



Vlaams Innovatie Netwerk event

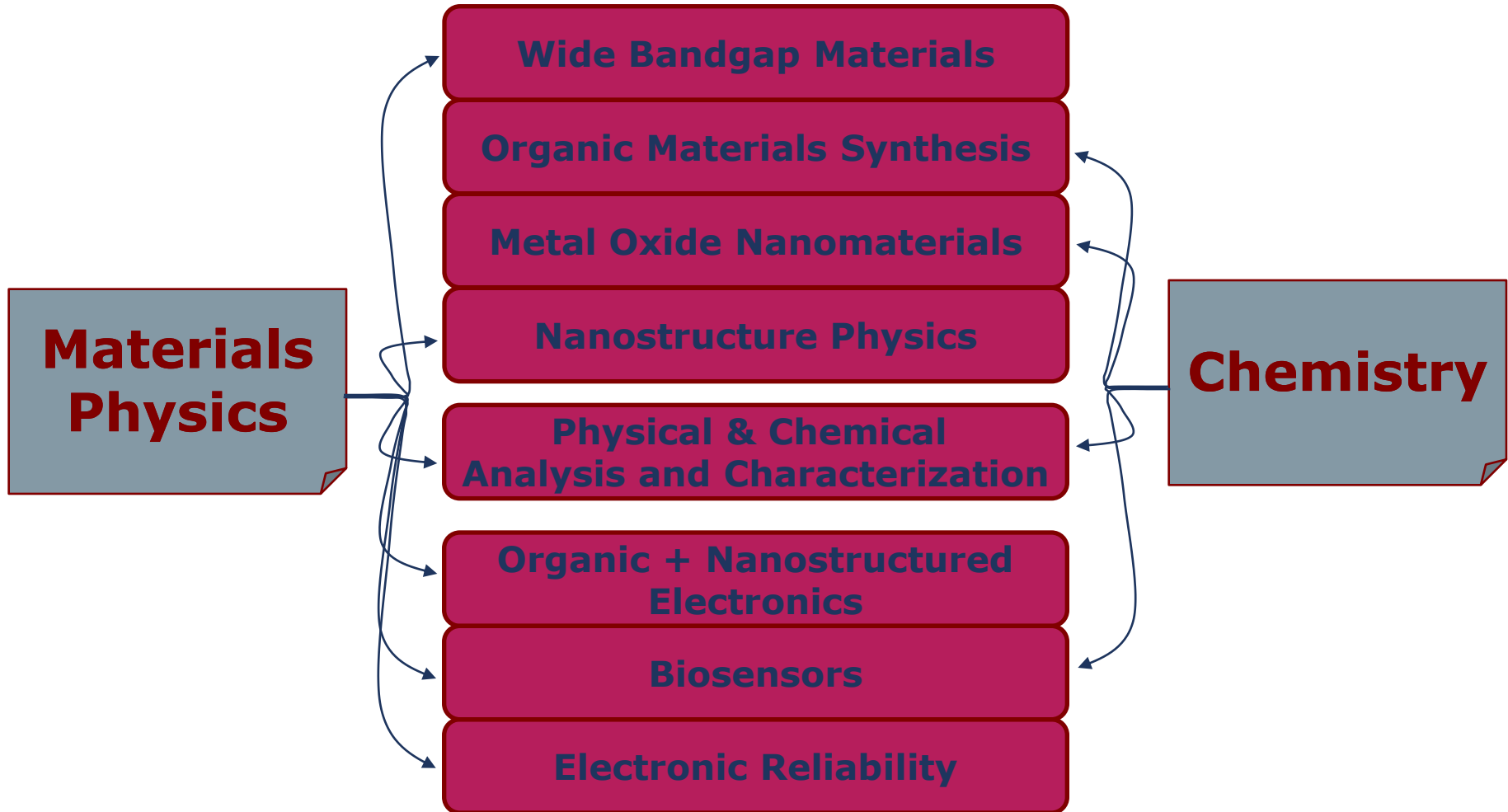
Prof. Dr. Ward De Ceuninck
Instituut voor
Materiaalonderzoek

Institute for Materials Research, Hasselt University
Division IMOMEK, IMEC vzw

Facts and Figures

Budget 2006	5.000 k€
Scientific staff	92
Technical staff	20
Master students	10
PhDs defended	7
Articles in journals	108
Lectures @ conferences	67
Posters @ conferences	62
Patents	4
Awards	2

