Sinano Institute members

“Who is Who Guide”

LIST OF MEMBERS

Institute's members	Organization Legal Name	Name of the contact
GRENOBLE INP	***Grenoble Institute of Technology***	Dr. Mireille Mouis
WARWICK	***University of Warwick***	Dr. David Leadley
KTH	***Kungliga Tekniska Högskolan***	Prof. Mikael Ostling
IUNET	***Consorzio nazionale interuniversitario per la nanoelettronica***	Dr. David Esseni
UCL	***Université Catholique de Louvain***	Prof. Denis Flandre
ISEN	***IEMN-ISEN***	Dr. Emmanuel Dubois
FZJ	***Forschungszentrum Juelich***	Dr. Siegfried Mantl
NCSR "D" IMEL & IMS	***National Center for Scientific Research "Demokritos"***	**IMEL:** Dr. Androula Nassiopoulou **IMS:** Dr Athanasios Dimoulas
TYNDALL	***Tyndall National Institute, University College Cork***	Prof. Jean-Pierre Colinge
WUT	***Warsaw University of Technology***	Prof. Romuald Beck
URV/UGR	***Universitat Rovira I Virgili*** ***University of Granada***	Prof. Benjamin Iniguez Prof. Francisco Gamiz
CHALMERS	***Chalmers tekniska högskola AB***	Prof. Olof Engstrom
LIVUNI	***University of Liverpool***	Prof. Steve Hall
GU	***The University of Glasgow***	Prof. Asen Asenov
UNEW	***University of Newcastle upon Tyne***	Prof. Anthony O'Neill
UU	***Uppsala University***	Dr. Stefan Nygren
ITE	***Institute of Electron Technology***	Dr. Piotr Grabiec
UTwente	***University of Twente***	Prof. Jurriaan Schmitz
ICN	***Catalan Institute of Nanotechnology***	Prof. Clivia Sotomayor
IES	***Institut d'Electronique du Sud***	Dr. Frédéric Martinez

Name of the organization			
Organization Legal name		***Grenoble Institute of Technology***	
Organization Short name		***Grenoble INP***	
Department/Faculty/Institute/Laboratory name		***FMNT***	
Internet homepage		***http://fmnt.online.fr/***	
Contact person for additional information			
Name: MOUIS	***First name: Mireille***	***Title: Dr***	***E-mail address: Mouis@enserg.fr***
Brief description of your organization			

The Federation for Micro Nano Technologies (FMNT) clusters the 4 academic laboratories which are involved in the field of micro-nano-electronics on the Minatec Campus in Grenoble, namely LTM, LMGP, SPINTEC and IMEP-LAHC. Their expertise ranges from materials and technology to devices, circuits and integrated micro-nanosystems. It covers:

- *Synthesis and characterization of functional materials, including advanced methods for the deposition of high-k dielectric materials with in situ control and deposition of 2D or 3D nanostructured materials using UV laser interferometry,*
- *Development of processes for nanoelectronics, with special focus on self organized growth of nanodots and nanowires and integration in devices,*
- *Device physics and extensive electrical characterization: mobility extraction, with in depth analysis of the scattering mechanisms, from electrical measurement in a wide range of temperature (10K-400K) at package or wafer level ; energy and depth resolved spectroscopy of interface states and defects in the gate dielectric, noise measurements (LF, RTS, shot noise), reliability…*
- *Near-field electrical characterization of nanostructures,*
- *Simulation of nanodevices and development of compact models of advanced devices (MUGFETs, quasi ballistic regime…).*

FMNT and CEA/INAC are co-operating a technology platform (PTA), which brings it support to research oriented projects.

PROCESSING

Equipment	Techniques/competences
• Etch platform with p-Si, oxide, metal and high k plasma chambers with high temperature process capabilities (250°C).	• Plasma patterning • In situ diagnostics & real time monitoring • Quasi *in situ* XPS analysis for plasma etching process analysis

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Angle Resolved X-ray Photoelectron Spectroscopy (ARXPS) system for 300 mm wafer size • 3D Atomic Force Microscope • Atomic Force Microscope (AFM) under controlled atmosphere (ambient temperature) • Laser interferometer / vibrometer • 200mm Cryogenic set-up for on-wafer electrical characterization (10-350K, DC-50GHz) • 300mm set-up for on-wafer electrical characterization (ambient, DC-150GHz) • Magnetoresistance and Hall effect set-up (PLCC mounting, 4-400K, 0-9T). After 09/2008. • Several set-ups for Charge Pumping, I-V-ω, G-V-ω measurements, pulsed I-V • Low-Frequency (LF) and Random Telegraph Signal (RTS) noise measurement • Self-consistent simulation of devices using the Non Equilibrium Green Function (NGEF) formalism • Band structure calculations (DFT)	• Surface analysis • Line Width Roughness and critical dimension metrology on patterned surfaces • Electrical modes of the AFM (STM, SGM, TUNA, EFM, MFM …), control in the x-y-z directions allowing local I-V measurements • Surface morphology, dynamic characterization of MEMS/NEMS structures (vibration modes…) • Improved techniques for the extraction of transport parameters and development of associated models, • Improved techniques for the study of thin SOI film and multiple gate devices • RF parameter extraction • Hall and magnetoresistance mobility extraction… • Characterization of interface states, depth resolved profiling of the trap density in thin dielectric layers… • Characterization of defects • Quantum transport in nanodevices, influence of local inhomogeneities (roughness, remote charges…), phonons… Influence of magnetic field. • Account for non standard materials, orientations, etc…

Name of the organization			
Organization Legal name		***University of Warwick***	
Organization Short name		***Warwick***	
Department/Faculty/Institute/Laboratory name		***Dept. of Physics***	
Internet homepage		***go.warwick.ac.uk/silicon***	
Contact person for additional information			
Name: Leadley	***First name: David***	***Title: Dr***	***E-mail address: d.r.leadley@warwick.ac.uk***
Brief description of your organization			
The Warwick Nano-Silicon Group is focused on the epitaxial growth of silicon and germanium based layer structures and has established a reputation for this over some 20 years, both in the UK and on the world stage. Most of our work is in collaborative projects with partners from UK and other European universities, advanced research institutes such as IMEC and LETI, and from industry. *Our specific expertise is in:* ** Epitaxial growth of Si, SiGe alloys and Ge layers by MBE and CVD, including n- and p-type doping for both active regions and strain-tuning buffer layers* ** Structural characterisation of layers, including XRD, TEM, SIMS and ellipsometry* ** Electrical characterisation of simple test structures and fully processed devices* ** Magnetotransport measurements of low dimensional structures including quantum Hall effect and correlated electron systems*			

PROCESSING

Equipment	Techniques/competences
• Solid state molecular beam epitaxy (SS-MBE) V100S • Reduced pressure chemical vapour deposition (RP-CVD) ASM Epsilon 2000E	• Epitaxial growth of Si, Ge C and related alloys • Investigation of strained layers and of strain tuning buffers

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Variable temperature probe station plus parameter analyzer and CV measurement equipment • Cryomagnetic system 14T, 0.3K • Low energy SIMS, using O_2 and Cs • Panalytical X'Pert Pro MRD for X-ray diffraction • JEOL 2000fx TEM • Zeiss SUPRA 55-VP FEGSEM	• Electrical characterization (CV, IV, 1/f noise) of silicon based materials and devices, between room temperature and 4K • Low temperature magnetoresistance, in fields up to 14 T and temperatures 300 to 0.3 K • Physical characterization of silicon based materials by SIMS, XRD, TEM, defect etch, AFM, SEM, ellipsometry

Name of the organization			
Organization Legal name	***Kungliga Tekniska Högskolan***		
Organization Short name	***KTH***		
Department/Faculty/Institute/Laboratory name	***School of Information and Communication Technology Department of Microlectronics and Applied Physics***		
Internet homepage	***http://www.ict.kth.se/MAP/***		
Contact person for additional information			
Name:	***First name:***	***Title:***	***E-mail address:***
Mikael	***Östling***	***Prof***	***ostling@kth.se***
Per-Erik	***Hellström***	***Docent***	***pereh@kth.se***
Brief description of your organization			
KTH, Royal Institute of Technology is Sweden's oldest and largest technical university with more than 17000 students, about 250 full professors and in total 3000 employees. The school of information and communication technology, ICT, is located at the new campus in Kista, a centre for Sweden's ICT industry. The ICT school has it's own cleanroom facility with full wafer processing capability including stepper lithography for Si nanoelectronics on 100, 150 and 200mm sizes. On 100 mm wafers the processing capability includes full MOSFET fabrication and patterning of lines down to 30 nm width is achieved with Sidewall Transfer Lithography combined with I-line stepper lithography. FinFETs, Ultra-Thin-Body and bulk devices can be made in the cleanroom. The cleanroom comprises basic research, applied research and pilot production in a wide perspective of nanotechnology materials.			

