Prominent corporations include Dongguan Zhongga and Suzhou Navitas.

Both silicon and silicon carbide are typical substrates for GaN devices. GaN radio frequency devices based on silicon carbide have the benefits of high thermal conductivity and high radio frequency output, making them appropriate for 5G base stations, satellites, radars, and other sectors. Power electronic devices are the major application for silicon-based GaN power devices. GaN devices based on GaN substrates, however, are at the front of the pack in terms of several performance indices, but the substrate is too expensive.

The upstream raw materials of the GaN manufacturing chain include GaN substrates and GaN epitaxial wafers. The cost of raw materials is somewhat expensive, there is a significant reliance on imports, and only 10% of production is done locally. GaN substrates present significant technical challenges in the realm of substrates. A 2-inch GaN substrate costs up to 5,000 US dollars on the worldwide market, and they are scarce. As a result, the first GaN devices to reach the market will be silicon- and silicon carbide-based.

GaN can be used for many different things. The main domains of "new infrastructure," including 5G base stations, UHV, new energy charging stations, and intercity high-speed rail, are where its downstream uses are most applicable. Furthermore, photovoltaics, wind power, DC UHV transmission, new energy vehicles, industrial power supplies, locomotive traction, consumer power supply (electric energy usage), and other industries can all benefit from the high-efficiency power conversion properties of GaN. Conversion contributes to the accomplishment of the "carbon peak, carbon neutrality" goal. Market & Market, Yole, and other organizations' growth rate projections indicate that the global GaN component market will reach $42.3 billion US in 2026, growing at an average annual compound growth rate of roughly 13.5%.

At the moment, silicon materials are still the most common semiconductor materials because of things like preparation technologies, subsequent processing, and raw material sources. Yet, the size of SiC and GaN wafers will be increased to 8 inches due to the surge in demand for terminal applications. SiC and GaN wafers can currently only be larger than 4-6 inches. The rise in production capacity of 8-inch wide bandgap power semiconductor wafers is expected to be driven by head suppliers' efforts in 8-inch wafers. The trend toward 8-inch SiC and GaN wafer sizes will persist throughout the coming years.

Ashley Hudgens
Easybom
+ +1 718-737-2822
support@easybom.com