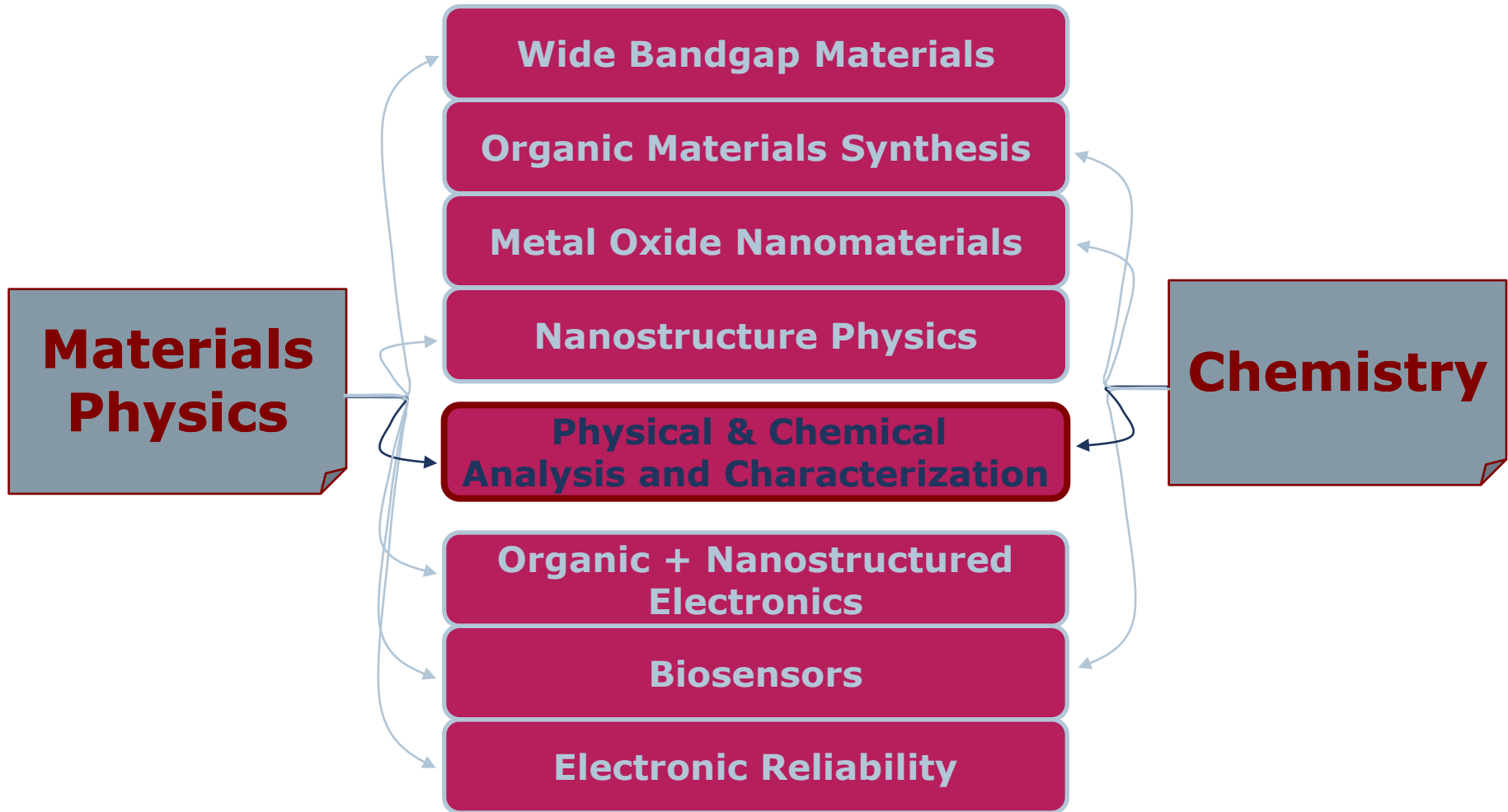




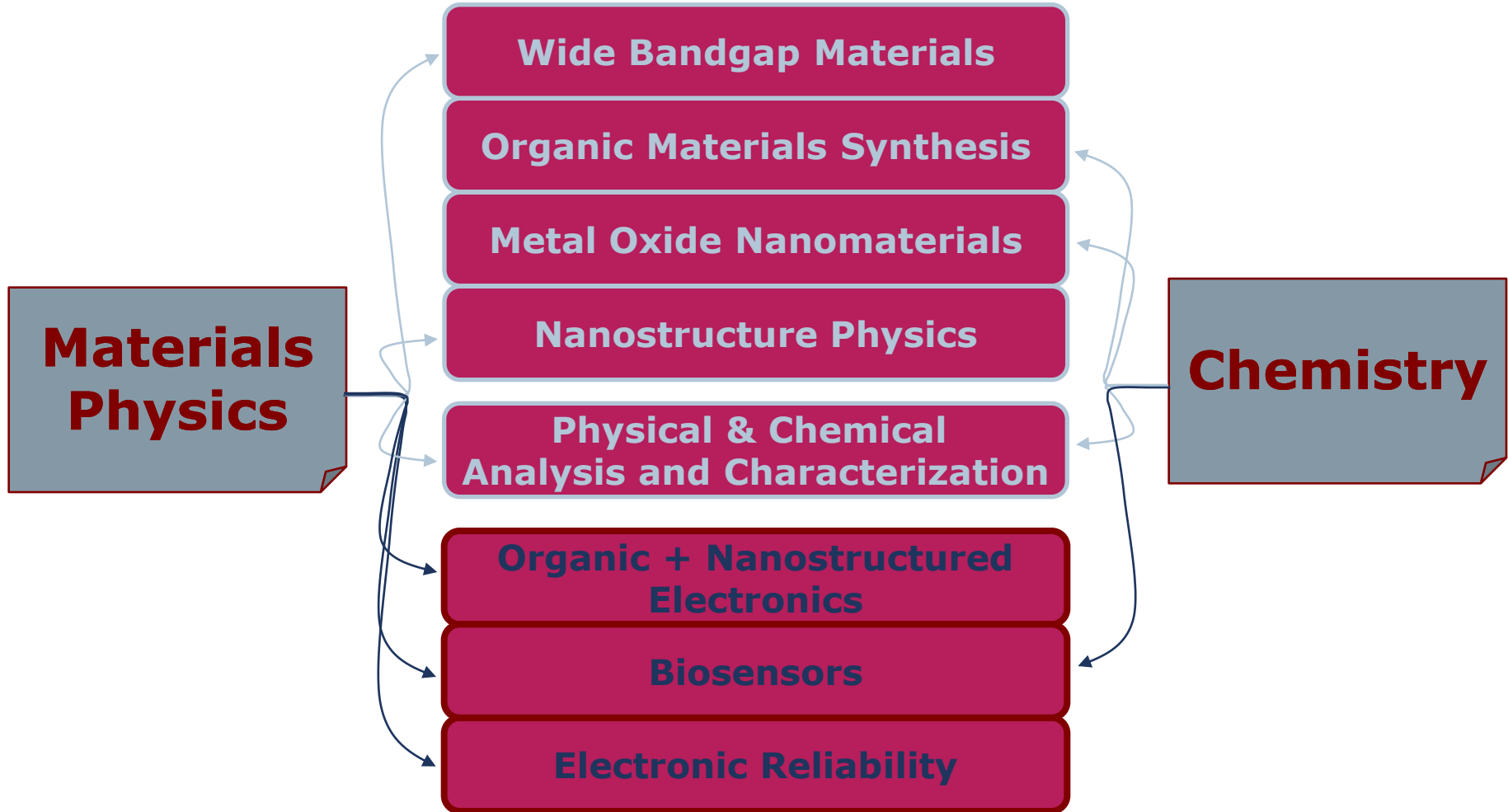
Production synthesis \rightleftharpoons Characterization \rightarrow Applications / Device Prototypes



Production synthesis ↔ Characterization → Applications / Device Prototypes



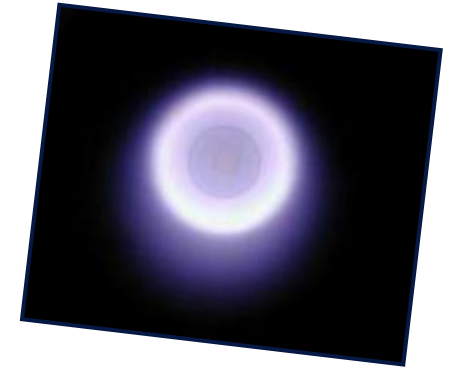
Production synthesis \rightleftharpoons Characterization \rightarrow Applications / Device Prototypes



Production synthesis \leftrightarrow Characterization \rightarrow Applications / Device Prototypes



Hard + Vis-transparent →
Highest thermal conductivity
High Young's modulus →
