

EPIPHY GROUP

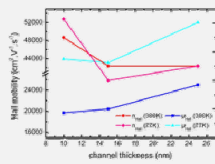
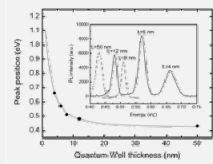
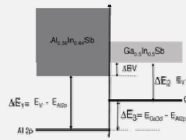
EPitaxy and heterostructure PHYsics

P. CAROFF, J.L. CODRON, C. COINON, I. COLAMBO, G. DELHAYE, G. DEOKAR, L. DESPLANQUE, S. EL KAZZI, J. FERRER, S. GODEY, D. HOURLIER, E. MOREAU, S. PLISSARD, D. VIGNAUD, X. WALLART

MOLECULAR BEAM EPITAXY OF III-V SEMICONDUCTOR HETEROSTRUCTURES

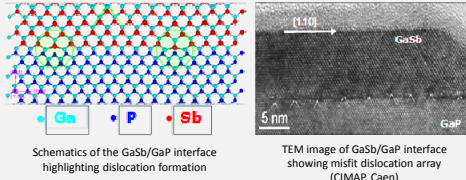
Electron transport properties in InAlSb/InGaSb heterostructures

- Metamorphic growth on InP (7% mismatch)
- XPS measurement of band offsets
- Very low electron effective mass (0,023 m_0) deduced from photoluminescence spectra.
- High electron mobility exceeding $25000 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ at 300K measured by Hall effect and SdH oscillations.

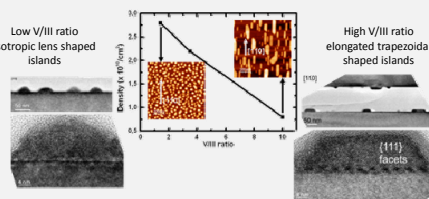


Nucleation and Strain relaxation at GaSb/GaAs(P) interfaces

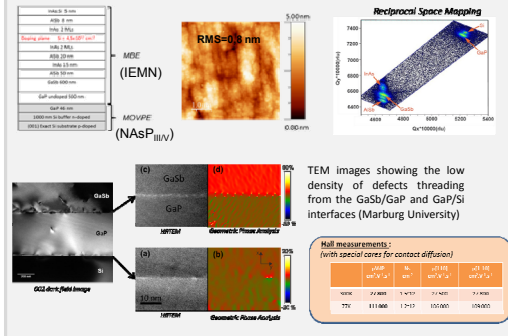
Interface studies



Influence of the Sb/Ga ration on the nucleation step



Monolithic integration of InAs based heterostructures on GaP/Si (coll. with NASP III/V GmbH)

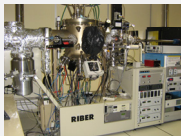


Collaborations

- IEMN Anode, Optoelectronics and Photonic THz groups
 - Néel Institute (Grenoble), CIMPAC (Caen), INL (Lyon), LTM CNRS and LETI (Grenoble)
 - Chalmers University (Göteborg), UC Louvain-La-Neuve, Marburg University, NasP_{III/V} GmbH
- Supports**
- ANR, CPER, Région Nord-Pas de Calais

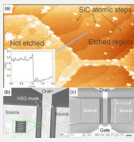
GRAPHENE EPITAXY

UHV epitaxy of graphene on SiC



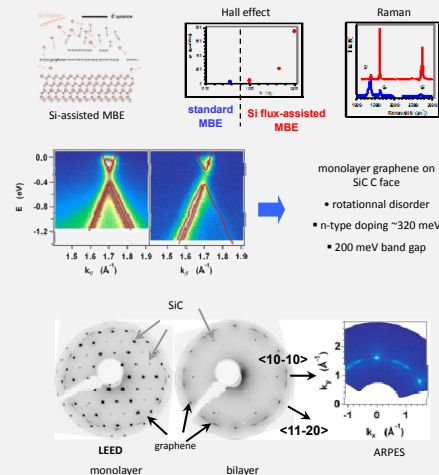
- ultra-high vacuum
- solid C & Si sources
- $T \leq 1500^\circ\text{C}$
- in situ RHEED, gas analysis, flux
- LEED, Auger

