

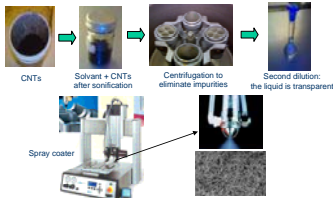
NANOSENSEFIN

micro-SENSORS based on carbon NANOTubes for gas FINGERprinting

Objective :

The proof-of-concept of a new original approach for highly selective and sensitive sensing of gas using CNTFET (patented)

Automatic scanning machine for CNT mats deposition

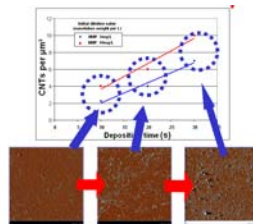


- Optimize distance spray nozzle and sample
- Programmable machine (x,y,z)
- Instantaneous evaporation of solvent
- Optimize Heating temperature to avoid droplet formation (coffee droplet effect)

High uniformity mats with controlled uniformity

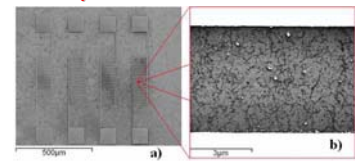
Why a CNT mat?

- Important cost reduction, Easier to fabricate
- Better overall electrical control

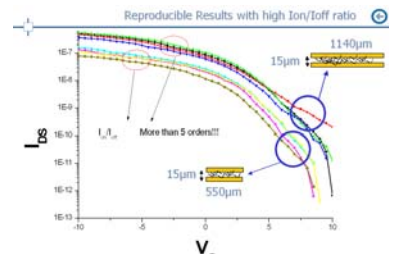


CNT density as a function of the deposition time

I_{On}/I_{off} ratio as a function of CNT density and Electrode distance

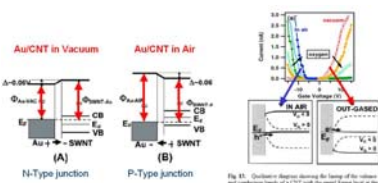
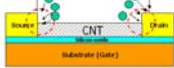


CNTFET obtained using CNT mats

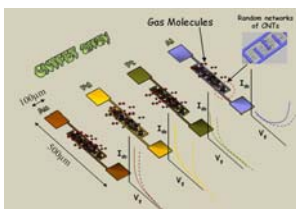


Gas sensors using CNTFET array Physics and new concepts

The main interaction is at the Metal/CNT junction

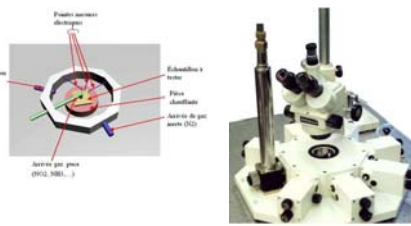


Ph.Aucaris et al., Proceedings of the IEEE, Vol.91, n.11, 2003

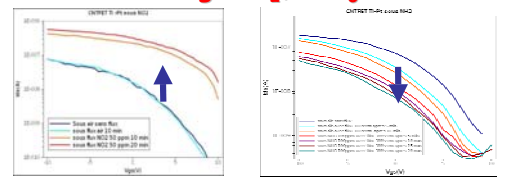


Array of Fet Transistors Having a Nanotube or Nanowire Semiconductor Element and Corresponding Electronic Device, For the Detection of Analytes, P.Bondavalli et al WO2006EP62615

Specific test bench

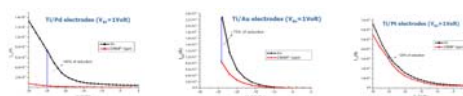


Sensing NO₂, NH₃



Current change as a function of concentration

Tests after DMMP exposure



Metals (WF value)	Pd (5.1 eV)	Au (5.1 eV)	Ti (4.33 eV)	Pt (5.65 eV)
I_{ds} gas exp / I_{ds} initial (%)	90%	70%	60%	20%

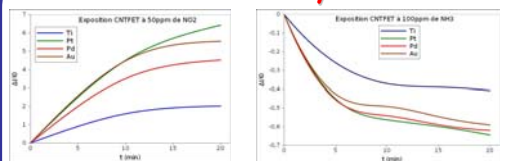
1ppm

Metals (WF value)	Au (5.1 eV)	Mo (4.9 eV)	Pt (5.65 eV)
I_{ds} gas exp / I_{ds} initial (%)	60%	30%	10%

0.5ppm

P. Bondavalli, P. Legagneux, D. Pribat, J. Experimental Nanoscience, accepted (2008)
P. Bondavalli, P. Legagneux, D. Pribat, Proceeding of Nanotech07, Vol.3, pp29-32 (2007)
P. Bondavalli, P. Legagneux, D. Pribat, IEEE, Avril 2007

Selectivity



	NO2 50 ppm	NH3 100 ppm
Au	448%	-49%
Ti	159%	-37%
Pd	351%	-54%
Pt	450%	-56%

Each CNTFET shows a specific current change as a function of the metal electrodes

Conclusions and perspectives

- Uniform CNT mats can be obtained using Air-Brush technique
- Effective and reproducible CNTFET have been obtained
- To understand deeply the Physics of CNTFETs based sensors (chemical and physi-adsorption)
- To perform measurements using mixtures for selective sensing

Contact : Paolo.bondavalli@thalesgroup.com, Louis.Gorintin@thalesgroup.com