MICROWAVE POWER DEVICES GROUP (PUISSANCE)

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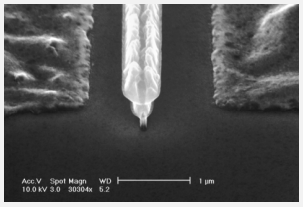
OBJECTIVES

Design, fabrication and characterisation of advanced devices based on wide bandgap semiconductors (GaN, AlGaN, InAl(Ga)N, BN, AlN, Diamond): Microwave Power Transistors, Resonant Tunneling Diodes, DUV Photodetectors,THz Electron Plasma Wave Detectors, Devices on Flexible Substrate, Nanowire and Nanoribbon Electron Devices, Actuators, DC–DC Converters.

MICROWAVE POWER DEVICES

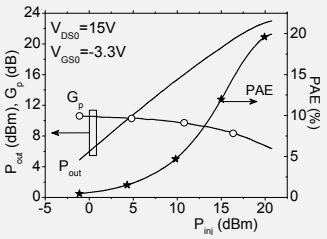
OMMIC collaboration

Lg=90nm



SEM view of the cross section of double-T-shaped gates

$G_{m\,max}$ = 509 mS/mm
F_t = 100GHz
F_{max} = 206GHz

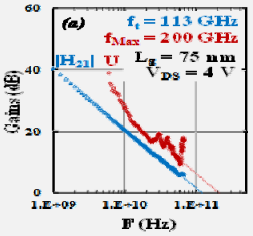


CW power performance of a 2x30x0.06µm² $Al_{0.29}Ga_{0.71}N$/GaN/Si(110) HEMT at 40GHz

On **Si(110)** substrate:
@40GHz:
P_{out} = 3.3 W/mm
PAE = 20.1%,
Power gain = 10.6dB

STATE OF THE ART RESULT
Whatever the crystalline orientation

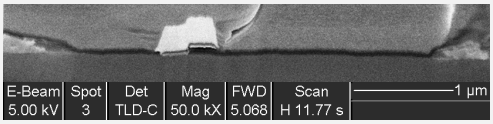
AIXTRON EPITAXY



HBT

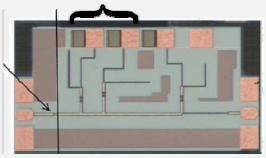
Current gain and cut-off frequency of a 2x50x0.225µm² InAlN/AlN/GaN HEMT

@40GHz: Pout = 2 W/mm
PAE = 13%,Gp= 6dB



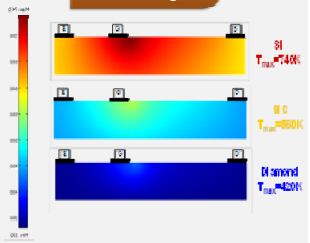
SEM view of the cross section of Ge spacer gate based on SiN technology.
AlGaN/GaN HEMT on Si(100) substrate: P_{out} = 2.9W/mm@10GHz

Integrated Tuner



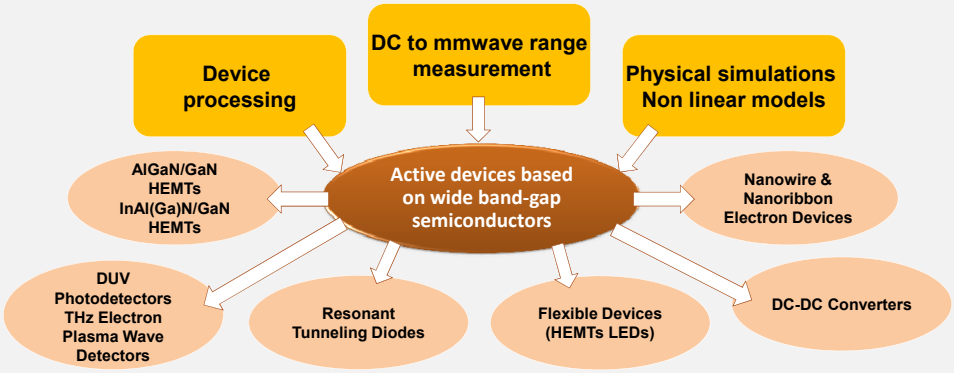
Transistor with programmable integrated tuner for power characterization in 140-220 GHz

