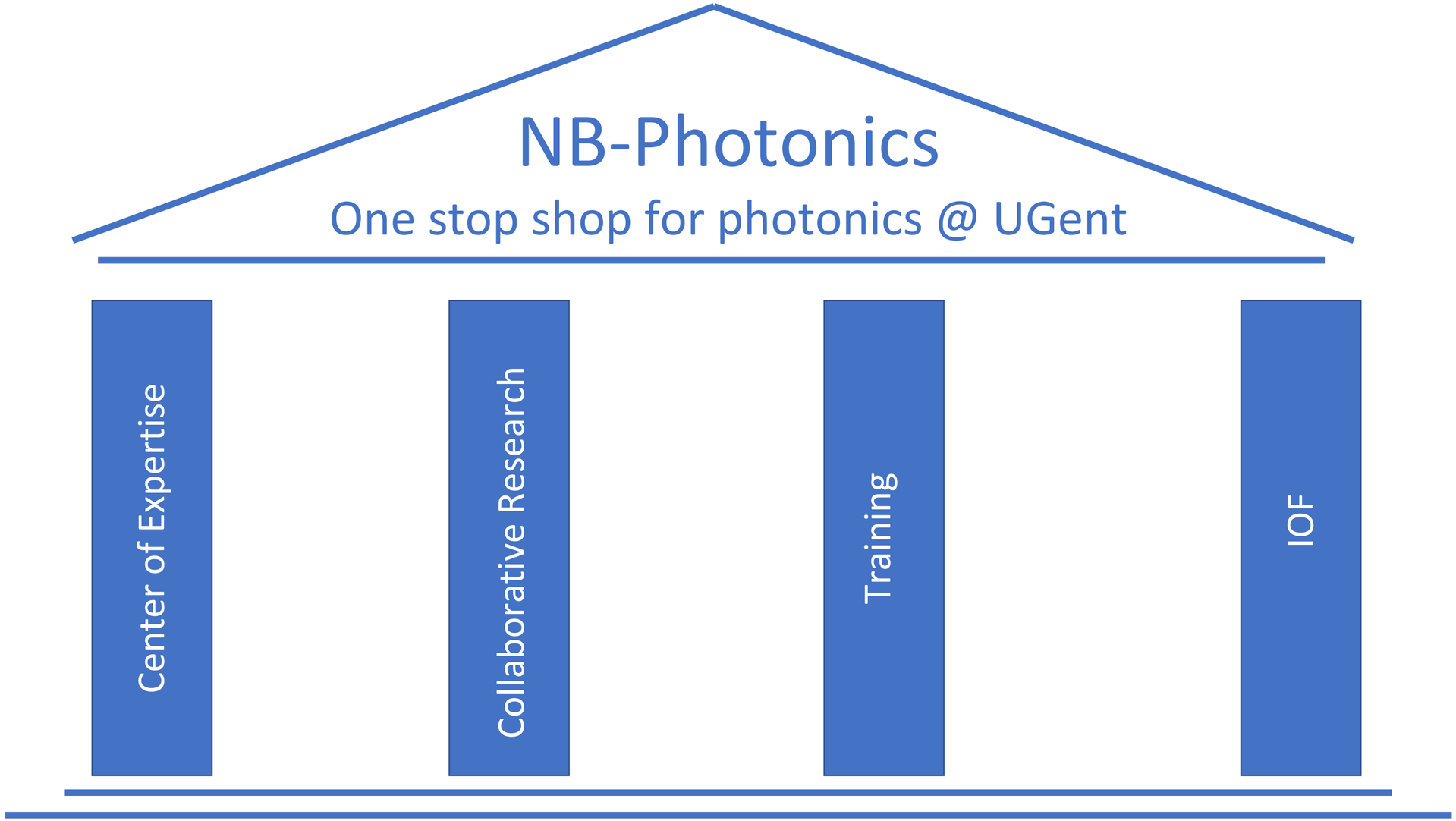
nb-photonics

Center for Nano- and Biophotonics
Ghent University

GHENT UNIVERSITY

Center of Expertise

CENTER OF EXPERTISE (CoE)



CoE

- A UGent platform that brings together photonics and photonics related expertise of more than 21 profs from 10 departments within the field of nano- and bio-technology.
- CoE co-ordinates the access to the extensive knowledge, infrastructure and facilities of its members.
- CoE acts as a liaison between the members and the users (both within and outside UGent).

SERVICES OFFERED BY THE CENTER

- Simple consultation
- Characterization using existing tools
- Design of tools enabled by photonics
- Building tools enabled by photonics

<One stop Shop> for photonics!

To know more about the services and how to avail them visit the website (**nb-photonics.ugent.be**) and/or contact Kamal Kaur (Kamalpreet.Kaur@Ugent.be)

SPEAKERS

Speaker	Research group
prof. Dirk Poelman	LumiLab
prof. Johan Bauwelinck	IDLab
dr. Toon Brans	LGBPP
dr. Felix Mattelaer	CoCooN
dr. Pieter Geiregat	PCN
dr. Tom Gheysens	PBM
prof. Bart Kuyken	PRG
prof. Kristiaan Neyts	LCP
prof. Andre Skirtach	Nano and Bio-Photonics
prof. Geert Van Steenberge	CMST
dr. Thomas Vervust	NaMiFab

LumiLab

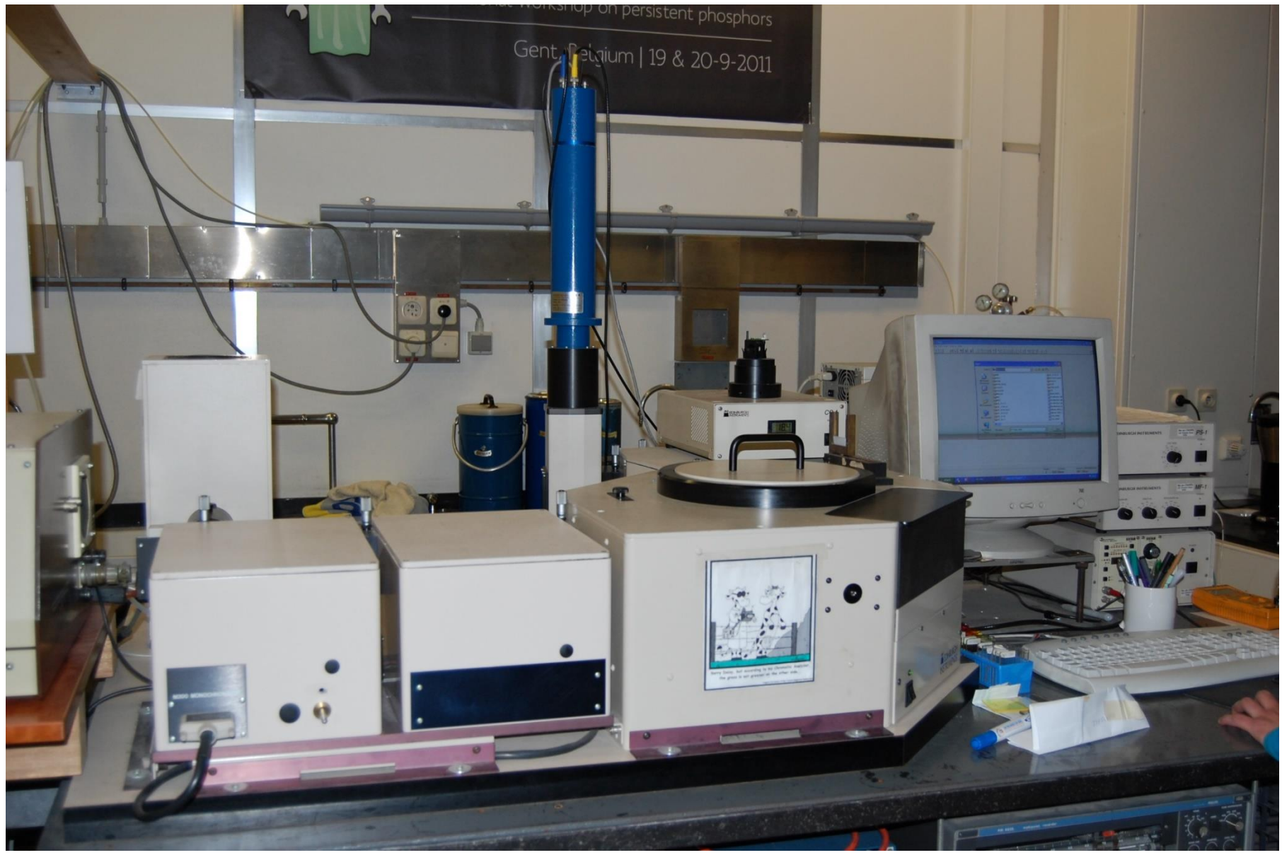

LumiLab
department of solid state sciences
Ghent university
@UgentLumiLab

FACULTY OF SCIENCES – CHEMISTRY AND SOLID STATE PHYSICS

- Photoluminescence spectroscopy:
  - Emission spectra
  - Excitation spectra
  - Decay spectra
- SEM-EDX-CL micro-spectroscopy
- UV-Vis-NIR spectrophotometry

PHOTOLUMINESCENCE SPECTROSCOPY

- Photoluminescence spectroscopy:
  - Emission spectra
  - Excitation spectra
  - Decay spectra



SEM-EDX-CL SPECTROSCOPY

- Imaging (SE/BSE)
- Composition (EDX)
- CL light emission (spectroscopy)

