European Nanoelectronics Forum 2011
15th-16th November, 2010
Dublin, Ireland
Grant Agreement #?

Reconfigurable Microsystem Based on Wide Band Gap Materials, Miniaturized and Nanostructured RF-MEMS

Objectives

NANOCOM Missions

- Micro and Nano Technologies for smart systems:
  - GaN for power and robustness at high frequencies
  - Sensor for interfacing to real-world
  - MEMS and Mini-MEMS for reconfigurability and tunability
- NANOCOM Mission:
  - Integrate new nanostructured materials in MEMS technology to address charging effect and at the same time enhance thermal performances of the device

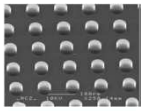
NANOCOM Objectives

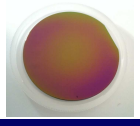
- Developing innovative solutions for the RF front-end baseband by fabrication of agile RF transceiver and reconfigurable antennas with MEMS switches, sensors and actuators.
  - Objective 1: Achieve the integration of WBG devices and RF MEMS switches in LCP.
  - Objective 2: Achieve the long-term reliability of RF-MEMS by solving poblems associated with these devices to bring this technology to industrial systems.
  - Objective 3: Realize and optimise WBG based sensors and actuators and develop the necessary technology for their monolithic integration with WBG MMICs and RF MEMS.
  - Objective 4: Display the integration of all of these technologies through four demonstrators.
  - Objective 5: After the fabrication of these demonstrators the fabrication process flow will be transfered by TRT to a foudry for industrialization.

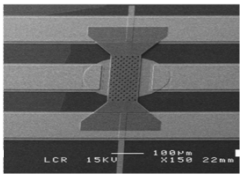
RT Developments

Nanostructured materials integration

- Integration of nanostructured PZT
- Development and integration of single oriented carbon nanotubes in silicon nitride dielectric
- Development and first integration of diamond thin layers
- Dielectric, electrical and thermal characterizations
- Development and fabrication of MiniMEMS







Beyond state of the art MEMS performances

- Design and fabrication on GaN, Si and LTCC of MEMS and MiniMEMS switches, circuits and phase shifters
- Request:
  - RF performance
  - High power handling
  - Thermal management
  - Reliability
  - Complementary SiP functions (passive functions, fluidic interfaces, etc)

Criteria	State of the art	NANOCOM goals
Frequency (GHz)	10 GHz	100MHz-20 GHz
Insertion loss (dB)	0.1 dB	0.1 dB
Isolation (dB)	35 dB	> 35 dB
Power handling (W)	40 dBm (10W)	> 45 dBm (30W)
Switching time	1 µs	0.1 µs

III-Nitride based sensors

- GaN & AlN → Gaz & T sensors
- Fab process compatible with MMIC & MEMS/NEMS process
- Gaz sensors
  - SAW sensor;
  - FBAR sensor;
  - Sensitivity of the FBAR based gas sensor: 2 (Hz/MHz)/(ng/cm2);
  - Sensitivity of the SAW based gas sensor: 50-500 (Hz/ppm) (depending of coating material and gas species).
  - Integration into DEM #4
- T sensor
  - SAW monolithic with GaN MMIC (HEMT)
  - T range from – 40 to + 120
    Precision ~ 2-3 C

Application Demonstrators

DEM # 1

- Reconfigurable smart active antennas with RF-MEMS switches
- X band, 20W peak

DEM # 2

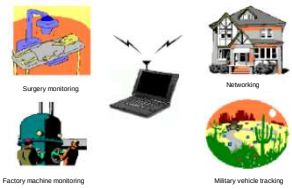
- RF-MEMS based agile radio (tunable filter) for air traffic mangement radars
- Wideband, high reliability

DEM # 3

- RF-MEMS based reconfigurable reflect array antenna
- X band, 20W peak, short switching times (<500ns)

DEM # 4

- Miniaturized piezo sensor and actuator based on III-nitride materials



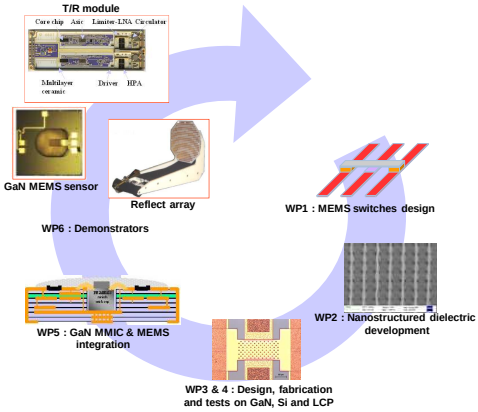
T/R module for active antenna:

- Replace circulators by RF-MEMS SPDTs integrated on the same substrate as the HPA and LNA

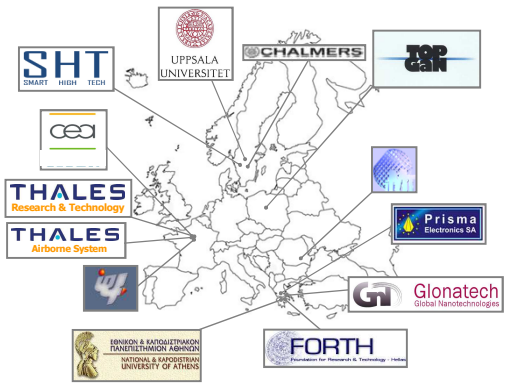
Sensors an actuators:

- Applications of wireless microsensor network with integrated sensor/actuator and microwave functions

Project Fact Sheet



- ✓ **ENIAC Joint Undertaking**
  SP 2 – Wireless communications
  SP 3 – Energy efficiency
- ✓ **Total cost: 3,3 M€**
  ENIAC Contribution: ? M€
  National Contribution: ? M€
  Total efforts: 626,25 pm
- ✓ **13 European Partners**
  5 countries
  2 large industries
  4 innovative SMEs
  7 academic institutes
- ✓ Coordinator: **Thales Research & Technology** Fr
- ✓ Duration: **3 years**



THALES Research & Technology
Palaiseau (91) - France
www.thalesgroup.com

Contact:
Afshin.ziaei@thalesgroup.com