

Silicon Carbide – Power Semiconductor Alternative for Silicon

Based on Frost & Sullivan materials

Wide bandgap (WBG) materials are emerging as potential alternatives for silicon in recent years owing to the shift observed in the global semiconductor scenario. The limitations observed in silicon related to switching and designing for high voltage applications are enabling the research and development in WBG materials such as silicon carbide (SiC) and gallium nitride (GaN). Silicon carbide is a key WBG material that has the potential to replace silicon in high voltage and high temperature applications.

Properties of SiC

- SiC has a high breakdown voltage with bandgap energy of 3.6eV (electron volts) compared to 1.2eV of silicon. This will enable the fabrication of power devices with better performance.
- The on resistance of SiC transistors is very low in comparison to silicon transistors, which make it a desirable semiconductor material for high power applications.

Power electronic devices such as SiC Schottky diodes, SiC MOSFETs (metal-oxide semiconductor field-effect transistors), SiC JFETs (junction FETs), SiC BJTs (bipolar junction transistors), and SiC IGBT (insulated gate bipolar transistors) are few of the semiconductor devices currently available in the market. These are being used in power electronic systems such as inverters, switch mode power supply systems, wireless charging circuits, and industrial drives.

Application Scenario of SiC

- Major power electronic systems such as UPS (universal power systems), SMPS (switched-mode power supply), and AC drives. SiC modules are being deployed in photovoltaic inverters and wind turbines.
- Hybrid vehicles and high power applications are the key areas wherein SiC modules are used in order to enable the efficient working of power electronic components at high temperatures and high voltages.

Key Companies Working in GaN

CREE, Wolfspeed, Texas Instruments, Infineon Technologies AG, NXP Semiconductors, Fujitsu, and ROHM are some of the key companies across the globe working in the domain of SiC. Few promising start-ups such as TranSiC, GeneSiC, and Ozark IC are also entering the SiC semiconductor market with their unique product offerings.