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# Progress in SiC and GaN High Voltage Power Devices

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SiC and GaN has many attractive material properties, such as high breakdown field, which make them suitable for power electronic applications. The first SiC commercial power devices were available in 2000 while the first GaN devices a decade later. At present, new generations or types of power devices in SiC and GaN are also commercially available. In this talk, we present the recent progress in the development of high-voltage power switching SiC and GaN rectifiers and transistors and the remaining technical challenges and commercialization issues.

We will review the highlights of the latest research reports and commercial device offerings. In particular, while SiC Schottky rectifiers continue to increase in blocking voltage (up to 1.2kV) and current (up to 50A) ratings, GaN Schottky rectifiers have come and are coming again into the market, claiming to have an inherent cost advantage. In addition, SiC power transistors, including JFET, MOSFET and BJT, are available up to 1.2kV and at least 20A and GaN power HEMTs on silicon substrates, between 30 and 600V, have also been mostly available. Bipolar rectifiers, transistors and thyristors with very high blocking voltages (up to over 20kV) have been reported but are mostly not yet available commercailly. Multiple RESURF technique has been applied to GaN on sapphire, resulting in 10kV devices. 600V vertical type GaN power transistors on silicon substrates also start to be commercially available.

Remaining technology obstacles for 4H-SiC include: large-diameter, low disclocation density, lightly doped n-type ($<10^{15}cm^{-3}$) substrates, MOS threshold voltage control and channel mobility improvement, gate oxide reliability improvement, and minority carrier lifetime enhancement and stability. For GaN power devices, they include: enhancement mode threshold voltage control, sustainable avalanche breakdown, elimination of current collapse, minimum buffer layer current leakage, as well as cost-effective, large diameter, low defect substrates.