PROCESSING

Equipment	Techniques/competences
Equipment is for 100 mm wafers unless specified. • G and I-line stepper lithography on 100, 150 and 200 mm wafers • AMAT P5000 etching tool with 3 chambers for dielectrics, poly-Si and metal etching. • LPCVD: SiN, LTO, in-situ phosphor doped poly-Si, undoped a-Si and poly-Si, TEOS • SiO_2 gate dielectric down to t_{ox}=2.4 nm • RTA • AMAT Centura system with deep Si etch chamber and dielectric etch chamber for 200 mm wafers. • ASM Epsilon SiGe CVD reactor	• Sidewall Transfer Lithography to pattern lines with width down to 30 nm • Full process line for nanoscale MOSFET fabrication on 100 mm wafers with 3,5 month turn-around-time. • Processing on bulk and Ultra-Thin-Body SOI including Tri-gate and FinFET devices • Competence in low temperature dopant segregated Schottky barrier MOSFETs • Competence in PtSi and NiSi integration in MOSFETs • One-level metallization on MOSFETs • Competence in SiC bipolar transistor fabrication. • Competence in selective strained SiGe growth on patterned Si wafers.

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• HRSEM, FIB and HRTEM • SIMS • HRXRD • ISE software • Wire bonding (thick and thin)	• Competence IV, CV and high frequency S parameter measurements • Device Modelling

Name of the organization			
Organization Legal name		***Consorzio nazionale interuniversitario per la nanoelettronica***	
Organization Short name		***IUNET***	
Department/Faculty/Institute/Laboratory name		***Consorzio nazionale interuniversitario per la nanoelettronica***	
Internet homepage		***http://www.iunet.it/***	
Contact person for additional information			
Name: David	***First name: Esseni***	***Title: Dr.***	***E-mail address: esseni@uniud.it***
Brief description of your organization			
The "Consorzio Nazionale Interuniversitario per la Nanoelettronica" (IUNET, Italian Universities Nano-Electronics Team), is a non-profit, private Organization, aimed to lead and coordinate the effort of the major Italian University Teams in the field of Silicon Based Nanoelectronic Device Modeling and Characterization. The groups involved in the NANOSIL Project are the following: ARCES-University of Bologna, DEIT Politecnico of Milano, DII-University of Pisa, and DIEGM-University of Udine. They offer renowned and complementary expertise in the field of modeling, simulation design, characterization of CMOS-based nanometer-size electronic devices. Their technical reputation is confirmed by the many IST projects where they have been recently involved under FP6 (PULLNANO, EMMA, SINANO, FINFLASH), under FP5 (DEMAND, NANOTCAD, NESTOR, PHANTOMS, ULIS) as well as many other European and national projects.			

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• State-of-the-art characterization equipments for low frequency device measurements • State-of-the-art characterization equipments for high-frequency, RF measurements • Low temperature measurements • Single device and statistical characterization of Non-Volatile Memories	• Advanced CMOS and Non-Volatile memories characterization • Advanced CMOS modeling: o Semi-classical Monte Carlo modeling; o Full quantum transport; o Atomistic approaches • Advanced Non Volatile Memory modelling: o Phase Change Memories o Nitride based memories; o Nanocrystal memories;

Name of the organization			
Organization Legal name			***Université Catholique de Louvain***
Organization Short name			***UCL***
Department/Faculty/Institute/Laboratory name			***Electrical Engineering, Microelectronics (DICE) / Microwave (EMIC) laboratories***
Internet homepage			***http://www.dice.ucl.ac.be http://www.emic.ucl.ac.be***
Contact person for additional information			
Name: Flandre	***First name: Denis***	***Title: Prof.***	***E-mail address: denis.flandre@uclouvain.be***
Brief description of your organization			
The UCL DICE and EMIC Laboratories are part of the CERMIN (UCL Research centre for micro- and nano- materials and electronics devices). They form a multidisciplinary team, involving device physicists, technologists and experimentalists, as well as analog, RF and digital circuit designers. Current activities focus on innovative device fabrication, extensive DC to RF characterization and simulation, including: CMOS/bipolar/diodes on SOI, advanced architecture MOSFETs (multiple-gate, e.g. planar DG, FinFETs, SON), Nano-MOSFETs with low-barrier Schottky source-drain contacts, Quantum Single-electron-memories and transistors, Ballistic transistors, Magnetic devices, various MEMS and sensors. In FP6 NoE "SINANO", UCL led the WP2 "non-classical Si-based nano-MOSFETs".			

PROCESSING

Equipment	Techniques/competences
• UCL laboratories are equipped with a complete pilot fabrication line of about 1000 m^2 (Winfab.eu), for the rapid prototyping and validation of new fabrication steps and of new integrated devices or Microsystems, on silicon / SOI substrates (3 inches)	• Full fabrication process for 1µm Single/Double gate SOI MOSFETs and CMOS ICs (more than 10000 gates) since early 90's, namely fully-depleted and Gate-all-Around (GAA) technologies. Silicon-on-nothing (SON) and innovative double-gate process developed within FP6 NoE SINANO. • Thin silicides on SOI: Er-Pt (for low Schottky barriers), Ni (for low ohmic and RF devices)… • Quantum wires, Single-Electron-Memories, Single-Electron-Transistors… with nano-dimensions defined by e-beam lithography, nanoimprint and controlled oxidations.

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• A large set of characterization tools is available (for complete list, refer to www.emic.ucl.ac.be/WebBooking). • Electrical measurement set-ups cover a large range of frequencies (from DC up to 110 GHz) and temperatures (from few mK	• The Microelectronics and Microwaves laboratories have been collaborating since 1991 on the measurement and extraction of static and dynamic behaviors and parameters for SOI MOSFETs, e.g. statistical digital/analog/RF figures-of-merit,

up to 400°C) on wafer-scale (semi-automatic prober) as well as packaged circuits levels. • Semiconductor simulation tools (ISE, Silvaco, Synopsis…). • Electro-magnetic simulations. • Complete CAD tools for integrated circuits and systems design	floating-body and substrate time constants, distortion, matching, 1/f noise, crosstalk. • DC and RF behaviors of SOI MOSFETs such as Fully and Partially Depleted, Body Contacted and Dynamic Threshold as well as multiple-gates FETs as DG MOSFETs; SON MOSFETs and FinFETs.· • Atlas 3-D module used for simulating GAA MOSFETs and FinFETs. • Compact modeling of SOI fully-depleted single-gate, double-gate and graded-channel MOSFETs and RF macro-modeling. • Ultra-Low-Power innovative design concepts for SRAM, MTCMOS, low leakage CMOS, analog blocks (voltage reference, charge pump, low leakage diodes, power management, RFID…)

Name of the organization			
Organization Legal name		***IEMN-ISEN***	
Organization Short name		***IEMN-ISEN***	
Department/Faculty/Institute/Laboratory name			
Internet homepage		***www.iemn.univ-lille1.fr***	
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Brief description of your organization			
IEMN has approximately 165 permanent research scientists, 94 engineers and technical staff, 140 PhD students and 35 post-docs. IEMN has developed a recognized expertise over a wide spectrum of research fields covering advanced device fabrication (compounds and silicon), material physics, circuit design, optoelectronics, nanostructures, molecular electronics, microsystems, acoustics and sensors. The coexistence of specialists in all these research areas increases exchange of knowledge between very different disciplines where IEMN has acquired the expertise required for the design of non-conventional CMOS materials and devices. This work is carried out with numerous national and international partners from the research as well as with the industrial world. IEMN is equipped with excellent research facilities installed over 13000 m2, including 1400 m2 of clean room. The main IEMN group associated to the activity of NANOSIL is the Silicon Microelectronics Group that has developed main research themes that cover i) the design and fabrication of nanometric MOS architectures, ii) the modelling and simulation of silicon processes/devices and iii) the design of analogue integrated circuits.			