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Available online at www.sciencedirect.com
ScienceDirect
Ceramics International 42 (2016) 5497–5503
CERAMICS INTERNATIONAL
www.elsevier.com/locate/ceramint

Photoluminescence and phase related cathodoluminescence dynamics of Pr^{3+} doped in a double phase of $ZnTa_2O_6$ and $ZnAl_2O_4$

L.L. Noto[a,c,*], S.K.K. Shaat[a], D. Poelman[b], P.F. Smet[b], L. Martin[b], M.Y.A. Yagoub[a], S.M. Dhlamini[c], O.M. Ntwaeaborwa[a], H.C. Swart[a,**]

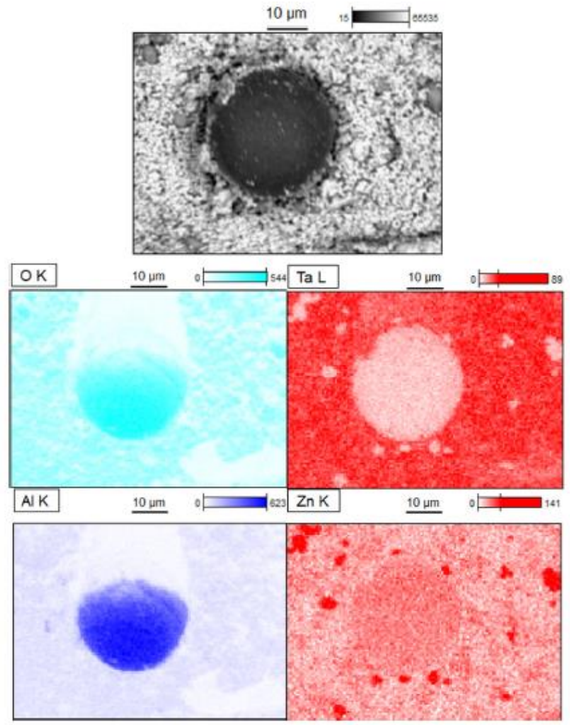
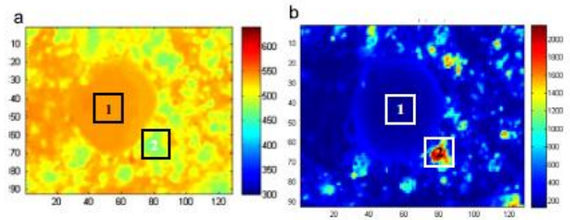
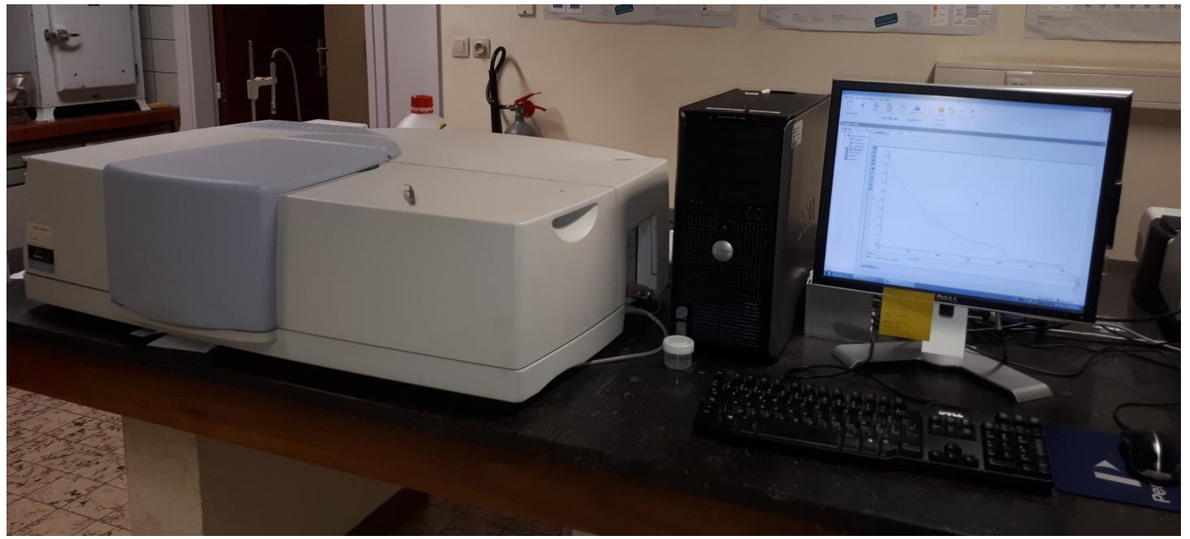


Fig. 4. The backscattered electron image (top) and maps in false colour of the elements in $ZnTaAlO_5:Pr^{3+}$.



UV-VIS-NIR SPECTROPHOTOMETRY

Lumilab, Dept Solid State Sciences



PCN group, Department of Chemistry

- 175 – 3300 nm
- Specular R, T
- Diffuse R, T

UV-VIS-NIR SPECTROPHOTOMETRY

???

- Gas atmospheres
- Temperature dependence
- Wafer mapping

UV-VIS-NIR SPECTROPHOTOMETRY

Zonsverduistering.nl

Eclipsbrilletjes belicht

Noot van de redactie: Dit is een interessant artikel uit 2001, maar door veranderingen in materialen wellicht niet meer geheel bij de tijd. Moderne eclipsbrillen moeten voldoen aan ISO-keurmerk 12312-2. Helaas is de vermelding van dit keurmerk geen garantie, aangezien er ook namaakbrillen in omloop zijn.

Naar aanleiding van de totale zonsverduistering van 11 augustus 1999 was er -- terecht -- heel wat te doen rond de veiligheid van de verschillende soorten eclipsbrilletjes. De conclusie was, dat enkel de 'echte' eclipsbrilletjes voldeden en dat alle alternatieven zoals floppy-schijfjes, CD's en fotonegatieven gevaarlijk waren voor directe zonnewaarneming. Met een nieuwe totale verduistering voor de deur, leek het ons interessant om de verschillende soorten eclipsfilters nog eens van naderbij te bekijken.

Twee kinderen, met eclipsbrilletjes op, zijnde de kinderversie van het Woowoo-brilletje (type 11 in het artikel) en een brilletje met metaallaag (type 8 in het artikel) (Foto: Dirk Poelman)

Aan de hand van optische transmissiemetingen zullen we trachten duidelijk te maken waarom de alternatieve filters af te raden zijn. Een filtertje dat visueel een aangenaam en voldoende donker beeld geeft, kan in de praktijk inderdaad heel onveilig zijn!

Een filter voor het waarnemen van de zon moet de hoeveelheid straling die het oog binnendringt, tot een aanvaardbare waarde beperken. Enige tijd geleden stelde Dr. Ralph Chou een stel specificaties voorop waaraan minstens moet voldaan zijn (deze specificaties werden overgenomen als voorwaarden voor CE-markering). Er wordt hierbij een maximale transmissie (fractie van het licht die doorgelaten wordt) opgegeven in de verschillende golflengtegebieden van de zonnestraling. Deze transmissie kan uitgedrukt worden in %, of in optische dichtheden (O.D.). De optische dichtheid O.D. = log (1/T), met T de transmissie. Volgend tabelletje geeft de correspondentie tussen beide eenheden :

Lasers Med Sci
DOI 10.1007/s10103-013-1307-4

ORIGINAL ARTICLE

Optical properties of root canal irrigants in the 300–3,000-nm wavelength region

Maarten A. Meire · Dirk Poelman · Roeland J. De Moor

Inorganic Chemistry — Article — pubs.acs.org/IC

Fe^{II} Spin Transition Materials Including an Amino−Ester 1,2,4-Triazole Derivative, Operating at, below, and above Room Temperature

Marinela M. Dîrtu,[†] Anil D. Naik,[†] Aurelian Rotaru,[‡] Leonard Spinu,[§] Dirk Poelman,[∥] and Yann Garcia*[,†]

RSC Advances

PAPER

CrossMark click for updates

Cite this: *RSC Adv.*, 2015, 5, 22334

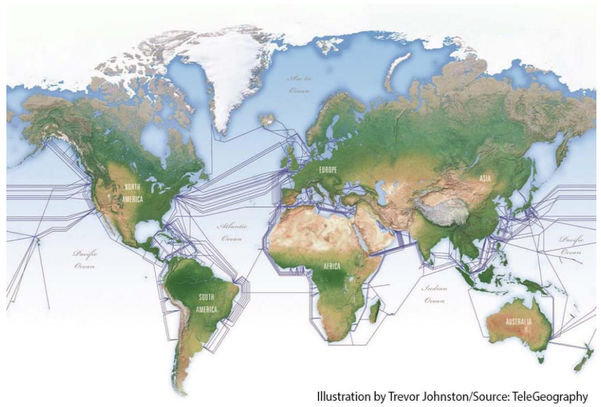
Au@UiO-66: a base free oxidation catalyst†

K. Leus,[a] P. Concepcion,[b] M. Vandichel,[c] M. Meledina,[d] A. Grirrane,[b] D. Esquivel,[a] S. Turner,[d] D. Poelman,[e] M. Waroquier,[c] V. Van Speybroeck,[c] G. Van Tendeloo,[d] H. García[b] and P. Van Der Voort*[a]

