Challenges to Overcome Breakdown Limitations in lateral β-Ga_2O_3 MOSFET Devices

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Due to the large band gap of 4.8 eV and the resulting high breakdown strength of 8 MV/cm, the semiconductor material β-Ga_2O_3 has a very promising potential for next-generation power electronic applications. The higher breakdown strength compared to established technologies based on SiC or GaN allows a much more compact design of the transistor structures, which leads to reduced switching and conduction losses. This enables far more efficient, lighter and smaller power electronic converters to be implemented than it is possible today. In this talk the fabrication of high-performance metal-oxide-semiconductor field-effect transistors (MOSFETs) on Si-doped homoepitaxial layers on (100) Mg-doped semi-insulating β-Ga_2O_3 substrates is presented. The fabricated devices exhibit maximum drain currents, on/off-current ratios and ON-resistances of ~75 mA/mm,10^9 and 110 Ω·mm, respectively. Moreover, breakdown voltages at around 1200 V for devices with a gate-to-drain distance of 6 µm are measured which equals an average breakdown field strength of 2 MV/cm. Further investigations on devices with and without field-plates reveal interface-related material inconsistencies which might represent the current main limitation factor in reaching high breakdown voltages in β-Ga_2O_3 MOSFET devices.