PROCESSING

Equipment	Techniques/competences
• MBE growth: - 1 RIBER Compact 21 (solid sources) - 1 RIBER 32P (gas sources) - 1 RIBER compact 21 (Carbone based epilayers) • Ion Implantation: - 1 EATON GA204 ion implanter - 2 RTA • LPCVD: - 5 TEMPRESS tubular furnaces - 1 furnace for nanowires • Sputtering: 4 equipments for magnetic and piezo materials • Organic materials platform: 3 gloveboxes with spinning coater and evaporator. • E-beam lithography: - 1 LEICA EBPG 5000+ - 1 VISTEC EBPG-5000plusES • Optical lithography: - 3 mask aligners - 1 double face aligner - 1 substrate bonder • Wet etching:	• **Material Resource** Molecular Beam Epitaxy equipment: one is equipped with solid sources, the otherwith gas sources for the elements V, and solid sources for elements III. In order to characterize materials and epitaxial heterostructures, • **Deposition resources:** We gathered under the terminology "Resource Deposition" all of the physical techniques of deposition such as for example, the techniques of evaporation or cathode sputtering of various metals or alloys... as well as chemical techniques for metals deposition, dielectrics or various materials such as the LP-CVD, the PE-CVD and the electrolytic deposition. • **Etching Resource** We have an "Etching Resource" in which are gathered the techniques of dry etching (plasma technique) and the wet etching techniques (chemical techniques). Thus, our dry etching equipment, have 6 frames of RIE, ICP or micro

- 5 chemical benches for Si - 4 chemical benches for III-V compounds • Dry etching : - XeF2 etching - 1 STS ICP for Si deep etchning - 1 OXFORD RIE-ICP for III-V compounds - 1 OXFORD RIE etching - 1 IBE etching • PECVD: 1 OXFORD PECVD system • Metallization: - 4 UHV evaporators - 1 automatic UHV evaporator - 2 sputtering equipments - 1 multi cathode sputtering equipment - 1 evaporator for polymers - 1 RTA • Sample cleaning, dicing, polishing, bonding: - supercritical CO2 drying - chemical and mechanical polishing - 2 wafer dicing saws - 2 bonding machines	waves type. But each equipment is dedicated to a type or to a family of materials: Si, oxides and silicon nitrides, arseniured, phosphorated, nitrided, antimoniated, metals... in order to avoid cross material contaminations. Moreover, we are equipped with a chemical etching by xenon difluoride, allowing etching selectively Si / SiO2. About wet etching, we have 8 dedicated etching stations, under sorbonne. The main available baths are : KOH, TMAH, HF, and we have dedicated locations to the organic acids, HNO3, H2SO4, etc... • **Lithography resource** Under "Lithography Resource", are gathered the optical and e-beam lithography means : ► optical lithography : single face alignment and double face equipment, make possible to carry out the alignment of masks and the exposure with UV250 and UV400. Thanks to the use of adapted resins, it is possible to expose the submicron patterns. ► e-beam lithography : we have 2 e-beam equipments. Provided with proximity correction and simulation software, they carry out direct writing on substrates from 2 to 4 inches.

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Technology • 3 profilometers • optical microscopes, reflectometer… • spectroscopic ellipsometry • 2 SEM • 1 near field microscope • 1 large field AFM • Surface characterization (ESCA) • DDX, Hall effect, femtoseconde laser…	• **Analytical characterization** The material resource has physical techniques of characterisation such as the ESCA, equipped with sources making it possible to carry out XPS, UPS, and Auger analyses. We also have a double X-ray diffraction apparatus, a photoluminescence bench equipped with several sources (Argon laser,YAG, Xe lamps) and monochromators allowing to work from 0,2 to 1,7 µm, at temperatures ranging between 10 and 300K. A "femto-second" unit equipped with a pulsed source associated to a titanium-sapphire oscillator (700-1000nm, 100fs) and an optical parametric oscillator (1,1-1,65µm, 100fs). • **Microscopy, FIB** Latest generation FEG (Field Effect Gun) type Scanning Electronic Microscope. Provided with a Schottky type electron source we reach a resolution of 1,2nm@1kV and 1nm@15kV. Finally, in order to work on a nanotechnology level, we obtained a double beam microscope: STRATA DB 235. Thus, it is possible to carry out at the same time, micromachining (etching or deposition) using a Focused Ion Beam (FIB), and imagery using a Scanning Electronic Microscope (SEM). It is thus possible, in addition to the standard analyses applied to the

	laboratory, to carry out observations of transistor grid profiles, multi-layers structures crosses from there, or platinum deposition and TEM preparations.

Equipment	Techniques/competences
► Vector Network Analyzer are operating : from 30KHz to 110GHz in coaxial structure. from 50GHz to 110GHz and from 140GHz to 220GHz in guide structure. ► Pulse Vector Network Analyzer is operating from 1GHz to 50GHz with 100nsec of pulse duration. ► Noise measurement between 10MHz and 40GHz. ► Non Linear Vector Network Analyzer (600MHz to 20GHz). ► Noise measurements at 60GHz and between 75 and 110GHz. ► Power measurements at 60GHz and 94GHz with E/H plane tuners. ► Microwave signal generator up to 50GHz. ► Spectrum analyzer up to 50GHz. ► Programmable DC source/ monitoring working in static and pulse mode. ► Power meter in coaxial structure up to 50GHz working in CW and pulse (100nsec) mode. ► Power meter in guide structure up to 110GHz. ► Microwave Cryogenic probe station (30K-50GHz). ► High temperature microwave probe station (600K-40GHz	• RF characterization The first target of this joint service is to carry out the full electrical and microwave characterization of devices from the technology center in order to perform a feedback for technology. To do this, year after year, several experiments and experimental techniques have been developed over a wide frequency range, from DC to THz and for a wide temperature range from 30K to 600K. These experiments and experimental techniques can be summarized in these 6 following areas : ► DC and microwave small signal measurements. ► Noise characterisation ► Non linear characterisation ► Characterisation over a wide temperature range ► THz characterisation ► Electromechanical characterisation of MEMS This expertise applies to a wide range of microwave components such as passive devices,antennas and MEMs, and also active devicese.g. HBT (InP), HEMT (AsGa, GaN, InP), GaAs metamorphic HEMT, Si MOSFET, in addition to this some devices which are more complex integrating some functionalities (MMICs, amplifier for low noise or power applications, fast sampling applications etc.)

Name of the organization			
Organization Legal name		***Forschungszentrum Jülich***	
Organization Short name		***FZJ***	
Department/Faculty/Institute/Laboratory name		***Institute of Bio- and Nanosystems (IBN1-IT)***	
Internet homepage		***www.fz-juelich.de/ibn***	
Contact person for additional information			
Name:	***First name:***	***Title:***	***E-mail address:***
Mantl	***Siegfried***	***Prof. Dr.***	***s.mantl@fz-juelich.de***
Brief description of your organization			
FZ- Juelich, *Institute of Bio- and Nanosystems (IBN1-IT) is part of the Helmholtz research center Juelich and performs application oriented basic research in the domains of information technology. The silicon related research activities concentrate on the investigation of new materials, e.g. strained silicon, high-k dielectrics, metal gates as well as on novel devices, e.g. Schottky barrier and planar NanoMOSFETs on SOI and nanowire transistors. For material synthesis CVD of SiGe, ALD for oxides and AVD for Nitrides, MBE (Si, Si-Ge, silicides, GaAs, AlGaAs), MOVPE (InP based materials) and laser deposition (high-k, ferroelectrics) are used. The thin films can be characterised with numerous methods, e.g. RBS, ion channeling, TEM, Raman spectroscopy, photoluminescence, AFM and STM. A 250keV and a 500 keV ion implanter as well as a 1.7 MeV Tandetron accelerator are available for ion implantation and analysis. The institute has a fully equipped clean room for the fabrication of microelectronic devices. Electrical and optoelectronic characterisation methods for devices are also available.*			

PROCESSING

Equipment	Techniques/competences
• Fully equipped clean room • Various ion implanters (up to 200mm) • Si-Ge CVD (200/300 mm wafers) • Aixtron Genus ALD (200/300 mm) • Aixtron Genus AVD (200/300mm) • Excimer laser ablation • Electron beam lithography • Sputtertool • etc.	• Ion implantation • ion beam analysis (RBS, Channeling) • CVD of SiGe • Atomic layer deposition of oxides • Atomic vapor deposition of nitrides • Laser ablation of oxides, nitrides • Molecular beam deposition (SiGe, oxides)

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Tandem accelerator • Transmission electron microscopy • XRD, SIMS, Raman • CV, IV, pulsed IV etc. • HF characterisation • Silvaco, Synopsis • etc.	• RBS, channeling • TEM, HRTEM with aberration corr. • XRD • Raman • AFM, STM • etc.