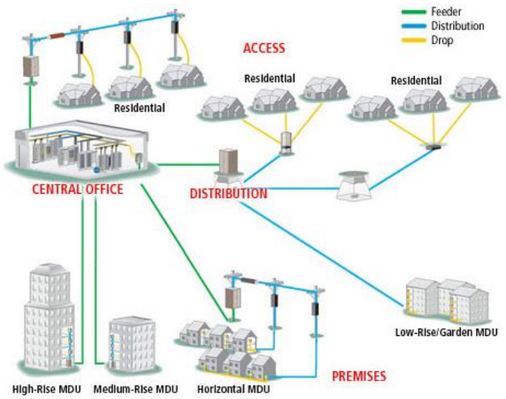
IDLab

HIGH-SPEED OPTICAL TRANSCEIVERS

Exponentially increasing data consumption is expanding the applications of optical communication and driving the development of faster and more efficient transceivers

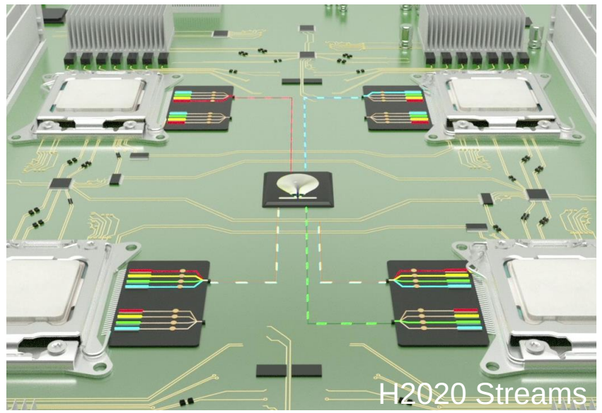


Long-reach

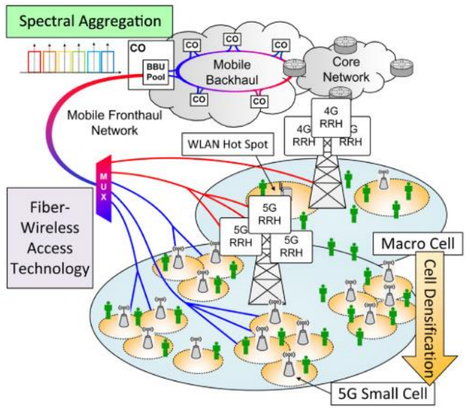


Metro and access

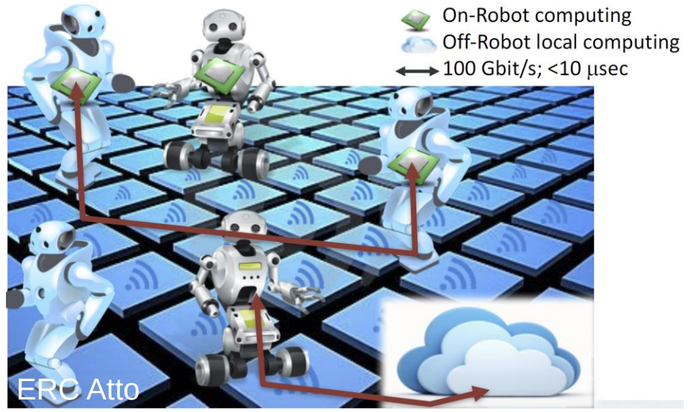
Datacenter



HPC



5G



Beyond 5G

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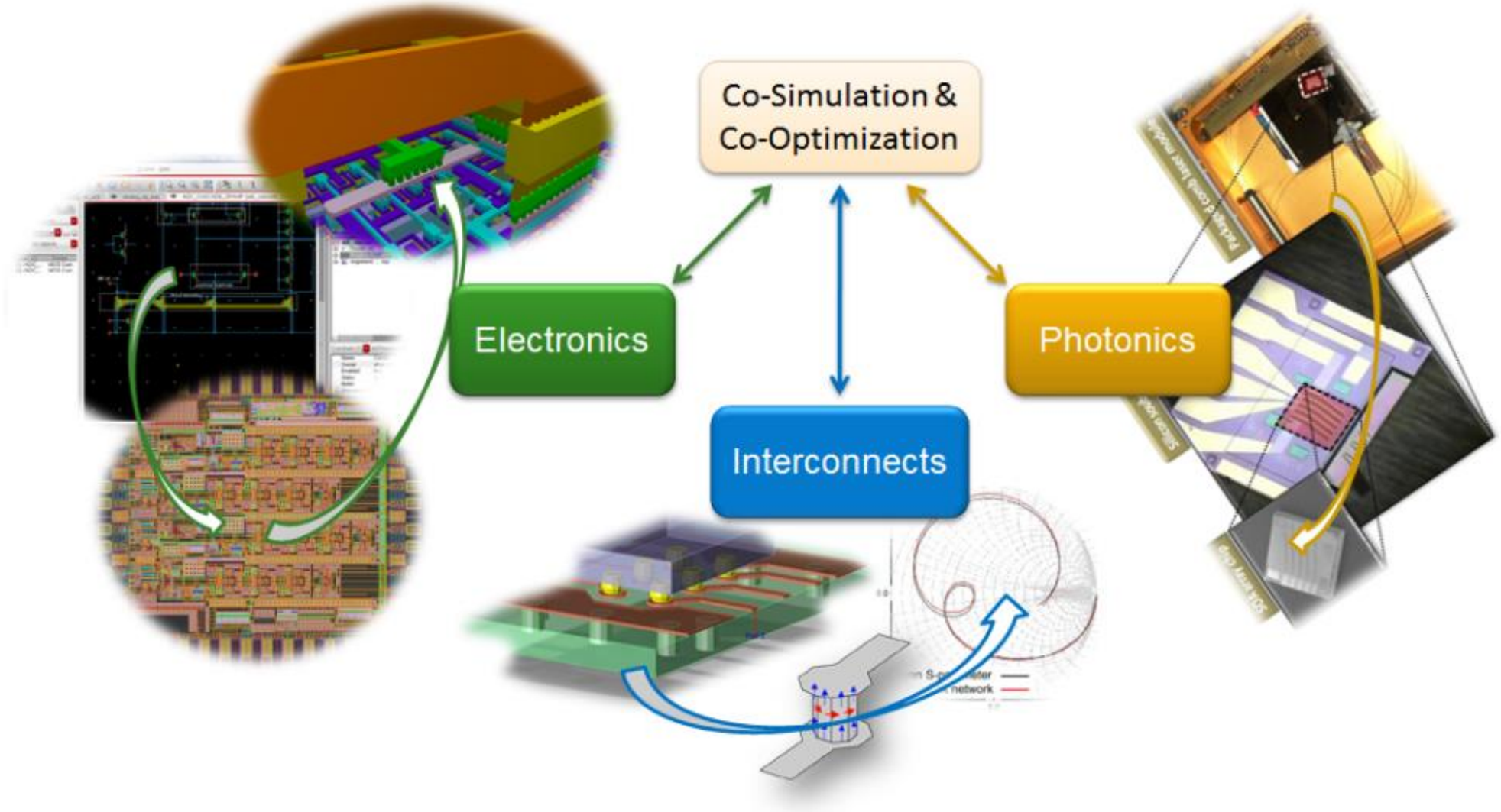
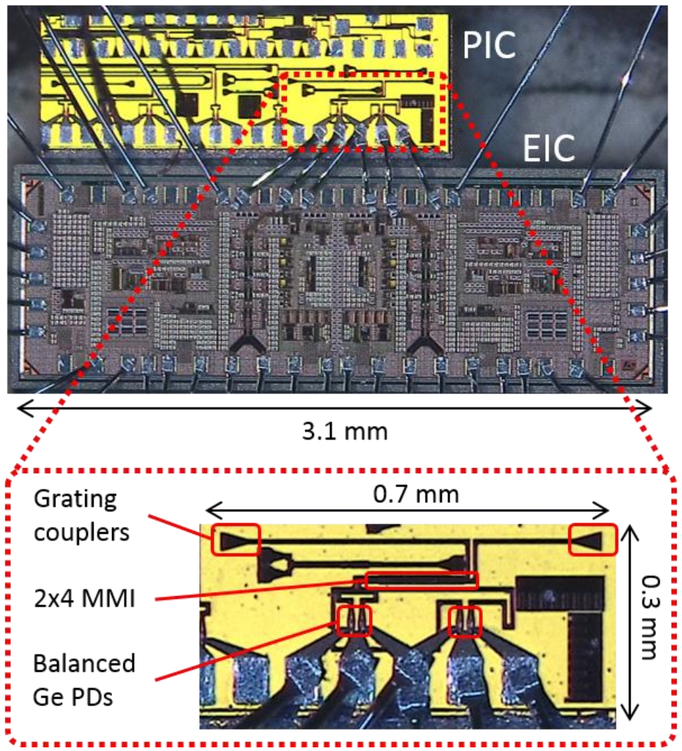
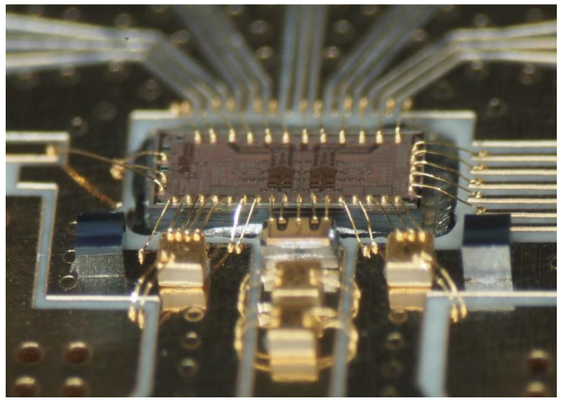
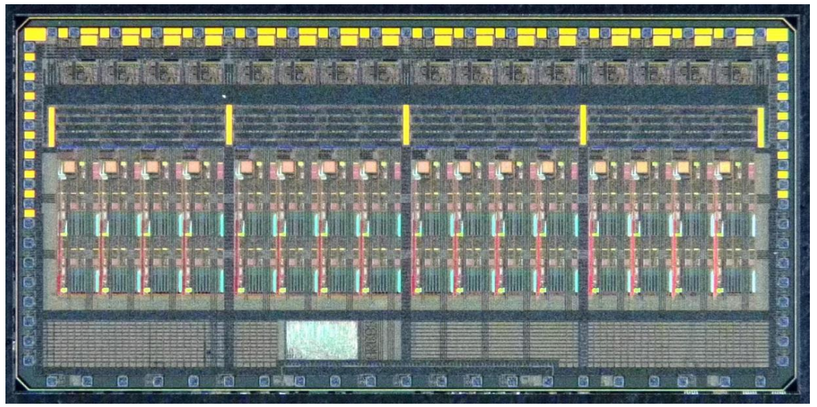
HIGH-SPEED OPTICAL TRANSCEIVERS

