平成 22 年 2 月 22 日(月)

各　位,

東北大学電気通信研究所
准教授　末光 哲也

第 44 回ナノ・スピン工学研究会の開催について

拝啓　時下ますますご清祥のこととお慶び申し上げます。
さて，下記の通り講演会を開催致しますので，皆様多数のご参集下さいますようご案内申し上げます。

敬具

日　時：　平成 22 年 3 月 4 日(木)　11:00～12:00
場　所：　電気通信研究所　ナノ・スピン総合研究棟 4 階　A401 室
講　師：　**Prof. Gaudenzio Meneghesso** (University of Padova, Italy)

講演題目：Parasitic effects in GaN-based High Electron Mobility Transistors

講演要旨：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. Saturation and overshoot velocity are around 3 x 10^{7} cm/s, with relatively good electron mobility values (1200 cm^{2}/V.s). Epitaxial structures can be grown on silicon carbide with limited lattice mismatch, thus exploiting the excellent thermal conductivity and semi-insulating properties of this material, suitable for rf and microwave device operation. GaN HEMTs are therefore extremely promising for power electronics applications from power conditioning to microwave amplifiers and transmitters.

In the last years, GaN HEMTs have been subject to various optimization processes, starting from the material properties, to the control of surface and buffer properties aimed at reducing transient phenomena, gate-lag effects and the "current collapse" problems. A better control of short-channel effects, gate current, and degradation phenomena at high electric fields, together with the development of suitable structures for the management of the electric field (using T-shaped and Γ-shaped gates and field-plates) have lead to the progressive increase of the operation drain voltage from 12 V to 24 V and 48 V.

A detailed characterization of the main parasitic effects in GaN HEMTs devices (gate leakage current, current collapse, kink effect, impact ionization gate current) will be reported. Several characterization techniques will be adopted for a detailed characterization of the observed instabilities including Electrical (DC and pulsed) and physical (Electroluminescence microscopy and spectroscopy, Cathodoluminescence, etc.) characterization techniques. Finally, some approach adopted to solve (or alleviate) the parasitic effects will also be described.

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