Name of the organization			
Organization Legal name		***National Center for Scientific Research "Demokritos"***	
Organization Short name		***NCSR "Demokritos"***	
Department/Faculty/Institute/Laboratory name		***Institute of Microelectronics (IMEL)***	
Internet homepage		***www.imel.demokritos.gr***	
Contact person for additional information			
Name: ***Nassiopoulou***	***First name:*** ***Androula***	***Title: Dr, Director of IMEL***	***E-mail address:*** ***A.Nassiopoulou@imel.demokritos.gr***
Brief description of your organization			
IMEL (Institute of Microelectronics) is one of the eight Institutes of the National Center for Scientific Research (NCSR) "Demokritos", Athens-Greece, devoted to silicon technology. It is currently established as the National Center of Excellence in micro-, nanofabrication, nanoelectronics and MEMS. Its facilities and infrastructure include a fully equipped silicon processing laboratory in a clean room area, nanolithography equipment, design tools, sensor fabrication equipment and characterization and testing facilities for materials, devices, circuits and systems. Research activities at IMEL are structured in the following 3 programmes: *-Micro and Nanofabrication, including patterning technologies, lithographic polymers and processes, front-end processes for micro- and nanodevices and thin films for electronics and MEMs* *- Nanostructures for nanoelectronics devices and sensors, including semiconductor nanocrystals embedded in dielectrics, nanowires and their applications, memory devices, molecular materials as components of electronic devices etc.* *- Sensors and MEMs. They include development of materials, technologies, and devices, as well as design activities. Examples are: gas and liquid flow sensors, gas sensors, accelerometers, pressure sensors, thermoelectric devices, energy harvesting devices, bio-sensors, and thin film devices.*			

PROCESSING

Equipment	Techniques/competences
Silicon processing laboratory in a clean room area of 500 m^2, equipped with the following: • 4 laminar flow chemical benches • 7 horizontal hot-wall furnace tubes • 2 horizontal LPCVD tubes for nitride, oxide (TEOS), polysilicon • 1 horizontal LPCVD tube for LTO • Ion Implanter (EATON medium current, 200 KeV) • Optical lithography systems (resolution down to 0,6 μm) • Reactive Ion Etcher • Metallization equipment • (thermal, e-gun evaporation, sputtering) • Process inspection equipment	• Nanopatterning technologies • Plasma etching • Growth of metals and dielectrics • Growth of polycrystalline and nanocrystalline Si • Growth of Si nanostructures embedded in a dielectric matrix, ordering of nanostructures • Fabrication of MOS capacitors and MOSFETs • Nanocrystal non-volatile memories • Micromachining, sensor fabrication, microfluidics • Molecular materials and devices • Thin film devices

Processing equipment not in clean room: • High Density Plasma Etcher • Different thin film deposition systems • (Sputtering, MOCVD)	

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
Electrical • Several probe stations • HP measuring systems (4142B, 4084B, 8110A, 700i series, 4140B, 4284, 4192A, 34401, 16500A) • Keithley measuring equipment (230, 220, 617, 195A, 6517A) • Oxford optistat cryostat for temperatures in the range 4.2-320K • Wafer level cryogenic measurements (Janis probe station) • Cascade Microtech Summit 9101 Analytical Probe Station for 150mm wafers • Anritsu 37269D Vector Network Analyzer 40MHz-40GHz **Optical** • Jobin Yvon spectrometer,wavelengths 300-1600nm • Ar+ laser • **HeCd 10mW 325 nm laser** • UV lamp with monochromator • Oxford optistat cryostat, 4.2-320K • FTIR: Bruker, Tensor 27 **Morphology, structural characterization** • Leo 440 SEM with Elphy/Raith e-beam lithography • attachment, JEOL JSM-7401F FEG SEM • AFM (Veeco CP-II), STM (NT-MDT) • Stylus profilometer model XP-2 of Ambios Technology **Testing equipment** • Systems for testing of gas flow, gas pressure, acceleration, humidity sensors, biosensors and systems, microfluidics testing etc. **Modeling and simulation software** • SILVACO tools for process and device modeling (Athina and Atlas) • Suprem and Pisces • Floops and Floods • Synopsis – Coventorware • FEMlab • Mentor graphics	**Characterization of Dielectrics** • Admittance measurements (1Hz up to 1MHz, 25-150°C) • I-V measurements (2 up to 4-terminal devices, 25-150°C) • Charge-to-breakdown measurements • Bias-Temperature-Stress measurements **Characterization of MIS Devices** • Admittance measurements (1Hz up to 1MHz, 25-150°C) • I-V measurements (2 up to 4-terminal devices, 25-150°C) • Hot-carrier stress measurements • Bias-Temperature-Stress measurements **EEPROM device characterization and reliability measurements** **Characterization of RF components** **Optical characterization** • Absorption measurements, wavelength range UV-VIS-IR • Photoluminescence (PL) • Laser excitation: 325 nm, 457.8nm, 488nm, 514.5nm • Spectrometer: 350nm-1600nm • Electroluminescence (EL): 350nm-1600nm • Photocurrent-photovoltage (UV-VIS) • FTIR **Characterterization of sensors** • Gas sensors • Microflow sensors • Accelerometers • Optical devices • Biosensors • Microfluidics **Modeling and simulation** • Process and device modeling • RF modeling

Name of the organization			
Organization Legal name		***NCSR-DEMOKRITOS***	
Organization Short name		***NCSR "Demokritos" (IMS)***	
Department/Faculty/Institute/Laboratory name		***Institute of Materials Science /Oxide MBE and Surface Analysis Laboratory***	
Internet homepage		***http://www.ims.demokritos.gr***	
Contact person for additional information			
Name: DIMOULAS	***First name: Athanasios***	***Title: Dr***	***E-mail address: dimoulas@ims.demokritos.gr***
Brief description of your organization			

The Institute of Materials Science of NCSR DEMOKRITOS promotes materials science and engineering in a diverse field. The oxide MBE and surface analysis laboratory focuses on high-k gate dielectrics on Si and high mobility semiconductors (Ge, III-V) for advanced CMOS aimed for beyond 22 nm technology nodes. Special emphasis is given on the development of appropriate surface passivation methodologies and compatible dielectric materials which combine good electrical quality interfaces with low equivalent oxide thickness for aggressively scaled transistor gates. This work is mainly supported financially by European ICT projects under the 5th, 6th and 7th framework programs which are coordinated by the MBE laboratory of IMS. The development of gate dielectrics is performed at the materials level by means of in-situ XPS and UPS physic-chemical characterization, and at a second stage by means of capacitor electrical characterization.

