CARBON BASED SMART SYSTEM FOR WIRELESS APPLICATION

Start Date : 01/09/12
Project n°318352 **Duration : 36 months**

Topic addressed : Very advanced nanoelectronic components: design, engineering, technology and manufacturability

WORK PACKAGE 7 : Project management

DELIVERABLE D7.5

Minutes of the T0+18 meeting

Due date : T0+18 **Submission date : T0+23**

Lead contractor for this deliverable : TRT

Dissemination level : PU – Public

WORK PACKAGE 7: Project management

PARTNERS ORGANISATION APPROVAL

	Name	Function	Date	Signature
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Approved by:	Afshin Ziaei	Research Program Manager	05/08/14	

DISTRIBUTION LIST

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1 ex	Fundacio Privada Institute Catala de Nanotecnologia	ICN	Clivia SOTOMAYOR
1 ex	Tyndall-UCC	Tyndall	Mircea MODREANU

CHANGE RECORD SHEET

REVISION LETTER	DATE	PAGE NUMBER	DESCRIPTION
Template	07/2013	8	Template
V1	05/08/2014	14	Final version

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2 AGENDA

Tuesday 27th of May		
9:30	Opening, Welcome and Agenda	
9:45 – 10:30	**WP1 Presentations** - Objectives & means - Schedule of main milestones & deliverables - Main results obtained on the period January-May 2014	WP leader
10:30 – 10:45	Break	
10:45 – 11.45	**WP2 Presentations** - Objectives & means - Schedule of main milestones & deliverables - Main results obtained on the period January-May 2014	WP leader
11:45 – 13:15	**WP3 Presentations** - Objectives & means - Schedule of main milestones & deliverables - Main results obtained on the period January –May 2014	WP leader
13:15 – 15:00	**Lunch** **Visit of IMT**	
15:00 – 16:00	**WP4 Presentations** - Objectives & means - Schedule of main milestones & deliverables - Main results obtained on the period January –May 2014	WP leader
16:00 –17.00	Technical discussion / Working groups/Conclusions	All

All the presentations made during the Progrees Meeting will be available as soon as possible on the website. We report here only the contents of the discussions that occurred during the presentations.

3 INTRODUCTION AND PROJECT OVERVIEW (A. ZIAEI, TRT)

Thanks to IMT to receiving us in Bucharest

The aims of the project are the RF active and passive fabrication devices with CNTs and Graphene.

Reminder of the WP responsible:

- WP1 : TAS (Y.Mancuso)
- WP2 : IMT (M.Dragoman)
- WP3 : FORTH (G.Konstandinis)
- WP4 : CNRS-LAAS (G.Deligeorgis)
- WP5 : ICN (C.Sotomayor)
- WP6 : TRT (A.Ziaei)
- WP7 : TRT(A.Ziaei)

- **Next progress meeting (T0+24) :** 16 September 2014 (Anconna, Italy)

- **Project extension:** All partners have agreed to request an extension to European commission

Two justifications:

- Integration issues (compatibility between processes for each key component (CNTs growth temperature….))
- Material beyond state of the art for Nano-RF

2 pages are necessary to explain the extension (1page for material issues (Mircea D.) and 1 page concerning the integration issues (George D.). We need this contribution for end of June.

- **Deliverables:**

All the deliverable for the first year are accepted or re-submitted.

WP1	D1.1, D1.3, D1.4 approved. D1.2 : re-submitted MS1: Achieved
WP2	All the deliverables are accepted (D2.1,D2.2,D2.4,D2.5) MS2 will be postponed until WP2 has been finished
WP3	D3.1 : Re-submitted D3.2 : Accepted
WP6	D6.1, D6.2 : accepted
WP7	D7.1,D7.2,D7.3,D7.9,D7.4,D7.16,D7.21 are accepted D7.10: re-submitted

WP6 : dissemination

Please send me your list of plublication/conference to update the website

Please use the private part of Nano-RF website for document exchange between partners

All deliverables are avaible in the private part of the website
All the presentation are uploaded in the server but I have to modify the website for the access

WP7 (Project Management) :
D7.11 : Progress Management report ==> **I need the cost for UPMC, SHT, UNIVPM (06/06/14)**

Work planned for T0+24 :

WP3 (Fabrication activities):

All the deliverable need to be submitted at T0+24 (September)