Physical-Thermal modeling

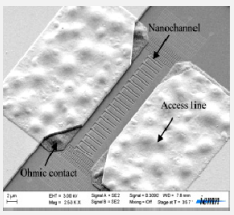


Evolution of lattice temperature in the transistor active area (V_{DS}=14V and V_{GS}=0.0V)

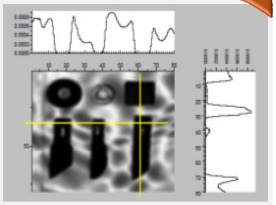
EXPERTISE



THz DETECTORS

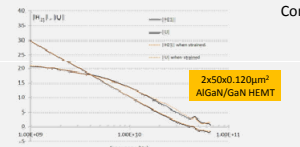


SSD SEM view of an array with 16 nanochannels



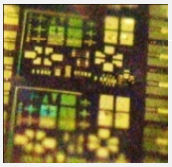
HEMT 2x50x0.15µm² as a detector in an Envelope at 240GHz (collaboration GES)

GaN FLEXIBLE ELECTRONICS

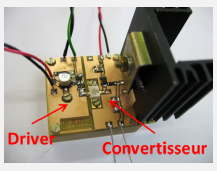


F_t=32GHz; F_{max}=52GHz
No evolution when strained

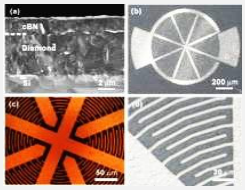
Components on 3M Flexible tape



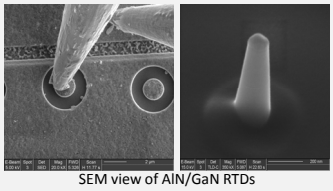
WIDE BANDGAP DEVICES



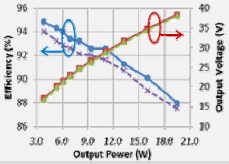
10MHz
GaN DC/DC convertor
V_{in} 16V



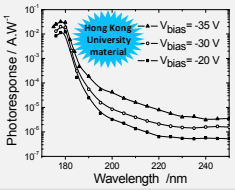
Morphology of the *c*BN/diamond composite film and image of a 1 mm diam. *c*BN photodetector

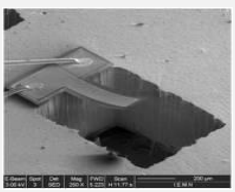


SEM view of AlN/GaN RTDs



Measured (Straight line) and simulated (dashed line) converter efficiency versus output power and corresponding values of the output voltage.





SEM view of NCD/Cr/AlN/Cr cantilever

COLLABORATIONS

Aixtron AG	AIXTRON
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European Synchrotron Radiation Facility	ESRF (F)
Georgia-Tech Institute Atlanta	GITA (USA)
Georgia-Tech Institute Lorraine	GITL(F)
Institut des matériaux Jean Rouxel	IMN (F)
Institute for Materials Research	IMO (B)
Laboratoire de l'Intégration du Matériau au Système	IMS (F)
Institut Néel	IN (F)
Laboratoire de Nanocaractérisation et de Nanotechnologie	LN2 (CA)
Institut de Nanotechnologie de Lyon	INL (F)
Institute of Electrical Engineering (IEE)	IEE (SK)
Institute of Electron Technology	IET(PL)
Laboratoire de Physique des solides et de Cristallogenese	LPSC (F)
Laboratoire de Physique des Gaz et des Plasmas	LPGP (F)
Laboratoire d'Intégration des Systèmes et des Technologies	LIST(F)
Microwave Characterisation Center	MC2 (F)
Ommic	OMMIC (F)
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