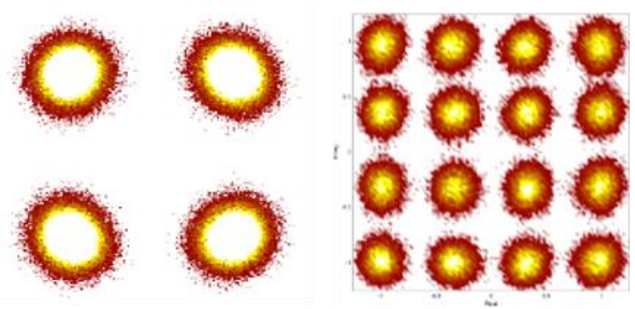


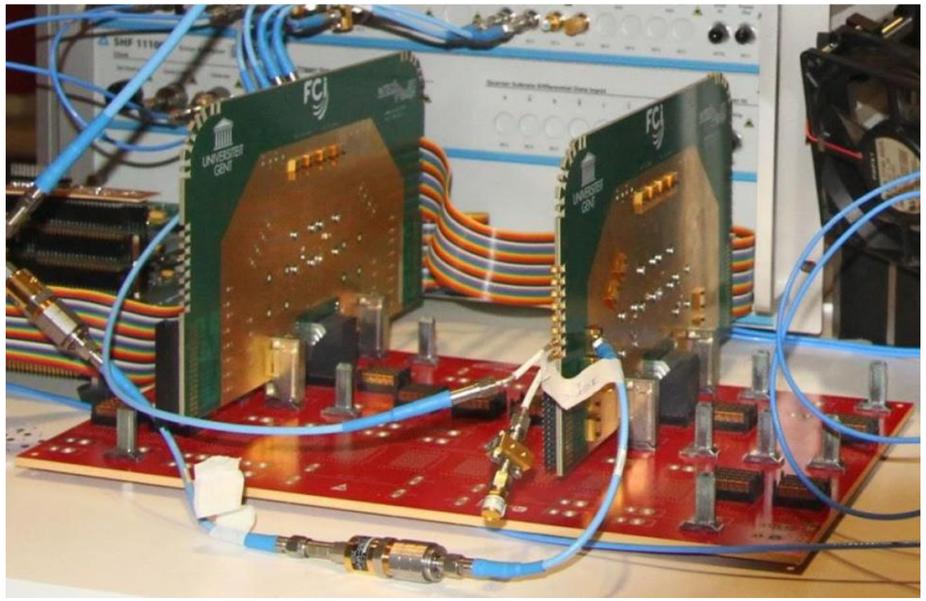
HIGH-SPEED OPTICAL TRANSCEIVERS

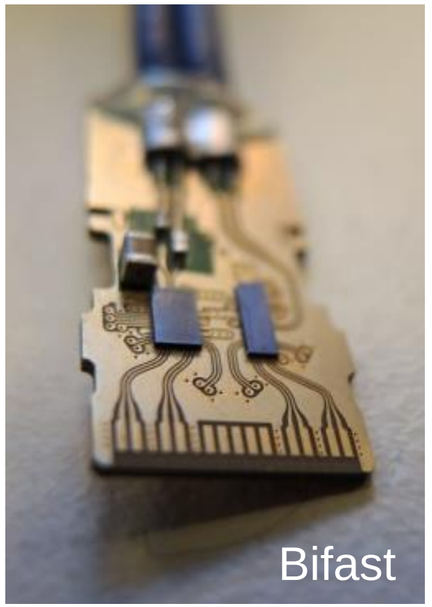






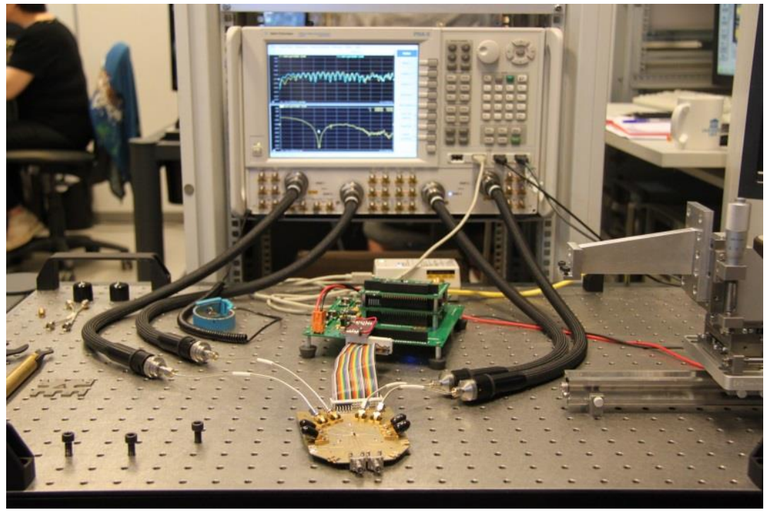


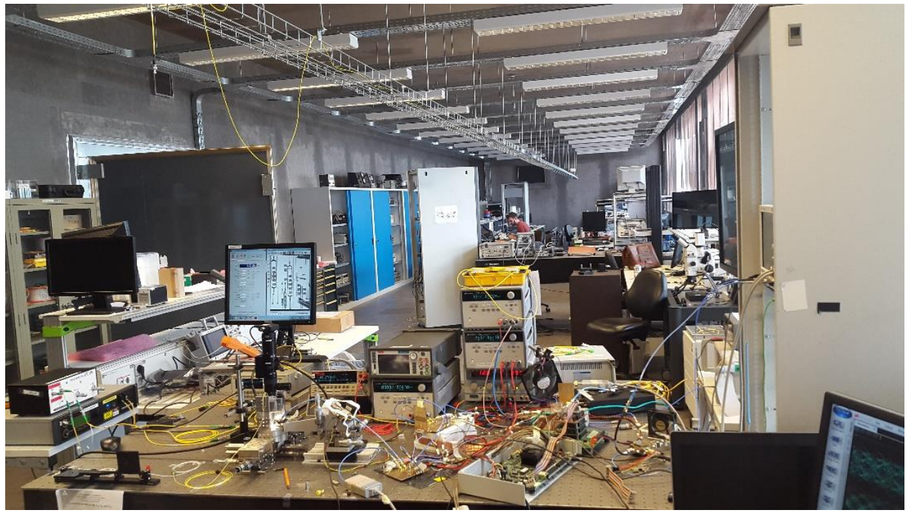




EQUIPMENT: RF - MMWAVE

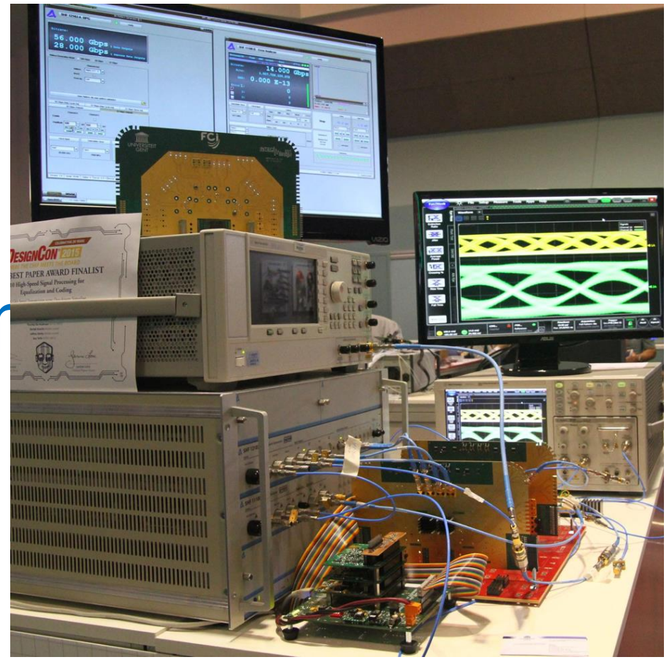
- Faradized lab
- Network analyzer: 4-port up to 67GHz
- Signal generation up to 70GHz
- Signal analyzer up to 26.5GHz
- Range of TRx, mixers… for system experiments