Del.	WP	Deliverable name	Deliver y date	WP leader	Lead Beneficiary
D3.3	WP3	Activity report on fabrication of the filter/oscillator:	T0+23	FORTH	FORTH
D3.4	WP3	Activity report on fabrication of CNT based FET:	T0+24	FORTH	CHALMERS
D3.5	WP3	Activity report on fabrication of CNT based RF switch:	T0+24	FORTH	SHT
D3.6	WP3	Activity report on fabrication of the CN antenna, graphene antenna , and the RF graphene devices:	T0+24	FORTH	LAAS
D3.7	WP3	Activity report on fabrication of the CNT interconnects:	T0+24	FORTH	CHALMERS
D3.8	WP3	Report on the integration technologies:	T0+24	FORTH	FORTH
MS4	WP4	Performance specifications and extractedparameters for all sub-modules available	T0+23	LAAS	TRT

WP4 (Test activities):
All the deliverables need to be submitted at T0+26

Del.	WP	Deliverable name	Delivery date	WP leader	Lead Beneficiary
D4.1	WP4	Activity report on CNT and graphene based FET tests	T0+26	LAAS	IMT
D4.2	WP4	Activity report on CNT based RF switch tests	T0+26	LAAS	LAAS
D4.3	WP4	Activity report on CNT based filter/oscillator and graphene detector tests	T0+26	LAAS	UPMC
D4.4	WP4	Activity report on CNT and graphene based antenna tests	T0+26	LAAS	UNIVPM
D4.5	WP4	Activity report on Graphene detector performance	T0+26	LAAS	IMT
D4.6	WP4	Activity report on CNT based interconnects	T0+26	LAAS	CHALMERS
D4.7	WP4	Activity report on parameter extraction procedures for DC and HF models for CNT based sub-modules	T0+26	LAAS	Tyndall

There are 6 deliverables for WP3 for T0+24

4 WP PRESENTATIONS

4.1 WP 2 (M.DRAGOMAN, IMT)

4.2 WP 3 (KONSTANDINIS, FORTH)

		Simulation/Design	Mask	Fabrication	Measurement
CNT Devices	CNT FET				FORTH
	CNT Switch				TRT
	CNT Antenna			TRT/SHT	UPMC
	CNT oscillator/filter		IMT	IMT/SHT/TRT	IMT
	CNTs interconnects				
Graphene devices	Graphene Detector				
	Graphene FET				
	Graphene Antenna				IMT
	RF graphene modules	LAAS	LAAS	LAAS	LAAS

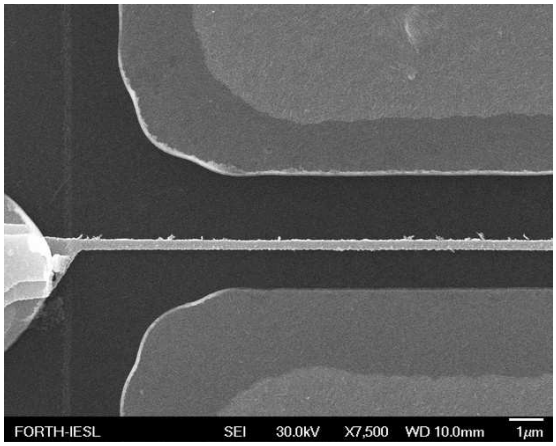
CNTs key components:

- **Oscillator/Filter (IMT):** this is a critical part of the project. Indeed, there is no significant progress for this task. For end of August, we need to fabricate and measure an oscillator/filter based on CNTs.

Mircea D. ➔ send GDS files to Stephane for the end of week (06/06/2014)
Stephane ➔ start the fabrication as soon as possible. Soon as Stephane have the gds file, he determines the process flow for discussion (IMT, SHT, FORTH). Maybe some preliminary test will be necessary…
Yifeng ➔ CNTs growth after fabrication. 10µm CNTs height is necessary.