Chemically resistant



Bio-inert

n- and p-doping like Si

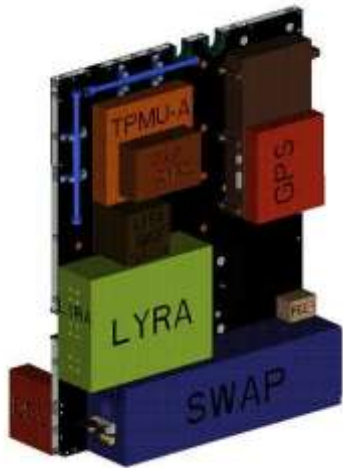
High carrier mobilities

Widest electrochemical window

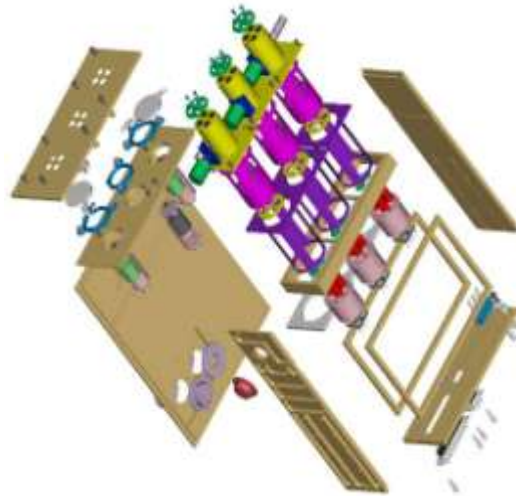
...



wide bandgap materials



“Solarblind” UV detectors in LYRA onboard PROBA-2 satellite



Diamond thickness shear mode resonator
“nano balance”

- Stable bio-inert surface
- Chemical resilience
- Electrochemical window

Sustainable and intelligent future

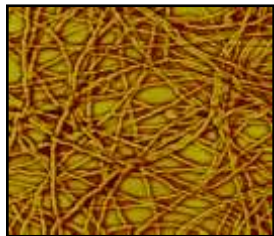
Bringing together Nanotechnology, Sustainable Development & Intelligent Ambient