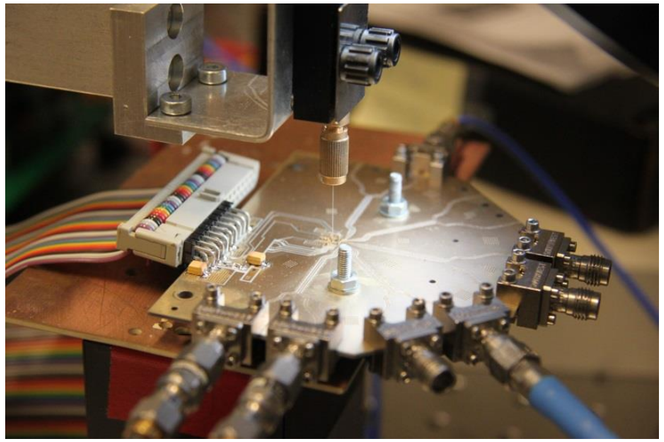




EQUIPMENT: BROADBAND - OPTICAL

- Bit-error-rate tester: up to 50Gb/s
- 4-ch 92GSa/s AWG (H)
- Optical spectrum analyzer: 0.6 – 1.75um
- 70GHz sampling scope
- 63GHz real-time scope (H)
- Tunable lasers for O-, C- and L-band
- Range of optical Tx/Rx, tunable lasers, filters, optical amplifiers, dispersion emulation … for system experiments

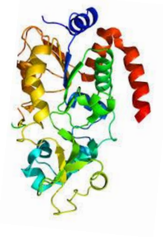
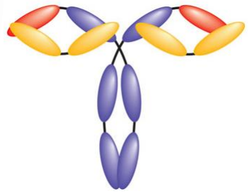




LGBPP

LABORATORY OF GENERAL BIOCHEMISTRY AND PHYSICAL PHARMACY

PROBLEM

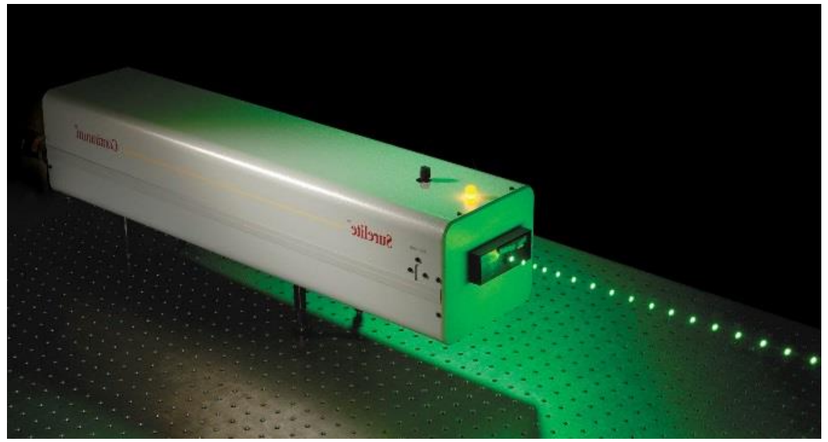
Delivery of exogenous macromolecular materials into the cellular cytosol

Cell membrane = barrier

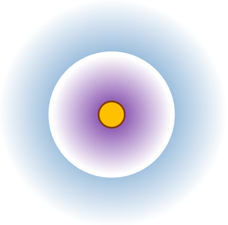
TECHNOLOGICAL SOLUTION

NP-sensitized photoporation

PULSED LASER LIGHT



NANOPARTICLE



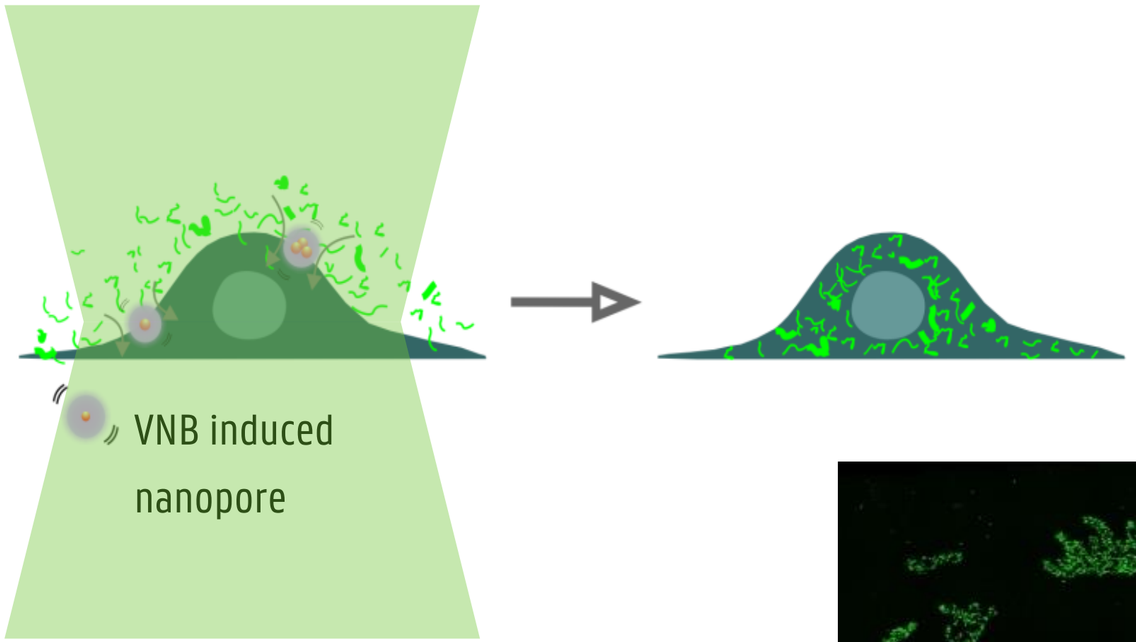
Vapour nanobubble (VNB)

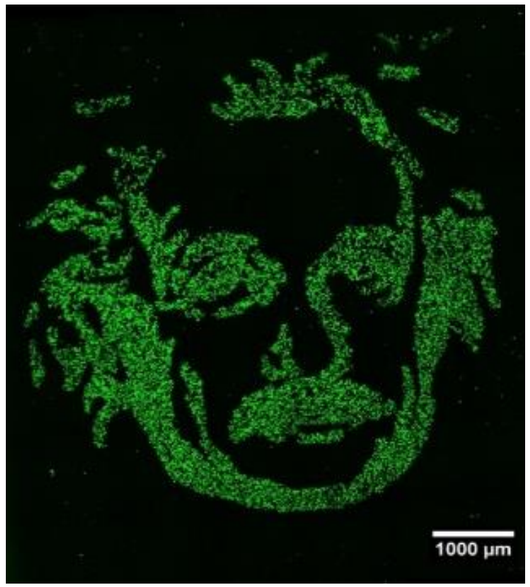
MECHANICAL ENERGY

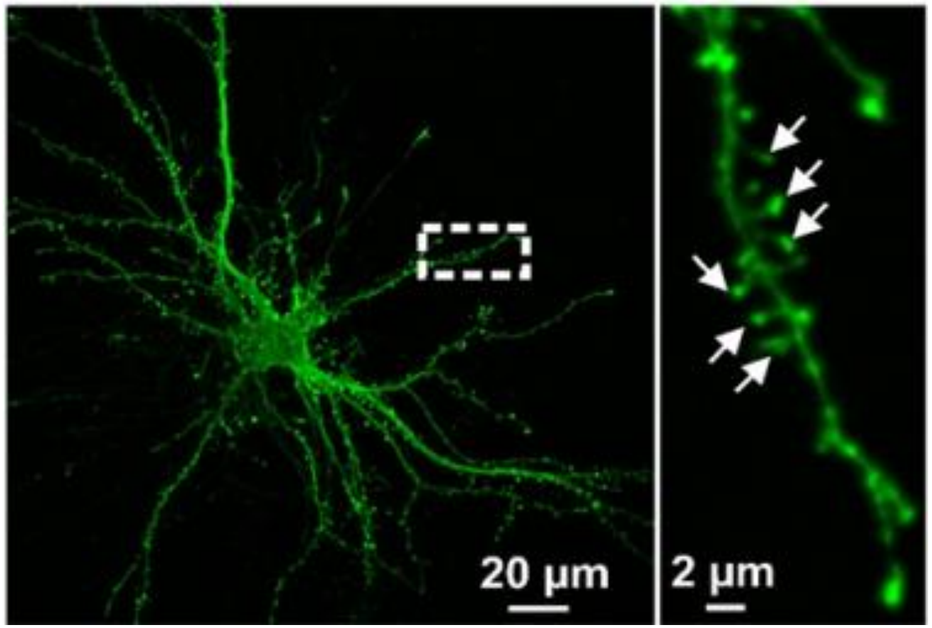
(@ nano-scale)