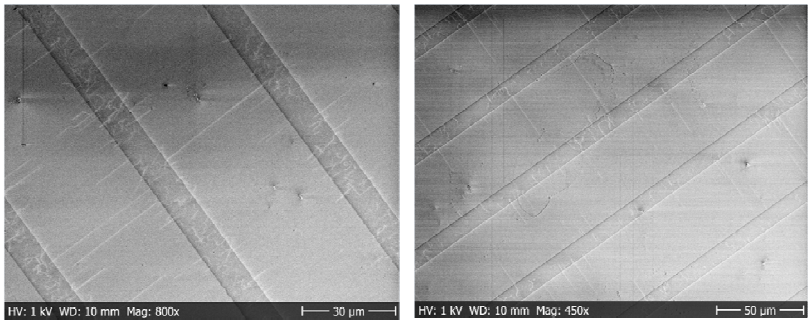
The objective is to finish the first run of fabrication for the beginning of July.

- **CNT FET (FORTH):** FORTH fabricated the first CNTs FET and the DC measurement are promising. Commercial CNTs (Nanointegris) are used for the fabrication.

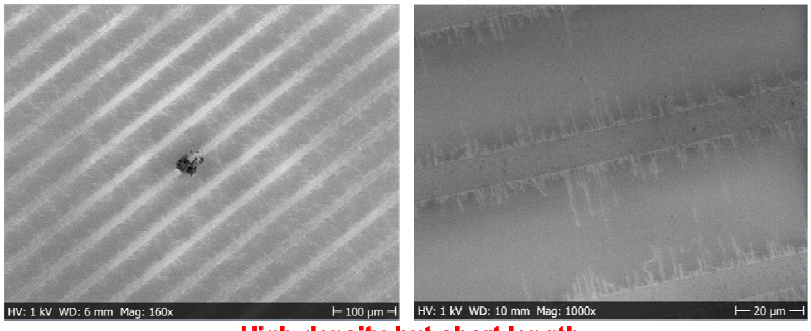


CNTs FET First fabrication

SHT try to develop the horizontally CNTs growth. Today is not possible to use this technology for the CNT FET (density is too low). There is some improvement and the next step is to replace the valve process.



Long length but low density

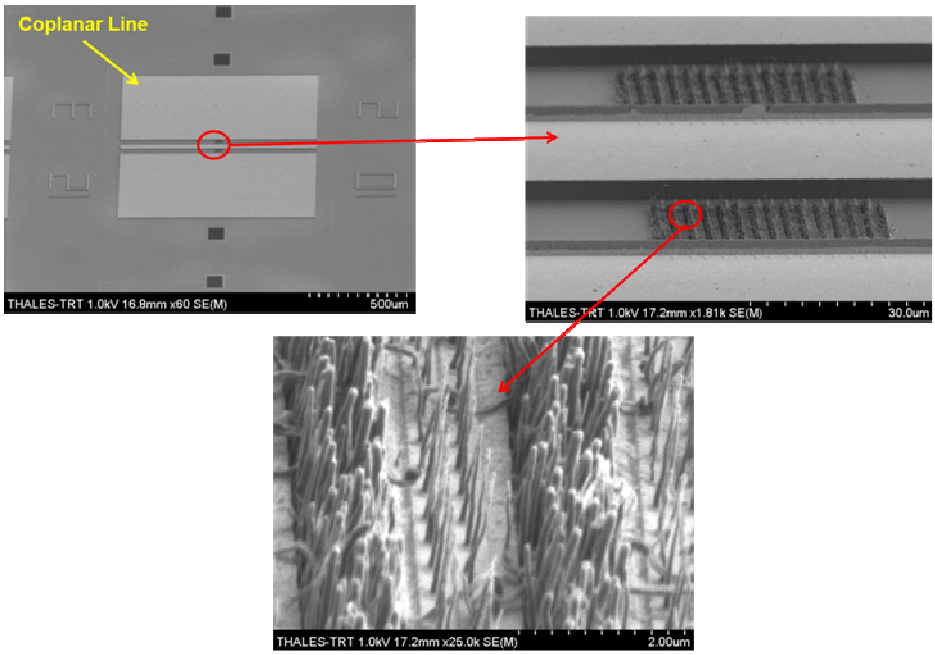


High density but short length

Horizontal CNT growth

Yifeng ➔ CNTs horizontally growth after reducing the CNTs length (10µm is enough for the application). ASAP
The objective for the review meeting is to show the feasibility of this device for the project (fabrication, RF performances) using commercial CNTs. We also show good progress about the horizontally CNTs growth and if possible we will show the first fabrication using CNTs provided by the consortium.