PROCESSING

Equipment	Techniques/competences
• Oxide /Si(Ge) MBE for thin-film growth •	• Growth of Epitaxial oxides on semiconductor • Deposition of amorphous high-k dielectrics • Epitaxy of Si, Ge and SiGe

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• In-situ RHEED • Mass spectrometry • In-situ XPS • In-situ UPS • In-situ LEISS • C-V, G-V, I-V capacitor characterization • Admittance spectroscopy (G-ω) • XRD characterization Bragg-Brentano mode	• In-situ monitoring of thin film epitaxial quality and orientation • Chemical reactions (e.g. oxidation) at interfaces • Valence Band Offsets of in semiconductor /dielectric interfaces by XPS and UPS • Estimation of metal workfunctions by UPS • Surface composition by LEISS • Dielectric constant, equivalent oxide thickness and gate leakage • Interface state density at semiconductor/dielectric interfaces by admittance spectroscopy in the temperature range 77 K to 370 K

Name of the organization			
Organization Legal name		***Tyndall National Institute, University College Cork***	
Organization Short name		***Tyndall National Institute***	
Department/Faculty/Institute/Laboratory name		***Silicon Research Grop***	
Internet homepage		***http://www.tyndall.ie/***	
Contact person for additional information			
Name: Colinge	***First name: Jean-Pierre***	***Title: Prof.***	***E-mail address: jean-pierre.colinge@tyndall.ie***
Brief description of your organization			
The Tyndall National Institute (Tyndall) was created in 2004 at the initiative of the Department of Enterprise Trade and Employment and University College Cork (UCC) to bring together complementary activities in photonics, electronics and networking research at the National Microelectronics Research Centre (NMRC), several UCC academic departments and Cork Institute of Technology (CIT). The objective is to create a research institute, which would become a focal point of Information and Communications Technology (ICT) in Ireland, to support industry and academia nationally and to increase the number of qualified graduate students for the 'knowledge economy'. The strengths of the institute at the present time lie in the area of photonics, electronics, materials and nanotechnologies and their applications for life sciences, communications, power electronics and other industries. Research programmes range from theoretical modelling and design to novel material, nanotechnology, device processing and fabrication, packaging and integration; and novel systems incorporating these new devices.			

PROCESSING

Equipment	Techniques/competences
• Silicon clean room • e-beam lithography, optical lithography • ALD cluster	• General silicon processing • MEMS

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• 3 cascade probes, DC to 100GHz, 4.2K to 300C • Raman, FTIR, SEM, TEM • 300-CPU cluster	• Gate dielectric in-depth characterisation • Ab-initio atomistic modelling

Name of the organization			
Organization Legal name			***Warsaw University of Technology***
Organization Short name			***WUT***
Department/Faculty/Institute/Laboratory name			***IMiO***
Internet homepage			***www.imio.pw.edu.pl***
Contact person for additional information			
Name: Romuald	***First name: Beck***	***Title: Prof.***	***E-mail address: r.beck@imio.pw.edu.pl***
Brief description of your organization			
Institute of Microelectronics and Optoelectronics is a part of the Faculty of Electronics and Information Technology of WUT. We are involved in both education (undergraduate, graduate and Ph.D. studies in the area of Electronics and Information Technology) and research (processing, modeling and characterization of semiconductor devices). We have at our disposal a clean-room (silicon compatible test structure manufacturing) and a characterization lab (I-V, C-V and CP measurements). *Our contribution consists mainly in comprehensive characterization of capacitor, gated diode and transistor structures by C-V, I-V and charge pumping measurements. We want to concentrate on the studies of the following parameters: mobility, generation lifetime and surface generation/recombination velocity (gated diode), interface properties (especially by means of charge pumping), gate leakage (tunnelling).* *The second field of WUT's expertise is modelling of MOS/SOI structures. The activity in this field within Nanosil in concentrated on lateral transport between the source and drain and the vertical transport through the high-K gate stacks.*			

PROCESSING

Equipment	Techniques/competences
• Complete MOS test structure manufacturing line, silicon compatible	• Ultrathin dielectric layers (SiO_2, SiON, SiN) formation in very low (<350°C) and standard high temperature processes by means of: o thermal oxidation (>800°C) o plasma oxidation (<100°C) o Ultrashallow implantation (<2nm) (<350°C) o PECVD (<350°C) • Ultrashallow (<2nm) implantation of nitrogen and fluorine • Very low thermal budget MOS test structure technology (particularly suitable for preservation of mechanical stress in the structure and thermal treatment studies)

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Agilent 4275A (HF-CV) • Agilent 4140B (QS-CV) • Agilent 4285A impedance meter • Keithley SMU236/237 (I-V)	• analysis of MOSFET I-V curves (threshold voltage, subthreshold slope, DIBL, mobility, etc.) • standard CV (also applied to SOI MOS

• Keithley 617 Ammeter (CP) • Unique pulse generator for CP measurements built in WUT	capacitors), gate-leakage current and reliability • analysis of the quality of the semiconductor-gate oxide interface by means of charge pumping (average interface-trap density, energy distribution of trap density) • extraction of generation parameters (surface recombination velocity, generation lifetime) by means of analysis of the electrical characteristics of gated diodes • spectroscopic ellipsometry for independent determination of layer thickness and its optical properties (with the possibility to gain information on chemical composition and physical structure of the layer) • modeling of tunnel currents through high-K gate stacks in single and double gate MOS/SOI diodes and transistors • modeling of electron mobility (drift-diffusion, relaxation time approach) in silicon structures with SiGe layers and high-K gate stacks.

Name of the organization			
Organization Legal name	***Universitat Rovira I Virgili*** ***University of Granada***		
Organization Short name	***URV/UGR***		
Department/Faculty/Institute/Laboratory name	***Electronics and Computer Science***		
Internet homepage	***https://sauron.etse.urv.es/DEEEA/*** ***/angles/recerca/nephos/*** ***http://electronica.ugr.es***		
Contact person for additional information			
Name: ***URV: Iñiguez*** ***UGR: Gamiz***	***First name:*** ***Benjamin*** ***Francisco***	***Title:*** ***Prof.*** ***Prof.***	***E-mail address:*** ***Benjamin.iniguez@urv.cat*** ***fgamiz@ugr.es***
Brief description of your organization			

*The Universitat Rovira i Virgili **(URV)** was created in 1991 in Tarragona (Catalonia, Spain) by the Parliament of Catalonia from the already existing university faculties and schools. The data show that the URV is not only one of the leading universities in Catalonia but also one of the leading universities in the European area for the quality of its teaching, its commitment to continuous training and the excellence of its research, development and innovation.*
The NEPHOS (Nanoelectronic and Photonic Systems) Group of the Department of Electronic, Electrical and Automatic Control Engineering, Universitat Rovira i Virgili (URV, Tarragona, Spain) is one of the NANOSIL partners. The NEPHOS group is composed of 5 Professors, one postdoc and 6 Ph D students. The main research interests of the group are:
1) Characterization and Compact Modeling of nanoscale devices: DG MOSFETs, GAA MOSFETs, FinFETs, strained Si MOSFETs,…
2) Characterization and Modelling of Organic and Polymer TFTs
3) Technology, modelling and design of 1D and 2D photonic crystals
Publications: 10/year in the field of compact modelling of advanced devices, one invited publication in IEEE TED in 2006, IET Premium Award for one paper published in IEE Proceedings: Devices, Circuits and Systems
The NEPHOS group organizes one annual workshop: the Postgraduate Student Meeting on Electronic Engineering, that takes place in URV campus every year in June, and consists of six lecturers conducted by prestigious invited researchers, and posters presented by graduate students. Regarding funded research projects, the NEPHOS Group participates in one Network of Excellence (NANOSIL), one Industry Academia Partnership and Pathway coordinated by URV (« COmpact MOdelling Network »), one European Coordinated Action (EUROSOI), four National Projects, and one Regional Project

***UGR:** This research group has a long experience in the field of numerical simulation of semiconductor devices with numerous papers published in international journals and presentations in international conferences. During the last years 15 Ph.D. dissertations have been developed and 7 state-funded research projects have been carried out in addition to the participation in several European projects: EXTRA, SINANO, and EUROSOI. The research fields of the group are listed below:*
-Electron-hole transport properties in semiconductor inversion layers including quantization.
-Monte Carlo simulation of transport properties of carriers in semiconductor heterostructures.
-Analysis and modelling of ultrashort channel devices.
-Strain Silicon/SiGe heterostructures.
-Study of transport properties of carriers in Silicon Carbide and Gallium Nitride inversion layers.
-Silicon-On-Insulator devices. Simulation of ultrathin silicon devices.

