SESSION 9a: POWER DEVICES

Chairs: Ruediger Schreiner, *Aixtron SE*
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The steadily growing interest in GaN for power switching has necessitated two full sessions devoted to the topic this year. The first of these two sessions opens with an invited paper by Michael Briere of ACOO Enterprises, reviewing the status of GaN-on-Si high-voltage devices for power conversion from 20 to 600 V. He describes the challenges and solutions in improving the robustness of these devices, as well as the cost advantage realized from manufacturing GaN HEMT power devices in a high-volume silicon CMOS factory. High breakdown voltage is key to overall robustness of these AlGaN/GaN HEMT devices, and the National University in Seoul next describes their design of a NiO_x-based floating metal ring between gate and drain to improve electric field uniformity near the gate. Their measurement of 930-V breakdown voltage demonstrates a 50% increase in comparison to more conventional designs. The subsequent paper, from IMEC in Belgium, reports a gold-free fabrication process for high-voltage GaN Metal-Insulator-Semiconductor HEMT (MISHEMT) devices on 150-mm silicon substrates. They describe how optimization of the gate-metal stack, dielectric passivation, and ohmic contact formation has led to high yield and robustness, with breakdown voltages of over 600 V. Next, even higher breakdown voltages are reported by another group at IMEC, for GaN-on-Si AlGaN/GaN double-heterostructure (DH) FETs. By removing the silicon substrate after device fabrication, they observe breakdown voltage independent of the original buffer layer thickness. They report BV of over 2000 V for devices with gate-drain spacing of 20 microns and buffer layers as thin as 600 nm. The session concludes with a second paper by Seoul National University, reporting their work with AlGaN/GaN HEMTs employing multilayer gate insulator stacks of aluminum and gallium oxides. Devices employing 10 nm-thick gate stacks of these oxides exhibit breakdown voltage of 1100 V and drain leakage current of only 33 nA/mm, compared to 380 V and 654 μA/mm, respectively, for conventional Al_2O_3-only devices.