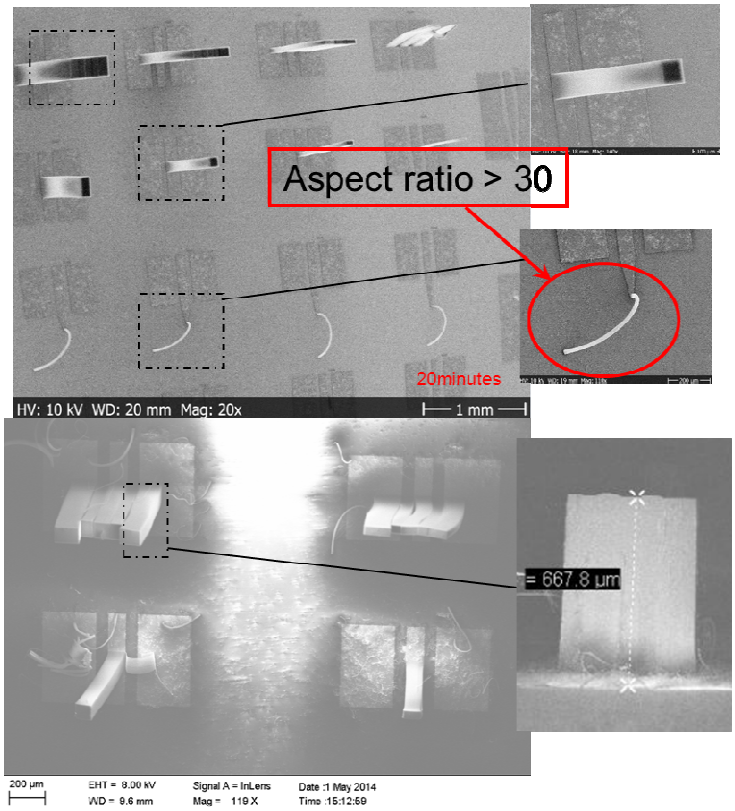
- **CNTs Switches (TRT)** : TRT are fabricated CNT RF switches and the process is reproducible. CNTs growth on Si HR substrate is possible.



CNT RF switches

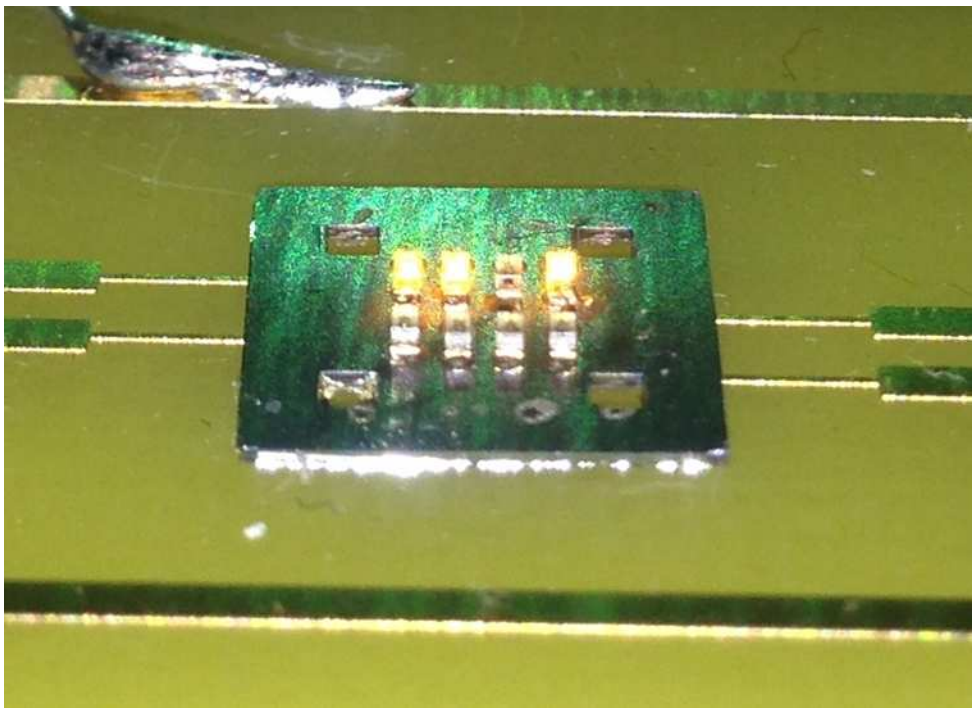
After measurement, two electrodes are connected (100nm space between them). Maybe due to the distance between the electrode or amorphous carbone deposited during growth. Some new tests are planned for the next week.
Stephane ➔ test structure fabrication and DC/RF measurement.
The objective for the review meeting is to show the RF measurements (actuation….)

