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"SiC Power Devices: Overview, Defect Electronics, and Reliability"

Through recent progress in silicon carbide (SiC) growth and device technologies, 600–3300 V SiC power MOSFETs and Schottky barrier diodes have been commercialized, demonstrating significant reduction of power loss in various power systems. However, both bulk and interface defects are present in SiC devices, affecting the performance and reliability of SiC power devices. Such defects include stacking faults, threading and basal-plane dislocations, point defects (carbon vacancy, etc.), MOS interface states, and oxide traps. In this tutorial, an overview and reliability issues of SiC power devices are presented together with current physical understanding of defect behaviors. Impacts of various defects on SiC power devices, typical degradation phenomena, and their reduction are reviewed. Methodology of assessing defects in SiC epitaxial wafers and devices is also discussed.

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