Th-18.15
SC 30.9
H 13)

Measurement and simulation of the C-V characteristics of high electron mobility transistors

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We measured the capacitance C versus gate voltage V_g relationships of several conventional and pseudomorphic high electron mobility transistors (HEMT) on wafer. It is well-known that the shape of the C-V_g characteristics is strongly influenced by the properties of the quasi two-dimensional electron gas (Q2DEG) which forms the active region of the device, as well as by the onset of a so-called parasitic channel in the wide bandgap material. In order to study the influence of the most important technological parameters on the capacitance, we solved self-consistently the Schrödinger and Poisson equations in the structure, using the thickness of the doped layer d_A, the doping density N_d and the built-in voltage V_b as fit parameters. The simulated and measured C-V_g characteristics were found to be in good agreement with each other; moreover, the correctness of the fit parameters, whose values deviate substantially from the nominal process targets, was corroborated by results extracted from measurements of other HEMT electrical properties. We also demonstrate how to exploit this technique for monitoring the spatial variation of d_A, N_d and V_b over the wafer, a result of particular importance for aiding in troubleshooting the manufacture process and calibrating the design of the device.

T-gate:
L_g = 160 nm
H-gate:
190

Th-18.30
SC 30.10
H 13)

Ultrafast pseudomorphic InGaAs/AlGaAs MODFETs fabricated with RIE gate recess

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High performance $In_{0.2}Ga_{0.8}As/Al_{0.23}Ga_{0.77}As$ MODFETs with a gate length of 0.2 µm are fabricated reproducibly and homogeneously exposing T-shaped gates with electron beam lithography and performing a RIE gate recess under highly selective and damage-free conditions. Special care is taken to control the shape of the recess geometry while removing the n^+-GaAs cap on top of the AlGaAs supply layer.

DC measurements reveal an extrinsic transconductance g_m = 560 mS/mm ± 4mS/mm with an associated drain current I_{ds} = 260 mA/mm and a maximum drain current exceeding 700 mA/mm (720 mA/mm ±8 mA/mm). Threshold voltage variations are below 25 mV. HF measurements show f_T values of 110 GHz. DC and HF results for gate lengths L_g < 0.2 µm will be discussed.

V_T = -1.145 V ± 19mV

f_T = 126GHz

f_{max} = 128 GHz

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Th-16.15
SC 31.1
H 11)

Photoindused Inversion of Magnetic Hysteresis in Semimagnetic Superlattices

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Circular polarized photoluminescence in magnetic fields in Faraday geometry have been studied at the band-to-band transition in $CdTe/Cd_{1-x}Mn_xTe$ short-period superlattices. Field induced circular polarization degree shows a hysteresis behaviour, related to the spin-glass properties of $Cd_{1-x}Mn_xTe$ barrier layers. The inversion of sign of magnetic hysteresis under photoexcitation by unpolarized light have been found for the first time. The inversion of sign of the magnetic hysteresis have been shown to reveal by flip-flop spin relaxation processes of holes on Mn ions in spin-glass clasters. The dramatic decrease of the spin relaxation time (more than two order of magnitude) in longitudinal magnetic fields and increase of this time in transverse fields have been found. Resonant character of this phenomenon have been established for the Zeeman splitting close to a gap in magnon spectra of spin-glass clasters.

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SC 31.2
(H 11)

Resonant Magnetotunneling in GaAs-AlAs Superlattices

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Resonant tunneling between different subbands is investigated in GaAs-AlAs superlattices (SLs) in magnetic fields parallel and perpendicular to the layers using I-V