SiC graphitization (SiC, Si face)



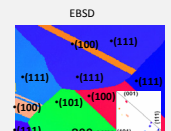
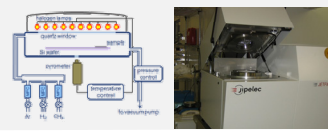
(nano)-device applications (with Carbon group)

Si-flux assisted Molecular Beam Epitaxy (SiC, C face)

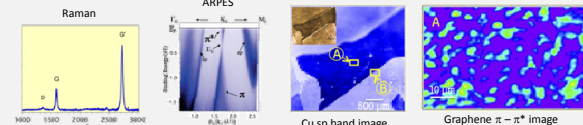


CVD of graphene on metallic substrates

- rapid thermal annealing system
- $\text{CH}_4 / \text{H}_2 / \text{Ar}$ gas lines
- pressure range: 10 torr – 1 atm.
- temperature $< 1200^\circ\text{C}$



Graphene/Cu foils



Graphene/Ni foils

- multilayer graphene (almost defect-free)
- hole mobility after transfer $\sim 2000 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$

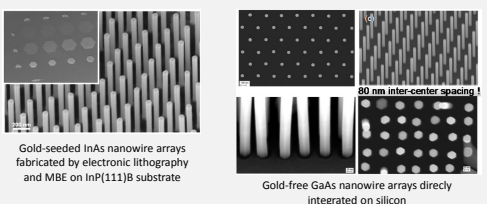
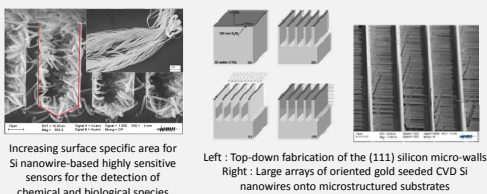
Collaborations

- IEMN Carbon, Physics and NCM groups
 - SOLEIL synchrotron (ANTARES), IPCMS (Strasbourg)
 - IHP Frankfurt/Oder
- Supports**
- ANR, EU-FET, CNRS, CPER, Région Nord-Pas de Calais

SEMICONDUCTOR NANOWIRES AND NANOSTRUCTURES

Combining top-down and bottom-up approaches

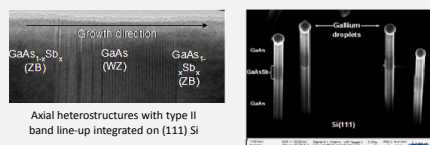
Substrate patterning before Si nanowire growth by CVD or III-V nanowire growth by MBE



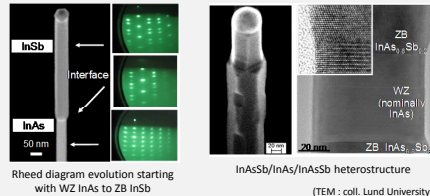
Development of MBE growth of Sb-based nanomaterial and heterostructures

- Influence of Sb incorporation on:
 - the nanowire crystal phase and faceting
 - the electronic structure of heterostructure nanowires

GaAs/GaAsSb system

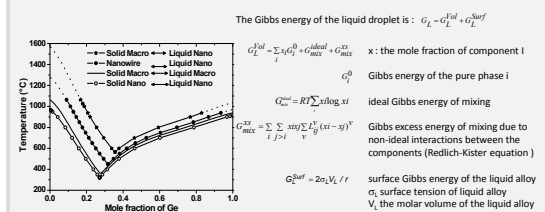


InAs/InSb system



Thermodynamics of nanosystems

Au-Ge phase diagrams for nanosystem with $r = 5 \text{ nm}$ along with the macrosystem (bulk) for comparison



Collaborations

- IEMN Physics, Photonic THz and CSAM groups
 - IPCMS (Strasbourg)
 - Lund University, EPFL (Lausanne), STCU (Ukraine)
- Supports**
- ANR, CPER, Région Nord-Pas de Calais