Materials used

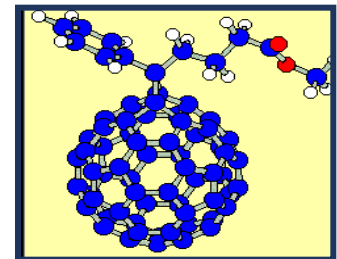
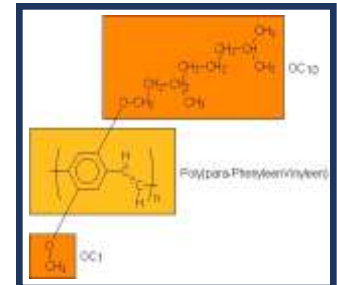
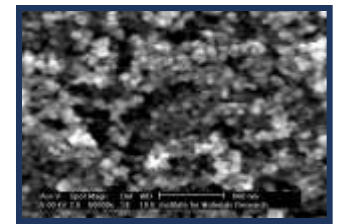
Semiconducting and conducting polymers, oligomers, C60-derivatives, carbon nanotubes,...

Nanostructured hybrid material systems

Combinations of polymeric and inorganic semiconductors => *combining the best of 2 worlds (stability & efficiency)*



P3HT
polymer
nanofibers



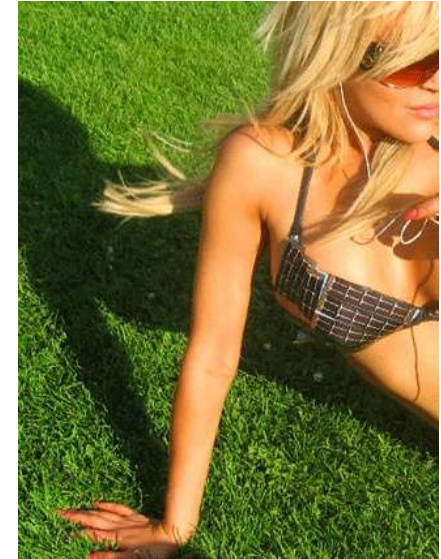
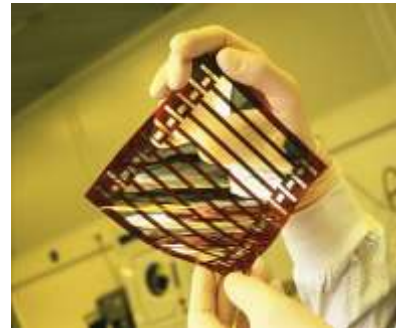
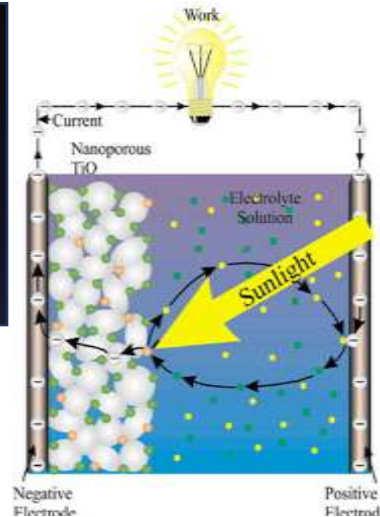
Scope

organic & nanostructured electronics

Study of fundamental properties of novel **organic** based and **nanostructured** material systems

Development of next generation electro-optical applications

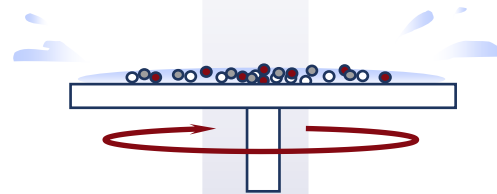
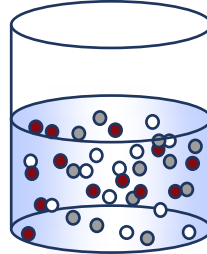
LEDs, solar cells, transistors, sensors, electrical nanowires,..



metal oxide nanomaterials



Development of water-based precursor solution



Film deposition



Thermal treatment



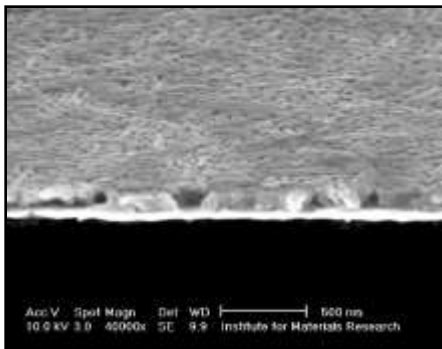
Oxide layer

Cheap & up scalable synthesis

Non-toxic, environmentally friendly processes

Coatings with tailored properties:

- UV-protection
- self cleaning
- antibacterial
- catalytic
- gas barriers in packaging