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
URV: • Prober Karl Süss PM5 • Impedance Analyzer HP4192A (C-f) • Capacimeter HP4280A (C-V, C-t) • Electrometer Keithley 619 • Temperature controller (20 ^{o}C - 200 ^{o}C) • Parametric analyzer HP4145B (I-V) • Spectrograph ARC SpectraPro-150 • Variable temperature micro-probe system (80 K – 730 K) • HP 81101A 50 MHz Pulse Generator • Agilent E5062A GNA Series Network Analyzer, 300 KHz-3GHz • Rande & Schwarz FSP Spectrum Analyzer, 9KHz-3GHz • Rande & Schwarz SM300 Signal Generator 9KHz-5GHz • Software packages for device and circuit simulation: Silvaco, ADS, VHDL-A, AIM-Spice source code,… ***UGR*** • Characterization Lab for nanoelectrónico devices, including Parameter Analyzers, Probe Stations, Network Analyzers, Hall measurement and magnetoresistance setup, Oxford cryostats, • 2 Linux clusters with 8 quad-core processor nodes (Intel Xeon) • Home-made nanodevice simulators for hole and electron transport	***URV:*** • Compact modeling techniques of nanoscale MOSFETs • Device model parameter extraction techniques • RF device characterization • Competence in physics of nanoscale MOSFETs

Name of the organization Chalmers University of Technology			
Organization Legal name			***Chalmers tekniska högskola AB***
Organization Short name			***Chalmers***
Department/Faculty/Institute/Laboratory name			***Microtechnology and Nanoscience***
Internet homepage			***www.mc2.chalmers.se***
Contact person for additional information			
Name: Engstrom	***First name: Olof***	***Title: Prof.***	***E-mail address: olof.engstrom@mc2.chalmers.se***
Brief description of your organization			
In year 2000, Chalmers finished a new building planned for a total staff of 200 persons within the field of "microelectronics", where groups from School of Electrical and Computer Engineering and the School of Physics combined efforts in common localities under the laboratory headlines of Microwave Electronics, Photonics, Solid State Electronics, Applied Quantum Physics and Quantum Device Physics. The building is equipped with a 1200 m^2 clean room area including equipment for semiconductor device research in silicon, III-V compounds, SiC and superconductors. From start, MC2 was organized as a university research center and in 2003 when Chalmers was re-organized, it was converted to one of the Departments replacing the "Schools" within the line organization of the university. MC2 produces on the average 15 PhDs, more than 200 scientific reviewed journal papers and about the same amount of conference contributions per year. *Staff from the Institute of Electron Technology (ITE), Warsaw, will also take part in the tasks devoted to Chalmers, ITE being a third party to the grant agreement. Professor Henryk M. Przewlocki has a long experience in MOS research and especially in optical investigations by internal photoemission studies for measuring energy band offset values of the MOS system. Professor Maria Kaniewska has a long experience of deep level transient spectroscopy (DLTS). Participation of Prof. Kaniewska's group in collaboration with Chalmers would be an efficient way to achieve information about charge carrier retention times and emission rates of the quantum dots planned as elements in memory structures. (see "third parties", page 78 of the Description of Work).*			

PROCESSING

Equipment	Techniques/competences
• See www.mc2.chalmers.se •	• See above •

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Electrical characterization • TEM, SEM, FIB, AFM	• Capacitance frequency spectroscopy, thermally stimulated current, deep level transient spectroscopy

Name of the organization			
Organization Legal name		***The University of Glasgow***	
Organization Short name		***GU***	
Department/Faculty/Institute/Laboratory name		***Device Modeling Group***	
Internet homepage		***http://www.elec.gla.ac.uk/groups/dev_mod/***	
Contact person for additional information			
Name: Asenov	***First name: Asen***	***Title: Prof***	***E-mail address: A.Asenov@elec.gla.ac.uk***
Brief description of your organization			
The Glasgow Device Modeling Group (http://www.elec.gla.ac.uk/groups/dev_mod/) is perhaps the largest university based specialized device modeling groups in the world including 3 academics, 2 EPSRC advanced research fellows, 10 postdoctoral researchers and 11 PhD students. It operates a 356 processing units cluster and a 32 processor IBM p690 SMP system and has privileged access to > 1000 processors on ScotGrid. Currently active research funding exceeds €8M.			

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• 356 processing units cluster • 32 processor IBM p690 SMP system • Access to > 1000 processors on ScotGrid	• In house 3D drift-diffusion, Monte Carlo and NEGF simulators • World leader in simulation of statistical variability • Statistical compact modeling • Grid simulation technology

Name of the organization			
Organization Legal name		***University of Liverpool***	
Organization Short name		***LIVUNI***	
Department/Faculty/Institute/Laboratory name		***Electrical Engineering & Electronics***	
Internet homepage		***http://www.liv.ac.uk/***	
Contact person for additional information			
Name: Hall	***First name: Steve***	***Title: Professor***	***E-mail address: s.hall@liv.ac.uk***
Brief description of your organization			
The University of Liverpool is one of the UK's leading universities and plays a key role in economic development in terms of employment, skills, research and technology. Currently the University has over 19,000 registered students and an annual income of £219 million, which includes £75 million for research. *The department of Electrical Engineering and Electronics is renowned for its excellence in research and a rating of 5A was awarded to the department in the last assessment exercise. At any one time there are on average over 100 students studying at PhD, MPhil and MSc (Eng) levels in the department.* *The Solid State Electronics Research group operates in the new Wolfson and BioMEMS laboratories, which are located in 800 sqm of mainly class-100 clean room environment. The group focuses on the design, fabrication, testing, measurement, analysis and modelling of micro/nano structures and devices that integrate silicon and related materials.*			

PROCESSING

Equipment	Techniques/competences
• ALCVD Aixtron 200FE reactor • Edwards E306A Coating System • Anneal System	• ALD/CVD thin film growth; 2 inch wafer capacity; accurate thickness control. • Metal evaporation; fitted with digital thickness monitor. • Forming gas anneal; can process multi wafers.

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• M2000U VASE™ Spectro ellipsometry + INSTEC™ Heat stage + Mapping Stage	• Multi-angle Spectro ellipsometry; Investigate: film thickness, optical dielectric constants, optical band gap, absorption coefficient and film uniformity; High resolution of 190nm to 1700nm; In-situ annealing analysis (-160 to 600 ^{o}C)
• HP 4192A impedance analyzer + Keithley 595 quasi-static CV meter	• High/low frequency capacitance voltage measurement; Investigates: equivalent oxide thickness, oxide charge density, interface states density.
• Keithley 602 Solid State Eletrometer + Heat Stage + Signatone™ Microprocessor controller	• Current voltage measurement; Investigates: activation energy, dielectric constant, Arrhenius plot; Ability to heat a wafer to a temperature from 15 ^{o}C to 300 ^{o}C; Precise control of temperature – within ± 1 ^{o}C
• HP 4155 Semiconductor Parameter Analyser + Booton 73B capacitance meter	• Capacitance transient measurement, constant voltage stress, transistor characterization; Fast data acquisition (50 µs); investigate: minority carrier lifetime, oxide charge trapping dynamics.
• Silvaco Atlas Athena Devedit simulation package	• Numerical 2D/3D Device simulation; mixed mode simulation; process simulation; able to extract DC and RF parameters.
Other possible facilities: • Transmission and Scanning Transmission Electron Microscopy (NW STEM and SuperSTEM) • X-ray photoelectron spectroscopy (ESCALab) • X-ray diffraction and X-ray reflectivity (XRR) • Medium Energy Ion Scattering (STFC Daresbury Laboratory)	• High resolution imaging, electron energy loss and energy dispersive X-ray analysis for elemental distributions

Name of the organization			
Organization Legal name		***University of Newcastle upon Tyne***	
Organization Short name		***UNEW***	
Department/Faculty/Institute/Laboratory name		***Electrical, Electronic and Computer Engineering***	
Internet homepage		***www.ncl.ac.uk***	
Contact person for additional information			
Name: O'Neill	***First name: Anthony***	***Title: Prof.***	***E-mail address: anthony.oneill@newcastle.ac.uk***
Brief description of your organization			
Newcastle University traces its origins to 1834. It has 4500 staff and 17000 students. The Nano-Materials and Electronics Group is well known for its expertise in: strained Si/SiGe technology for high speed low power integrated circuits; SiC for high temperature high power electronics; nanoscale electrical and physical characterization; ferroelectrics for anoelectronics; biomedical applications for nanoelectronics; reliability of IC interconnects; high-k dielectrics; fabrication; modelling and technology CAD; defect engineering and diffusion; photovoltaics; Microsystems and sensors; nanotechnology.			