- **CNTs antenna :** UPMC provided a gds files and TRT fabricated test structure. SHT performed the growth. The growth seems to be validated but the aspect ratio is an issue. For an aspect ratio>30, the CNTs bundle in not vertical align with the substrate.



Charlotte/Stephane/Yifeng ➔ Discussion to see if is possible to increase CNTs dots diameter.
Stephane/Yifeng ➔ Start the new fabrication and CNTs growth
Charlotte➔ RF measurement
The objective for the review meeting is to show RF measurement and the final design

- **CNTs interconnect** : Chalmers show a good progress and I think there is no issues/delay for the review meeting.



CNT TSV LED Demonstrator

Graphene key components :

- **Graphene FET :** FORTH fabricated the first CNTs FET and the DC/RF measurement are promising. Commercial graphene (Graphene supermarket and graphenea) and SiC graphene (LiU) are used for the fabrication.

Discussion and we need to clarify some details:

- **SiC graphene (LiU)**: graphene quality is good (better than the commercial graphene).. During the last review, Rosista mentioned some difficulty with the budget to buy substrates. This is still true?

Discussion between FORTH/Liu concerning size of sample and the number of sample necessary for the fabrication. FORTH needs more sample Please to clarify the situation ASAP.

- **CVD Graphene (SHT/Chalmers)**: Today, the quality is not good enough to fabricate device using the SHT CVD graphene. SHT showed some improvement using Pt catalyst.

Yfeng ➔ send the graphene grown using Pt to FORTH for graphene transfer and fabrication ASAP.
Use Si HR substrate for the transfer.

- **Exfoliated graphene(GI):** FORTH will try to fabricate FET using GI graphene. For the project, the exfoliated graphene is the reference.

- **Dielectric deposition (Tyndall) :** today, one difficulty is the dielectric deposition. The process has been validated but the next step is the fabrication using HfO2.

FORTH needs sample with HfO2 layer. Discussion FORTH/Tyndall ASAP.

The objective for the review meeting is to show a comparison between the graphene provided by the consortium and also with a commercial graphene.

- **Graphene Antenna :** IMT fabricated the first graphene antenna on Si. Mircea D. will perform RF measurement. If the measure are promising, he will fabricate the graphene antenna on Si HR substrate.

5 REVIEW OF WORK & ACTION LIST

Description	Date	Leader
One page for the project extension (integration issues)	**End of June**	**FORTH**
One page for the project extension (material issues)	**End of June**	**IMT**
Send cost to TRT (UPMC, SHT, UNIVPM)	**06/06/14**	**UPMC, SHT, UNIVPM**
CNT FET : horizontal CNTs growth 10µm length	**ASAP**	**SHT**
CNTs Oscillator/Filter : send gds file to TRT	**06/06/14**	**IMT**
CNTs switches : fabrication cell structures	**ASAP**	**TRT**
CNTs antenna : start new fabrication	**ASAP**	**TRT/UPMC/SHT**
SiC graphene : clarify the situation with the budget	**06/06/14**	**LiU/TRT**
CVD Graphene: send graphene using Pt catalyst to FORTH	**13/06/14**	**SHT**
Start GFET fabrication using exfoliated graphene (reference material)	**ASAP**	**FORTH**
Discussion FORTH/LiU concerning the sample needs for fabrication	**06/06/2014**	**FORTH/LiU**
Discussion Tyndall/Forth for dielectric deposition	**06/06/14**	**FORTH/Tyndall**
Send data/input for RF graphene/CNTs module design to LAAS	**06/06/14**	**FORTH/LAAS**
After measure, discussion between measure and simulation are necessary to optimize the design	**ASAP**	**FORTH/IMT/UNIVPM**
D3.3, D3.4, D3.5, D3.6, D3.7,D3.8	**September**	**ALL**
Next progress meeting Anconna	**16/09/2014**	**ALL**