TECHNOLOGICAL SOLUTION

NP-sensitized photoporation



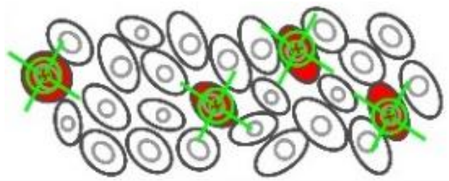




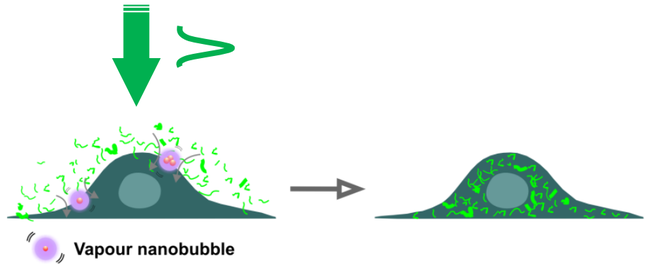
EXAMPLE APPLICATION

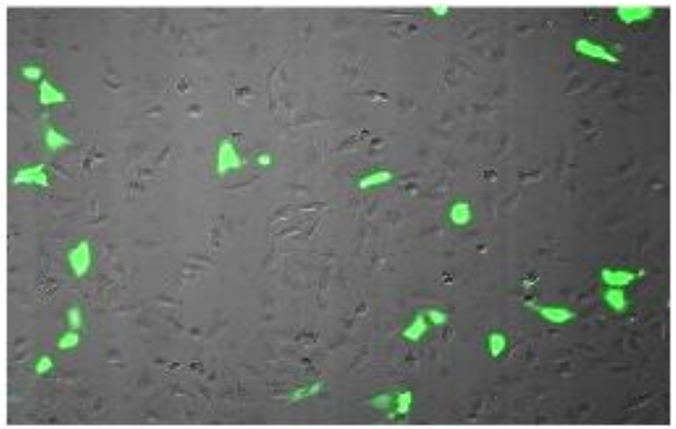
Image-guided spatial selective delivery

Find target cells

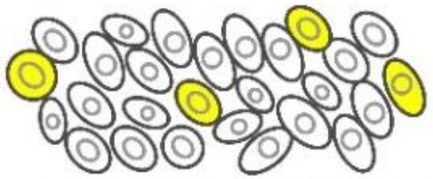


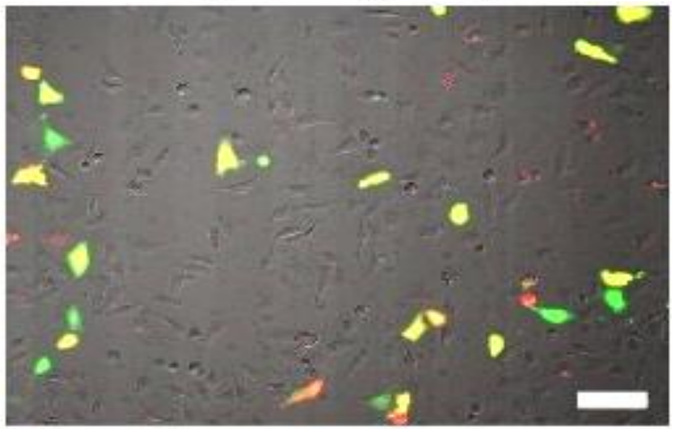
Photoporate target cells





Transfected target cells





THE PHOTONICS INVOLVED

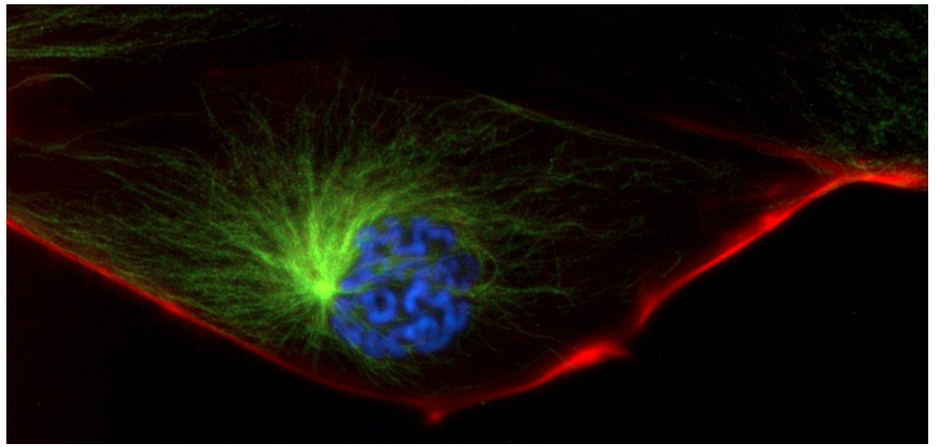
Wavelength tunable pulsed laser sources

pulse durations: fs, ps, ns
wavelengths: 500 nm – 1500 nm
average power: µW – mW – W
….

Nonlinear spectroscopy
Time resolved fluorescence
Multiphoton microscopy
Material processing
…

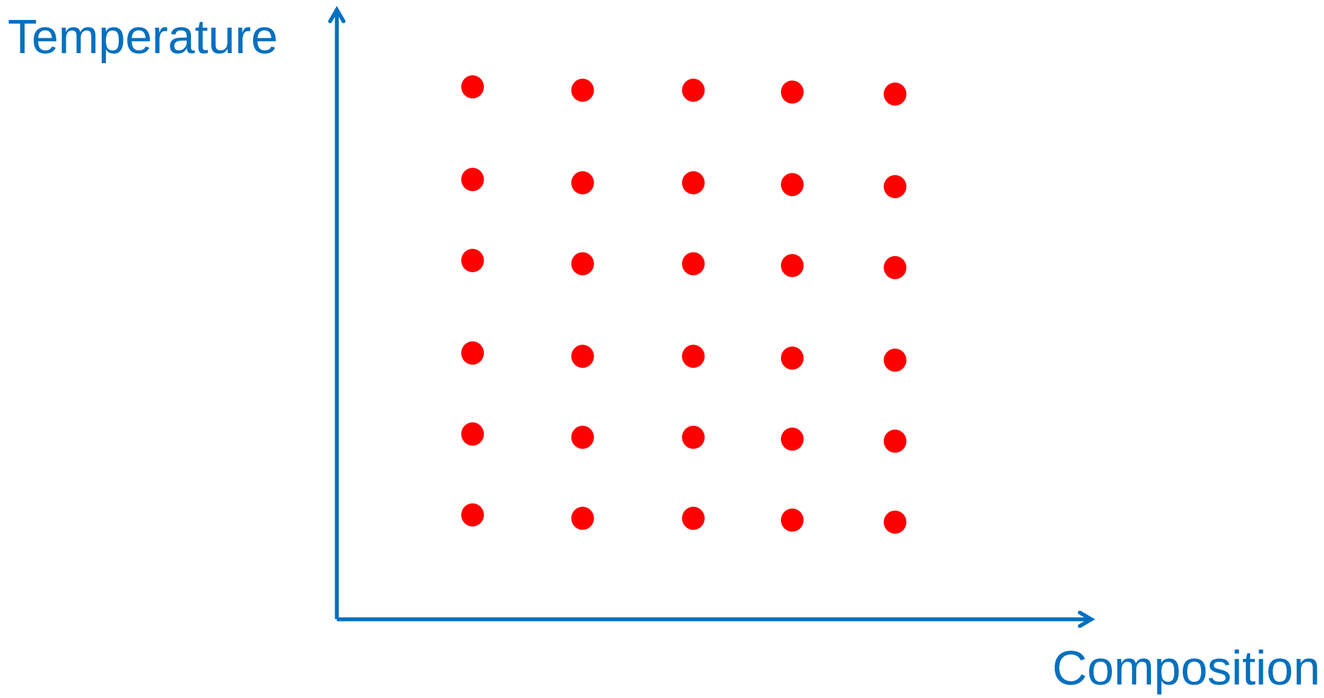
CENTRE FOR ADVANCED LIGHT MICROSCOPY

Advanced Light Microscopy servicing facility for research in Life Sciences



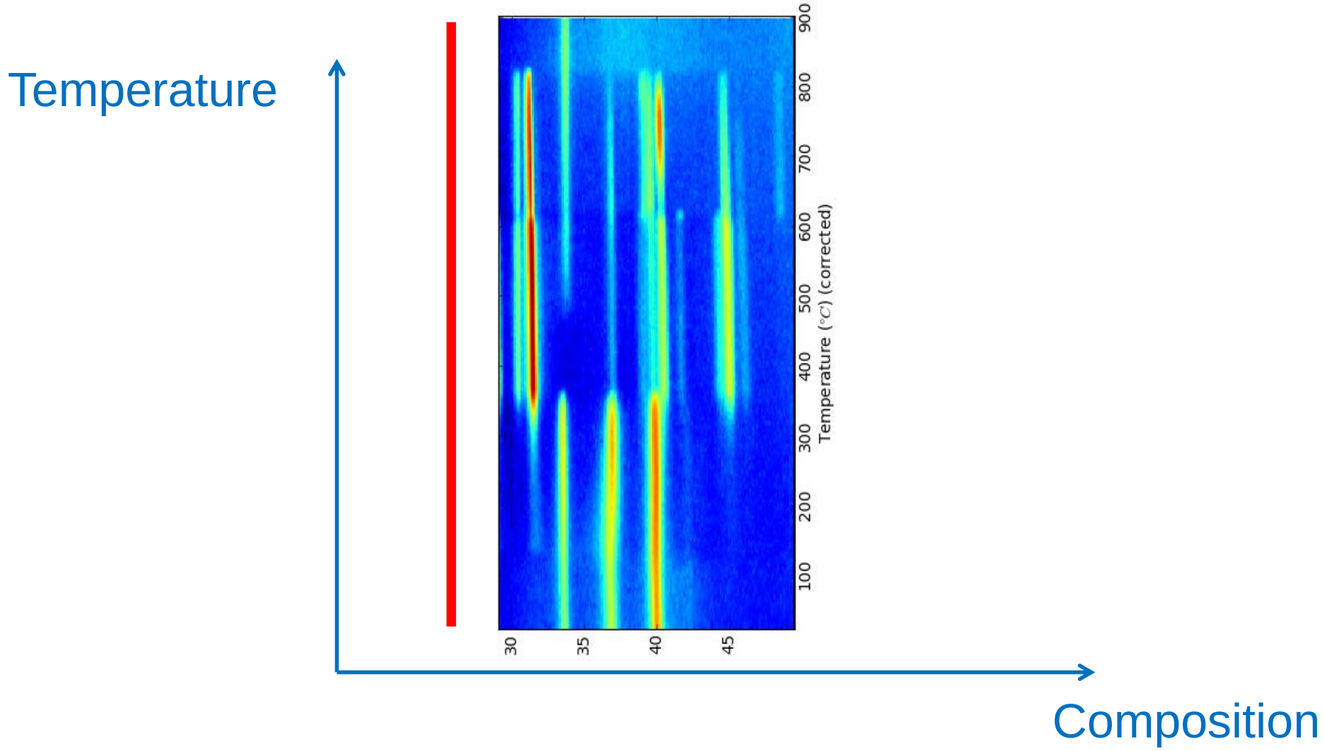
CoCoon

MATERIALS RESEARCH
EFFECT OF TEMPERATURE & COMPOSITION



Traditional approach:
a lot of « cooking&looking »