PROCESSING

Equipment	Techniques/competences
• More than 200 m^2 of fabrication space including 20 m^2 Class 100 and 100 m^2 Class 1000/10000 clean rooms • Processing cluster from Oxford Instruments including Plasmalab System 400 magnetron sputter and FlexAL plasma-assisted atomic layer deposition (ALD) tool for ALD and sputter deposition on 8" substrates; ALD module can be configured for thermal or plasma-assisted deposition of a wide range of oxide and nitride materials • JetFirst bench top rapid thermal processing (RTP) processor for oxidation and annealing wafers up to 200 mm in vacuum and various gases • Plasma-Therm 790 series reactive ion etching (RIE) machine for processing wafers up to 200 mm • JIPELEC RTP furnace specified for SiC post-implantation annealing at temperatures up to 2000°C • Two furnaces for oxidation in nitric oxide, dry and wet oxygen • Edwards coating systems with thermal and e-beam target evaporating • Two class 100 vertical laminar flow workstations with extraction for wet chemical processing	• Deposition and rapid thermal processing of thin metal films for formation of intermetallic compounds and silicides. • Fabrication of ohmic and Schottky contacts on silicon carbide • Local implantation in patterned silicon and silicon carbide • Post-implantation structure and surface recovery of silicon carbide • Oxidation and deposition of high-k dielectrics on silicon and silicon carbide • RIE patterning of silicon, silicon oxide and silicon carbide

• Contact photolithography tools and equipment	

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Climate controlled characterization facilities • nm resolution Raman spectroscopy, including TERS and thermal measurements • Combined AFM (resolution>0.01nm)/Raman (resolution>20MPa) mapping • Conductive AFM, SCM • Differential Hall • Ellipsometry • 4155C Parameter Analyzer with 41501B Pulse Generator extension • 4294A LCR Bridge • Thermal chuck attached to probe station • TCAD and computational modeling • Finite element strain modeling • Accurate defect etching • E8361A PNA Network Analyzer	• Sub-nm depth profiling of strain and composition (Si, SiGe) • Nanoscale strain measurements using TERS with complementary finite element modeling • Simultaneous evaluation of surface roughness, strain and related defects • Real-time monitoring of strain/morphology evolution on a nanoscale during thermal processing • Determining thin epitaxial layer thickness and composition • Defect identification: misfit dislocations, stacking faults and threading dislocations • Sub-nm depth profiling for doping/mobility data in Si and strained Si • TCAD modeling and simulation for validation of device performance • Ab initio modelling– defects, diffusion, band structure of heavily doped Si, solubility of dopants • KLMC – extension of length and time scales; dynamical effects • Analytical gate leakage modeling • High and low frequency noise measurements • Techniques to eliminate the impact of leakage in C-V analysis of advanced gate stacks, • Conventional I-V and C-V analysis • Interface trap density, conductance technique 3 level charge pumping • AC conductance measurements for self heating analysis • Split CV for determining channel mobility • Electrical characterization at elevated temperature

Name of the organization			
Organization Legal name		***Uppsala University***	
Organization Short name		***UU***	
Department/Faculty/Institute/Laboratory name		***Ångström Microstructure Laboratory (MSL)***	
Internet homepage			
Contact person for additional information			
Name: Nygren	***First name: Stefan***	***Title: Dr***	***E-mail address: Stefan.Nygren@Angstrom.uu.se***
Brief description of your organization			

The Ångström Microstructure Laboratory is a 2000 m^2 cleanroom facility ranging from class 10 000 to class 100. It is equipped to provide excellent resources for multidisciplinary micro- / nanoprocessing and materials analysis. Process environments have been established for silicon electronics, silicon micro- / nanosystems, diamond electronics and microprocessing, polymer processing and more. Most silicon processes are available for 100 and 150 mm wafers. An integrated laboratory for materials characterization offers instrumentation for e.g. HR electron microscopy (SEM and TEM), FIB (dual beam), XPS and AFM. Other MSL strengths and profile areas include tools for:

- *Laser lithography for mask fabrication and direct write*
- *Spin / spray processing for conformal resist coverage*
- *Nanoimprint lithography (NIL) with high resolution double-sided alignment*
- *High quality thermal processes in ten vertical diffusion and LPCVD furnaces*
- *High density plasma processes for metal and deep silicon etching*
- *Ion implantation and ion beam analysis*

Within electronic component technology, the research focuses on high performance high frequency microelectronic components for mobile communication, which has resulted in state-of-the-art high power silicon RF LDMOS transistor with world record power density and IC compatible bandpass filters and resonators for mobile phones. A related field is low cost, highly sensitive physical, chemical and biochemical sensors, preferably compatible with IC technology, where novel thin film Lamb devices and FBAR sensors have been demonstrated. The diamond project aims at fast switching Schottky rectifiers with > 10 kV blocking voltage.

MSL has participated in a previous European project for "Transnational Access to Major Research Infrastructures" (Ångström Nano Centre) and has, since the beginning in 2004, been one of three nodes in MyFab, the Swedish Micro- and Nanofabrication Network.

The total number of on-site users is around 180 per year, with approximately 20 % from industry.

Name of the organization			
Organization Legal name		***Instytut Technologii Elektronowej***	
Organization Short name		***ITE***	
Department/Faculty/Institute/Laboratory name			
Internet homepage		***http://www.ite.waw.pl/en/***	
Contact person for additional information			
Name:	***First name:***	***Title:***	***E-mail address:***
Grabiec	***Piotr***	***Ph.D.***	***grabiec@ite.waw.pl***
Brief description of your organization			
The Institute of Electron Technology (ITE) is a major Polish research centre with the primary focus on semiconductor micro- and nanoelectronics. Scientific staff includes 20 professors and 51 Ph.D.'s specializing in electronics, physics, chemistry and material technology. The mission of the Institute is to conduct the basic and applied research in the field of semiconductor electronics and physics in order to develop and commercialize innovative micro- and nanotechnologies and their applications in semiconductor micro/nano-electronics, optoelectronics, photonics and MEMS technology domains. ITE develops and sells market products such as devices, services and intellectual property rights to domestic and foreign customers. ITE is involved in educational and training activities for Polish and foreign Ph.D. students and engineers. The Institute is entitled to award Ph.D. and D.Sc. degrees in the field of semiconductor electronics. ITE consists of technology research departments, characterization laboratories and design groups, working in close collaboration. The largest, Department of Silicon Microsystem and Nanostructure Technology maintains a silicon CMOS/MEMS line with set of equipment located in a 1200sq.m. Clean Room (class 10 and 1000). The line renders possible research in the area of micro/nano-electronics, photodetectors and MEMS/NEMS (focus on More-than-Moore) and next, development up to a prototype and, if justified, to pilot production stage on 4 and 6 inch wafers, with min. feature size down to 0.9 um.			

PROCESSING

Equipment	Techniques/competences
• Full CMOS/MEMS line incl. • DWL 200 laser for masks and direct writing • ICP Bosch etcher • AML wafer bonder • Full list available on web page (see above)	• Radiation detectors • 1um FD SOI (under development) • Micro/Nano-probes • Comb drive actuators • Transducers, sensors (incl. chemical and bio-.), Lab o on a chip devices/systems

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Silvaco, SYNOPSYS & COVENTOR packages. • Probe station plus measure. equip. (Keithley) • HRTEM - JEOL JEM-2100 • FIB FEI Helios NanoLab (Dual Beam) • SEM - Philips XL30 • Agilent B1500A, 4294A, Keithley Pkg82, SSM450i • WSBF syst. of photoelectric measurement • LPT/SLPT measurement System • J.A.Woollam spectroscopic VASE ellipsometer	• Modeling/simulation (microelectronics and micromechanics) Parameter extraction and characterization (CMOS) • HRTEM, TEM, STEM (1nm spot), EDXS, HAADF techniques - HRTEM 0.14 nm, • 5 GIS, deposition of Pt, W, insulators, enhanced etch of insulators and polymers). • SEM, cathodoluminescence, EBIC, EDXS • Electrical characterization of nanostructures: I(V),C(V),Gp/w(w),MPAS

• Mono-Vista micro-Raman spectrometer • DLTS system, DLS-83-D (Semilab Hungary), • I(C)-V and Y measurement system (Keithley 237 high voltage source, Keithley 617 programmable electrometer and QuadTech 7600 precision LCR).	• Barrier heights,ECPD, band diagram determine. • Photoelectric Vfb distribution determination • Optical characterization of nanostructures • Characterization of chemical structure, measurement of mechanical stress in nanostruct. • Deep Level Transient Spectroscopy (DLTS) • Admitance spectroscopy

