



SEMINAIRE

(exceptionnellement de 14 h à 15 h, amphithéâtre PHELMA, Bât. INP, MINATEC,

ouvert à tous : enseignants, étudiants, chercheurs, administratifs, techniciens)

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“GaN HEMT/MIS-HEMT
technology and device reliability activities at TU Vienna”

par Dionyz POGANY

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Abstract: Due to wide energy band gap, heterostructure tunability and excellent transport properties, III-nitride semiconductors are promising for opto-electronic, RF, power switching and digital applications. Since 2003, our institute participated in four EU projects related to technology and characterization of GaN-based HEMTs. In the first part I will review our activities in development of InAlN/GaN, AlGaIn/GaN and AlN/GaN HEMTs and MIS-HEMTs going toward the normally-off operation which is demanded for power applications. Even if the dielectric insulation decreases the gate leakage current, the positive fixed charge at the dielectric/III-N barrier interface, which is of the order of the polarization charge, prevents from the achievement of higher positive threshold voltage. Physics of threshold voltage scaling with the dielectric layer thickness will be discussed. Furthermore examples of studies of lateral and vertical (i.e. across the GaN buffer) breakdown, self-heating effects and low frequency noise analysis of degraded devices will be presented. Finally some results of investigations of the threshold voltage instabilities in MIS-HEMTs subjected to forward bias stress will be presented. The stress-recovery characteristics of the threshold voltage drift show logarithmic dependence on time indicating a broad distribution of relaxation time constants. The role of traps at the dielectric/III-N barrier interface and of the III-N barrier in this dynamics will be discussed.

Dionyz Pogany received his “Diploma Engineer” degree in Solid State Engineering from Slovak Technical University in Bratislava, Slovakia in 1987, and PhD degree in microelectronics from INSA de Lyon, France in 1994. In 1994-1995 he was a postdoc at France Telecom in Grenoble. Since 1995 he has been with the Institute for Solid State Electronics in Vienna University of Technology where he leads a research team and has been an Associate Professor since 2003. He has been working on Si and III-V device reliability physics, fluctuation phenomena in devices and nanostructures, defects and interface state characterization, GaN HEMT electronics and technology, ESD phenomena, self-heating effects, breakdown mechanisms and non-linear transport in ESD protection and Si and GaN power devices, thermal analysis and development of optical methods for device and failure analysis. He published more than 300 scientific contributions, among which 120 are in journals.

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