MATERIALS RESEARCH
EFFECT OF TEMPERATURE & COMPOSITION



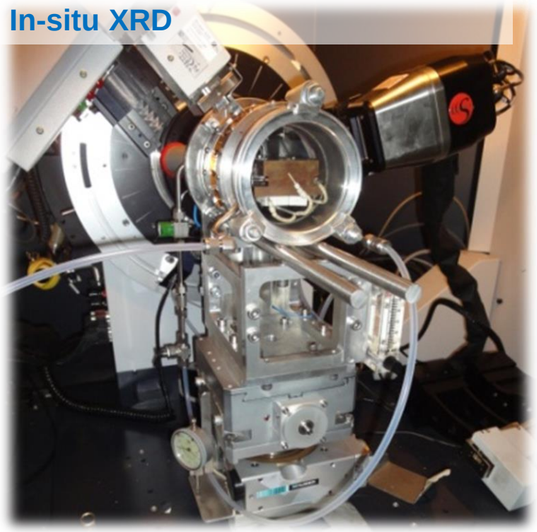
Traditional approach:
a lot of « cooking&looking »

Our approach:

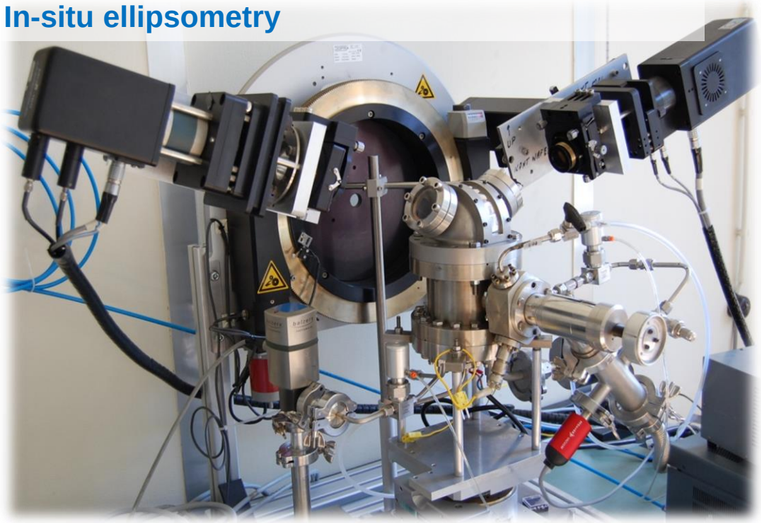
1) In-situ characterization during annealing

INFRASTRUCTURE FOR IN-SITU CHARACTERIZATION

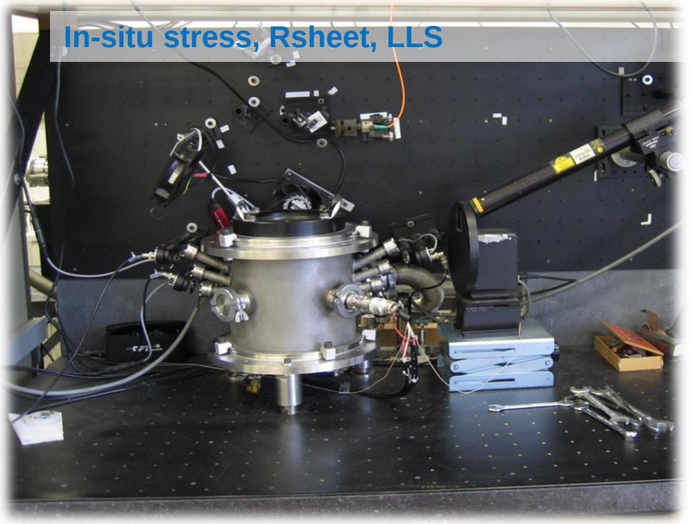
In-situ XRD



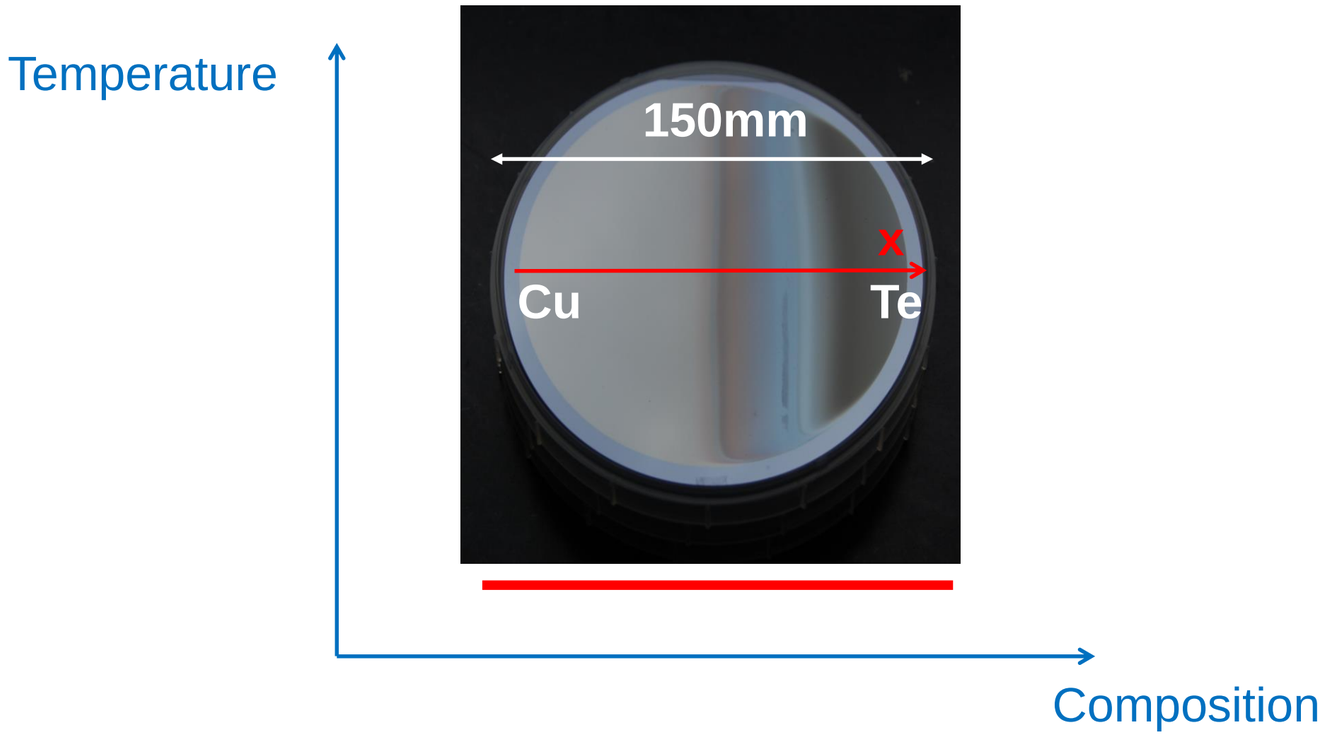
In-situ ellipsometry



In-situ stress, Rsheet, LLS



MATERIALS RESEARCH
EFFECT OF TEMPERATURE & COMPOSITION



Traditional approach:
a lot of « cooking&looking »

Our approach:

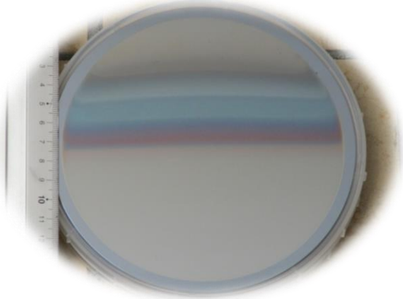
1) In-situ characterization during annealing