Name of the organization			
Organization Legal name		***University of Twente***	
Organization Short name		***University of Twente***	
Department/Faculty/Institute/Laboratory name		***MESA+ Institute for Nanotechnology***	
Internet homepage		***www.utwente.nl***	
Contact person for additional information			
Name:	***First name:***	***Title:***	***E-mail address:***
Schmitz	***Jurriaan***	***Prof. Dr.***	***J.Schmitz@utwente.nl***
Brief description of your organization			
The University of Twente is where talent can best realize its full potential. Students and staff are the key. Together, 3,300 scientists and professionals carry out ground-breaking research, bring about socially relevant innovation, and provide inspiring teaching for more than 9,000 students. To us, entrepreneurship comes as second nature. The campus is home to around 100 businesses, including student-run businesses. The University of Twente has also generated more than 700 successful spin-off companies. The university's business park, Kennispark Twente, encourages and assists entrepreneurs to start new companies. But there's so much more than that happening on our wonderful, green campus. Our sports and cultural facilities are unique and we host events such as the world's largest student think tank, Create Tomorrow. Another legend of the Twente campus is the Netherlands' largest student sports event, the Batavieren Race. The campus is a hive of activity - a truly inspirational place to be! - University of Twente, the entrepreneurial university.			

PROCESSING

Equipment	Techniques/competences
The University of Twente opened its new Nanolab facility in November 2010, a 1200 m^2 clean room for Nanotechnology experimentation with world class equipment.	➢ Silicon process integration ➢ Nanotechnology ➢ Many physical characterizations ➢ DC and RF electrical characterization ➢ Cryostatic characterization

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• DC and RF probe stations up to 300-mm • Thermochucks ranging -60 °C to 300 °C • Cryostatic measurements, optical/electrical • HRSEM, Dualbeam FIB, HRTEM • XRD, XPS, nanoprober, AFM • In situ spectroscopy in CVD/ALD	• Device modeling and simulation • DC I-V and C-V characterization • Infrared light emission • Plasma process modeling • Physical and chemical sensor • Radiation imaging

Name of the organization			
Organization Legal name		***Catalan Institute of Nanotechnology***	
Organization Short name		***ICN***	
Department/Faculty/Institute/Laboratory name		- Quantum NanoElectronics Group (Prof Dr Adrian Bachtold) - Physics and Engineering of Nanodevices Group (Prof Dr Sergio O. Valenzuela) - Phononic and Photonic Nanostructures Group (Prof Dr Clivia M Sotomayor Torres) - Theory and Simulation of Nanoelectronic devices (Prof Dr Stephan Roche)	
Internet homepage		***www.icn.cat***	
Contact person for additional information			
Name:	***First name:***	***Title:***	***E-mail address:***
Sotomayor Torres	***Clivia M.***	***Prof. Dr.***	***Clivia.sotomayor@icn.cat***
Brief description of your organization			
The Catalan Institute of Nanotechnology (Institut Català de Nanotecnologia, ICN) is a non-profit research institute that was created in 2003 by the Spanish regional government (Generalitat) of Catalonia and the Autonomous University of Barcelona (UAB) to foster cutting-edge research in nanoscience and nanotechnology. It is located on the Bellaterra campus near Barcelona (50.000 students). Together with a local node of the Spanish research council CSIC it forms the Centre for research in Nanoscience and Nanotechnology (CIN2, around 170 members). As of March 2011 ICN has 114 staff members representing 27 nationalities of which 83 are full-time researchers. The research fields cover new material properties resulting from their aggregation at the nanometre-scale, the development of methods for nanofabrication, growth, analysis, characterisation and manipulation of aggregates and structures of nanometric dimension, nanoelectronics, NEMS, spintronics, nanophotonics and nanophononics. ICN has recently set up a Nanofabrication Division, which will be fully operational in 2011-2012. Other Divisions are Electron Microscopy and Nanoscience Instrument Development. It is also establishing an associated Centre for Nanobiosecurity and Sustainability, which houses its nanometrology activities.			

PROCESSING

Equipment	Techniques/competences
• Dual FIB-SEM • E-beam Evaporator • Magnetic E-beam Evaporator • Microwave Plasma System • Lithography SEM • Wire Bonder • AFM • Nanoimprint tolos • Home-built self assembly reactor • Mini MBE for oxide nanostructures • Wire Bonder • Dip-Pen Writer • Pulsed Laser Deposition • Low Temperature STM • Atomic Layer Deposition Tool • Vacuum Coating System	• Nanofabrictaion • Thin film deposition methods • Reactive ion etching • Self-assembly • Scanning probe microscopy • Vacuum and cryogenic methods

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• High Res TEM • High Res SEM • Environmental SEM • Mid-Far IR Spectrometer • FTIR Spectrometer • UV-VIS-NIR micro Raman Spectrometers • Brillouin Scattering System • Near-field Optical microscope • SQUID • X-Ray Diffraction (powder) • X-Ray Diffraction (thin film) • Low Temperature STM • Inverted Microscope • Dilution Refrigerator & Magnet • Computer Cluster • Access to SIESTA	• Surface science • Nanoelectronics • Spintronics • Modelling of nanostrcutures and nanodevices • Nanophotonics • Nanophononics

Name of the organization			
Organization Legal name		***University Montpellier 2***	
Organization Short name		***IES***	
Department/Faculty/Institute/Laboratory name		***Institut d'Electronique du Sud***	
Internet homepage		***www.ies.univ-montp2.fr***	
Contact person for additional information			
Name: MARTINEZ	***First name: Frédéric***	***Title: Dr***	***E-mail address: Frederic.martinez@univ-montp2.fr***
Brief description of your organization			

IES is constituted of 3 research departments. The main research activities are modeling, design, characterization of microelectronics devices and innovating systems in electronics and optoelectronics. IES is 110 permanent staff and 50 Ph-D students.
The CCS (Composants, Capteur Systemes) department is involved in Nanoelectronic devices and sensors. 13 permanent members and 5 Ph-D students work in this field.

The expertise of the IES "Sensors, Devices and Systems" department covers different fields and complementary activities from sensors and systems manufacturing to mechanical, opto and electrical characterization of a wide range of nanoscaled devices. The main research activities of the group are focused on:

- *Development of materials and technologies (ferroelectrics, pyroelectrics, piezoelectrics)*
- *Integration of new materials in innovative devices (NanoTubes FET, Thin NT layers)*
- *Device components (Microsystems, micro-fluidic, thermics, MEMs)*
- *Application instrumentation (sensors, wireless systems, lab-on-chip).*
- *Advanced electrical characterization (low frequency noise, charge pumping, capacitance)*
- *Modelling (numerical and compact) of advanced devices (SOI, nanotubes).*

PROCESSING

Equipment	Techniques/competences
• Metal deposition (sputtering, evaporation) • Electronic Lithography • Oxide deposition (PECVD, sputtering) • Etching capabilities for silicon and oxide (RIE) • Mask aligner	• Processing, fabrication and implementation of thin film based micro and nano devices. • 30 years experience in microsystems and our expertise in the development of materials and technologies for sensor applications recognized on the world stage. • Our team masters all the fabrication chain from process and manufacturing with onsite resources to industrial implementation.

CHARACTERIZATION & MODELLING

Equipment	Techniques/competences
• Wide range of measurement setups for electrical characterization (DC-RF (C(f,V), I(V)), charge pumping, DLTS, high temperature, 200mm wafer probe station, ferroelectric tester, Hall effect…). • Low noise dedicated measurement setup (high resolution spectrum analyzer, femto and EGG instruments low noise amplifiers, Faraday cage, high vacuum chamber (10^{-7} Torr)) using a turbo molecular pump BocEdwards (EXT70H / primary pump XDD1) • Sensor benchmark tests (acceleration, vibration, humidity, temperature, IR microscopy). • Profilometer, AFM , ellipsometer • Simulation platform (Synopsys TCAD, 1D and 2D home-made noise simulators)	• Characterization and modeling of the transport induced in micro and nanoelectronic devices and systems (MOSFETs, Silicon-on-Insulator (SOI), bipolar transistors, single or thin layers of carbon nanotubes), • Low frequency noise (1Hz-10MHz) characterization and modeling. • These activities allow improving the fabrication processes of ultimate nanoscaled devices or the conception and the performances of advanced devices and systems.