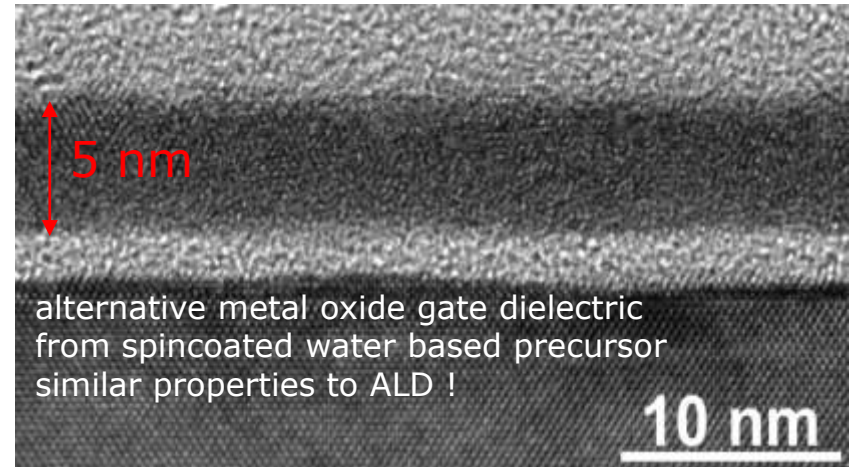


Challenges

- Miniaturisation of electronic devices
- Screening and synthesis of 'new' nanostructured metal oxides
- Designed multimetal oxides

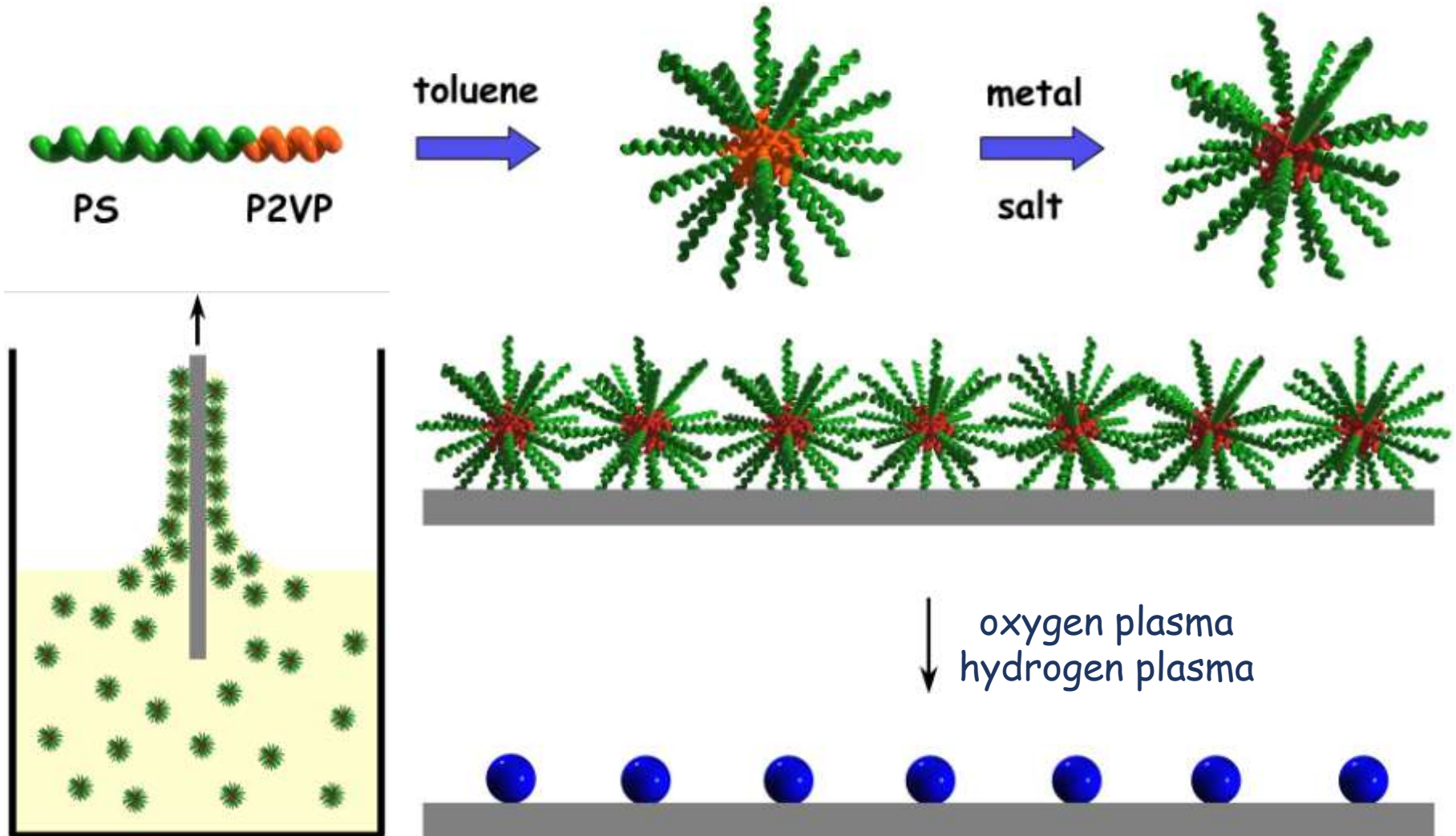
Applications

- High-K oxide films for alternative gate dielectrics
- ZnO and TiO₂ nanoparticles in new hybrid photovoltaic cells



