Reliability and Degradation mechanism of AlGaN/GaN high electron mobility transistors

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Introduction to the topic:

Gallium Nitride represents an almost ideal material for the fabrication of high power microwave devices and circuits: its high energy gap (3.4 eV vs. 1.4 eV for GaAs) is reflected into a very high breakdown field (3500 kV/cm); piezoelectric and spontaneous polarization effects within AlGaN/GaN result in 2D gas densities above 10^{13} cm^{-2}, 5 times higher than for GaAs-based HEMTs, without requiring doping of the barrier layer. Satellite communications, high performance radars and commercial ground base stations currently represent target system applications. Within these applications, it is expected that GaN-based transistors will replace the so far used Si-transistors in the near future mainly due to their larger bandwidth capabilities, their higher operating voltages as well as their higher linear efficiencies.

Structure of tutuorial

1) Introduction to AlGaN/GaN HEMTs
2) DC stress test results and RF Stress test results
3) Voltage robustness
4) Degradation Mechanism
   (Inverse Piezo, gate metal diffusion, increase of gate leakage current, generation of traps, Ohmic metal degradation)

Who should attend

In this tutorial an overview on reliability results and possible degradation mechanism of AlGaN/GaN HEMTs measured at different companies and institutes is given. In the second part the physics of degradation is explained in more detail. Anyone interested in this topic can attend.

Biography of tutorial speaker

Michael Dammann received his Diploma degree in physics from the Technical University in Karlsruhe, Germany in 1989 and his PhD. degree in technical sciences from the Swiss Federal Institute of Technology in Zurich, Switzerland in 1994. From 1994 to 1995 he worked at the Swiss Federal Laboratories for Materials Testing and Research in Dubendorf, Switzerland where he investigated the reliability of silicon pressure sensors. Since 1996, he has been with the Fraunhofer Institute of Applied Solid State Physics, Freiburg, Germany working on reliability and failure analysis of microelectronic and optoelectronic compound semiconductor devices.