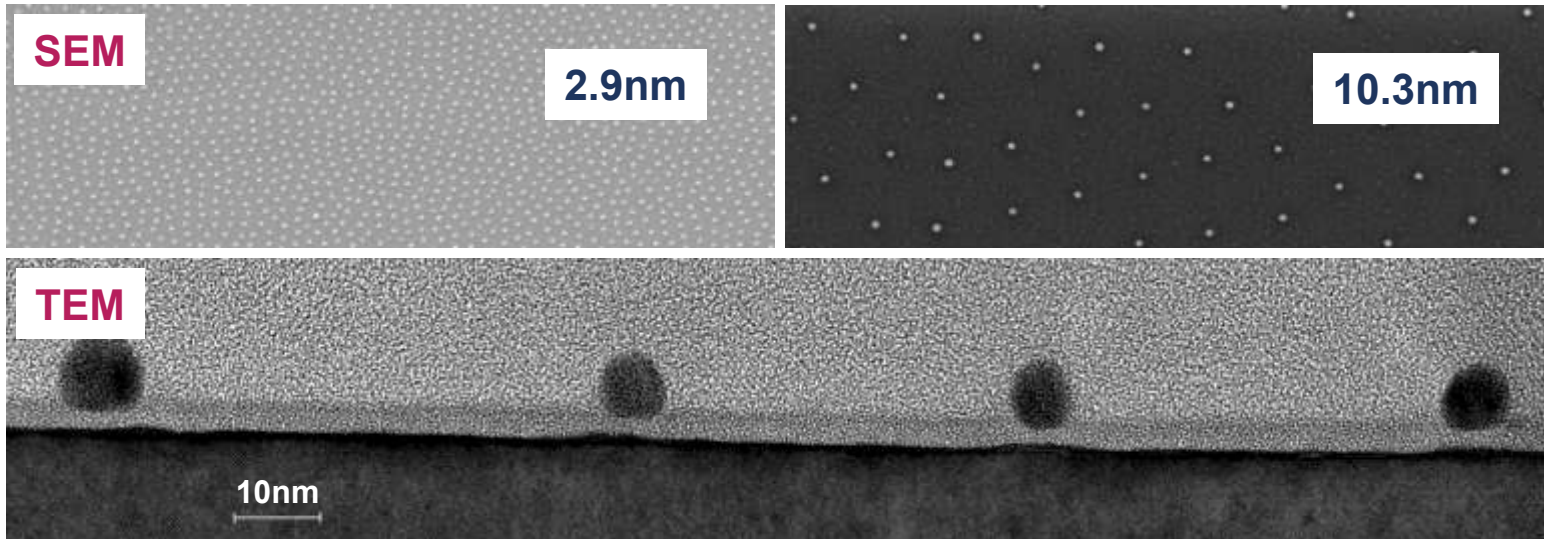
Nanoparticle arrays

micellar approach to nanoparticle arrays
(1...10 nm)



Enabling
technology

- Single molecule electronics
- Ultradense magnetic memories
(GMR-sensors Fert & Grünberg 1988)
- Masks for field-emitter devices





Biosensors

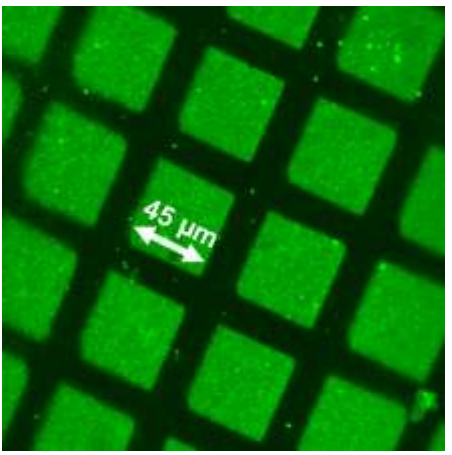
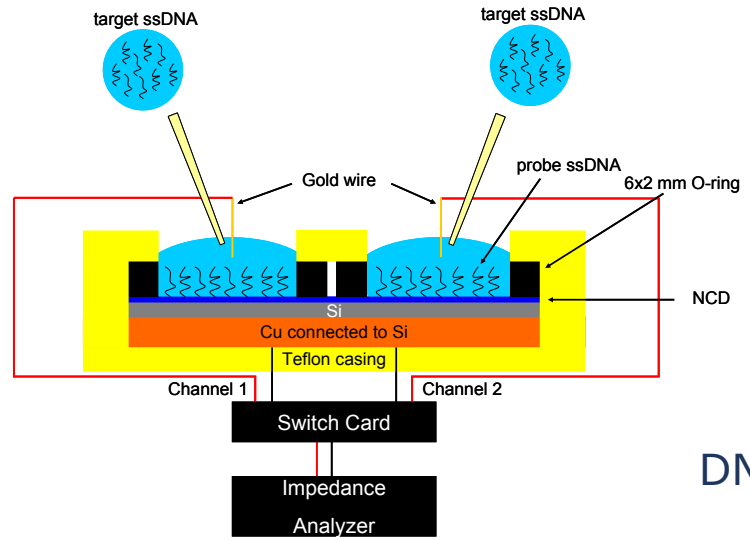
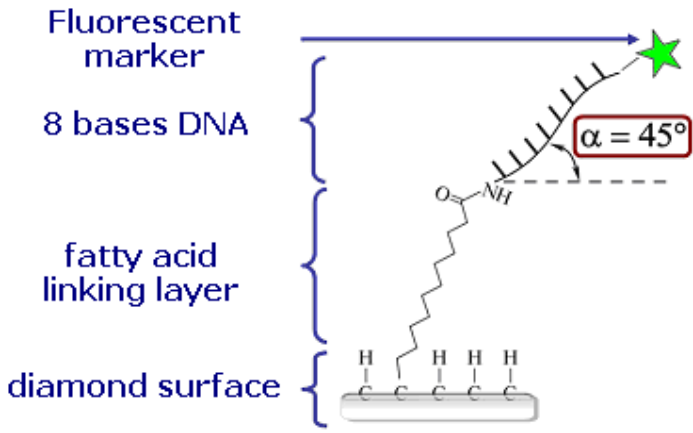
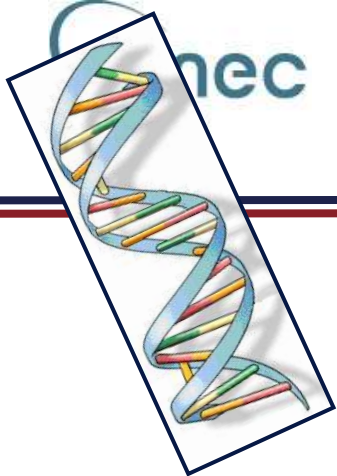
Smart electronic
devices

- medical Point-of-Care diagnostics
- environmental monitoring
- food & feed analysis

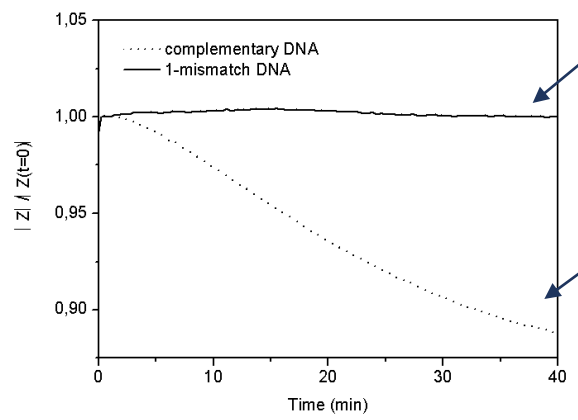
Advantages: fast, label free, real-time,
handheld, user-friendly, ...



Electronic Mutation Analysis



DNA-array on CVD diamond

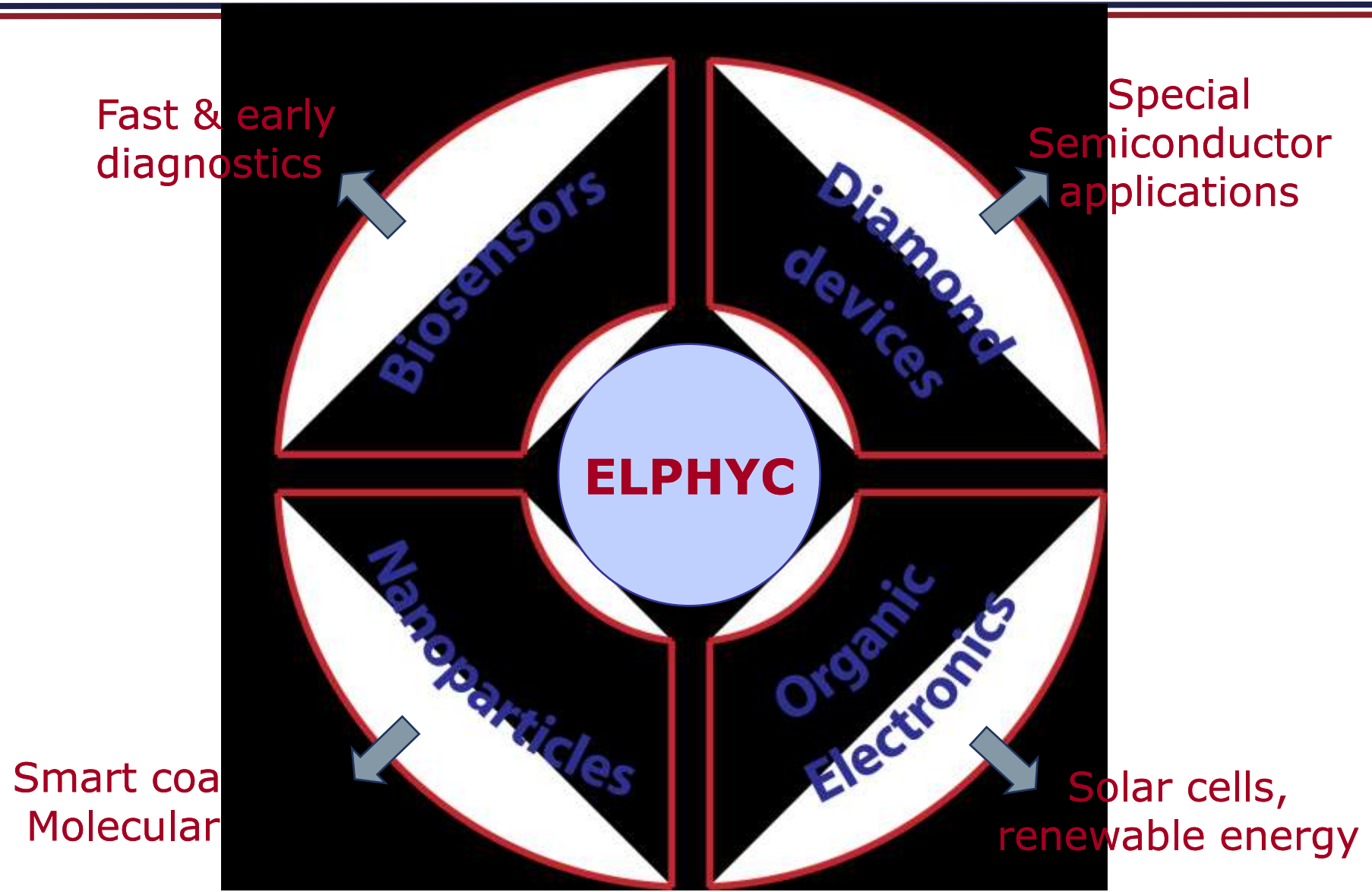


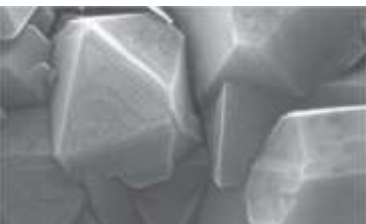
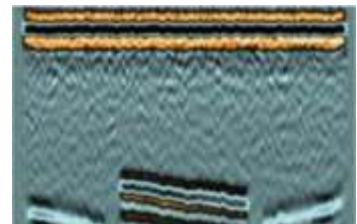
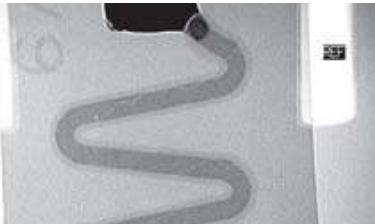
DNA fragments with genetic defect

hybridization

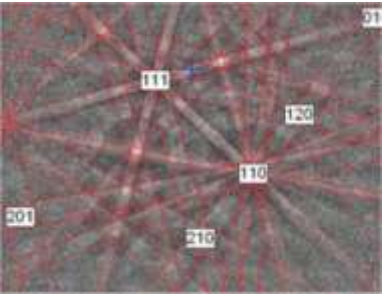
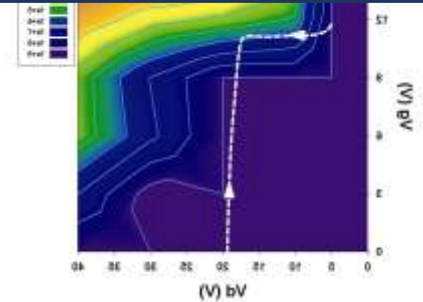
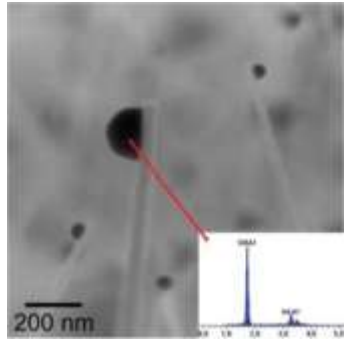


Looking into the future





Borzee, Kanigen Works Benelux, Electrocoat, Epiq Sensor-Nite, Yamauchi, Melotte, PlasmaJet, Cevema, Ledlite, Jabil Circuit Belgium, Melexis, Heraeus Electro-Nite, PolyVision, ZF-Getriebe, Gymna-Uniphy, STC/VCST, Eurostel, Panasonic Battery Belgium, Helvoet Rubber & Plastic Technologies, LVM Metalcoating, LGTB, Maex Precision Production, GL Technics, Alupa, Jaga, IAC Group, Helvoet Rubber & Technology, Bosal, Arcelor Tailored Blank Genk, Melexis, Barco, Belgacom, SML, DSM, Tyco Electronics, Emerson & Cumming, Alcatel Geel, AMIS, ON Semiconductor, Bosch Tienen, Alro, Borealis, Helvoet Pharma, Philips CFT, Siemens Automotive SA, Celestica, Alcatel Space, United Monolithic Systems SA, United Monolithic Systems GmbH, Thomson-CSF, AEA Technology, Daimler-Chrysler, Schlumberger, Temic Automotive, Vishay Vitramon, BC Components, NEMEC, Schlumberger, EPS, EVOX Rifa, Siemens-Matsushita, CQE, Eurofarad



contact ward.deceuninck@uhasselt.be

contact jan.dhaen@uhasselt.be

aspire invent achieve



Institute for Materials Research,
Hasselt University
Division IMOMECE, IMEC vzw
Wetenschapspark 1
3590 Diepenbeek
Belgium
Tel. +32-11-268826
Fax. +32-11-268899
@ imo-imomec@uhasselt.be