2) Deposition of thin film combinatorial libraries

INFRASTRUCTURE FOR COMBINATORIAL THIN FILM RESEARCH

Combinatorial PVD

Deposition



WORKFLOW

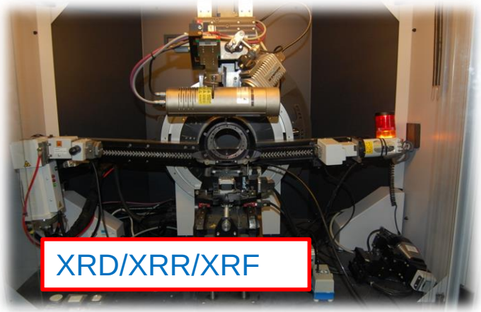
AFM

Mapping

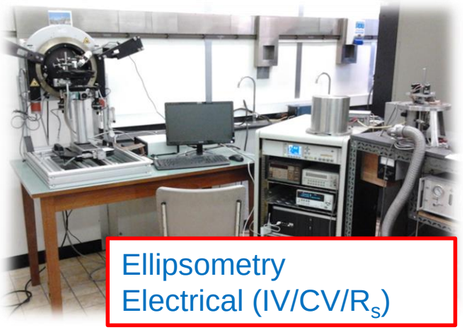
Anneal

RTP

SEM/EDX



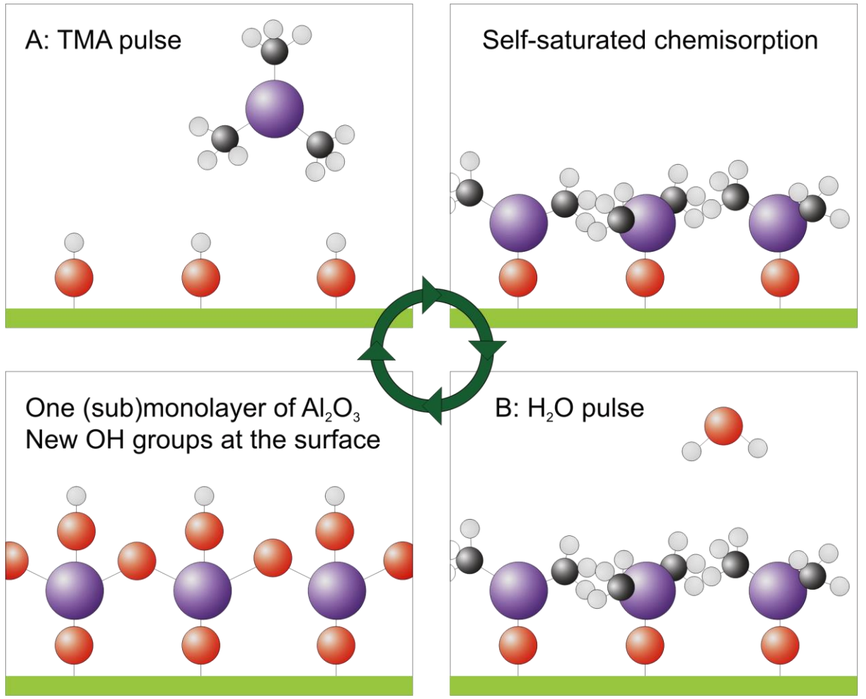
XRD/XRR/XRF

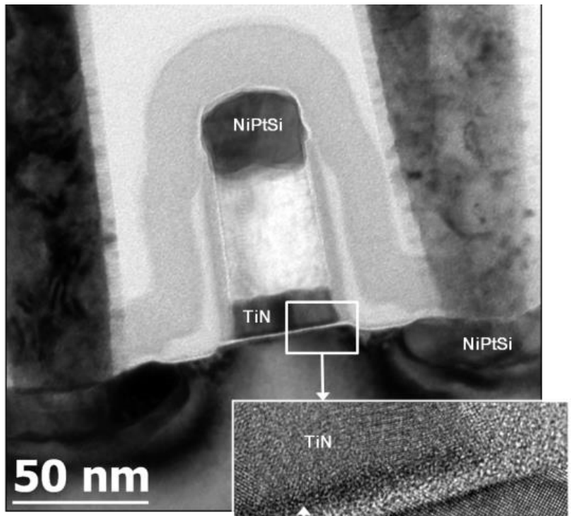


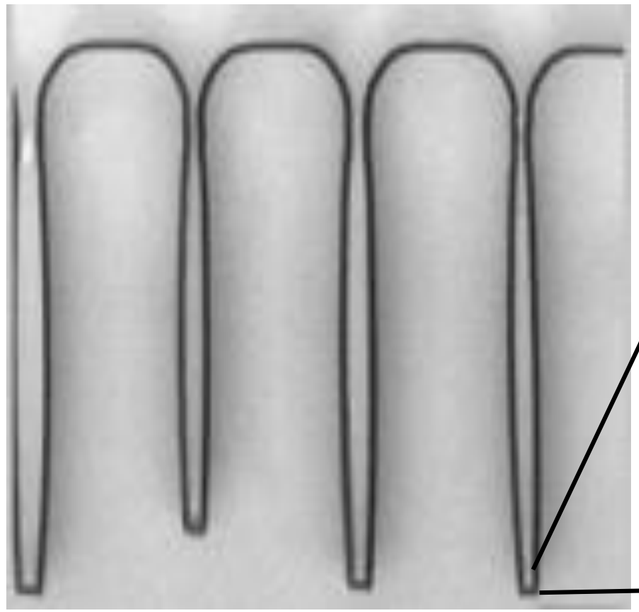
Ellipsometry
Electrical (IV/CV/R_s)

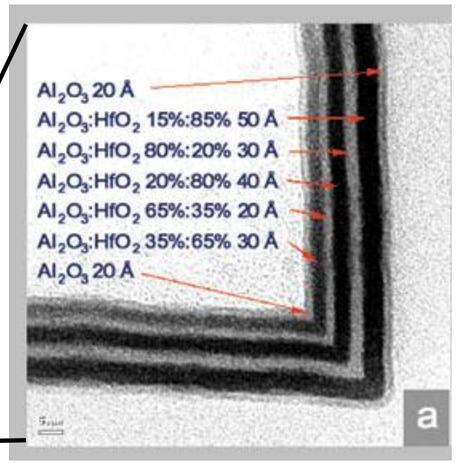
ATOMIC LAYER DEPOSITION

- Vapour phase deposition technique
- Self-saturating surface reactions enable
  - Atomic level thickness control
  - Conformal deposition onto 3D surfaces
- Ideally suited for 3D nanocoatings & surface engineering

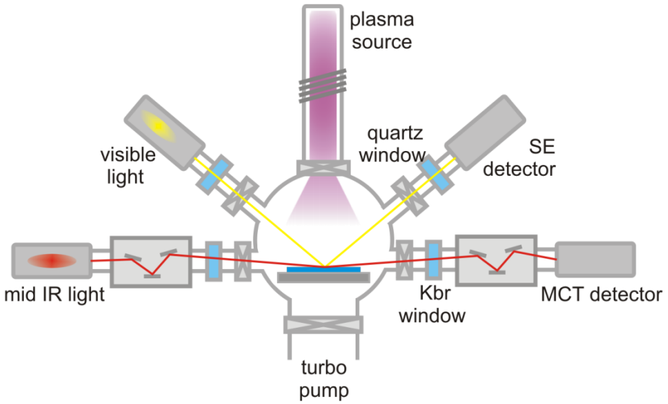








INFRASTRUCTURE FOR ATOMIC LAYER DEPOSITION



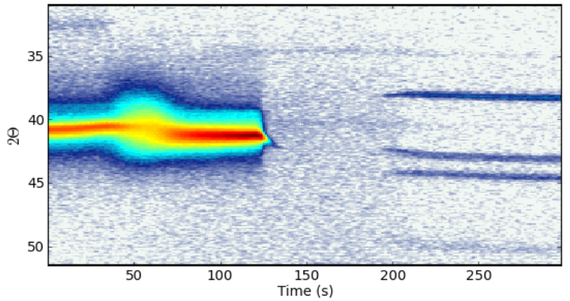
- **10 home-built ALD reactors**

- **In situ characterization during ALD for advanced process characterization**
  - Ellipsometry
  - Mass Spectroscopy
  - FTIR
  - Synchrotron-based techniques

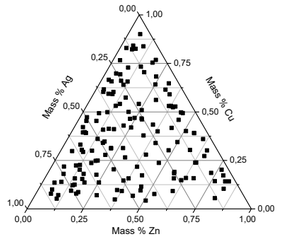
- **Available coating materials**: ZnO, TiO_2, Al_2O_3, Fe_20_3, VO_2, V_2O_5, HfO_2, ZrO_2, SnO_2, In_2O_3, Ga_2O_3, MnO_x, $AlPO_4$, $FePO_4$, Pt, Ru, Ag, TiN, VN, …

UGENT - COCOON GROUP

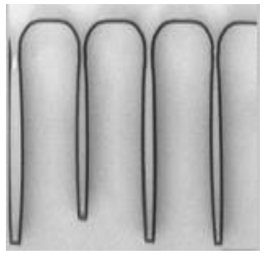
- In situ characterization during annealing

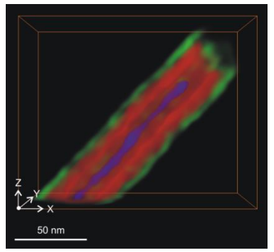


- Combinatorial techniques for screening of material libraries



- ALD for precision coatings





PCN

Physics and Chemistry of Nanostructures Group

PHYSICS AND CHEMISTRY OF NANOSTRUCTURES

- **Synthesis** of nanostructured materials (metals, semiconductors) for applications in photonics (large area & integrated) and catalysis.
- **Thin film deposition** (spin & dip-coating, langmuir) and large area device fabrication (PV, LEDs,..)
- Ultrafast optical and single photon **spectroscopy** (UV/VIS/NIR)

Physics and Chemistry of Nanostructures Group

Department of Chemistry (WE06)

Prof. Hens

Prof. Moreels

SYNTHESIS AND THIN FILM DEPOSITION

- Fully equipped **wet chemistry lab** for the synthesis of II/VI and III/V semiconductor nanocrystals; metal and metal-oxide systems; 2D materials (TMDCs, II/VI, ...), ...
- **Gloveboxes** for air-free handling with spincoater/dipcoater/evaporation.
- **Cleanroom** with dipcoater, Langmuir deposition & printing.

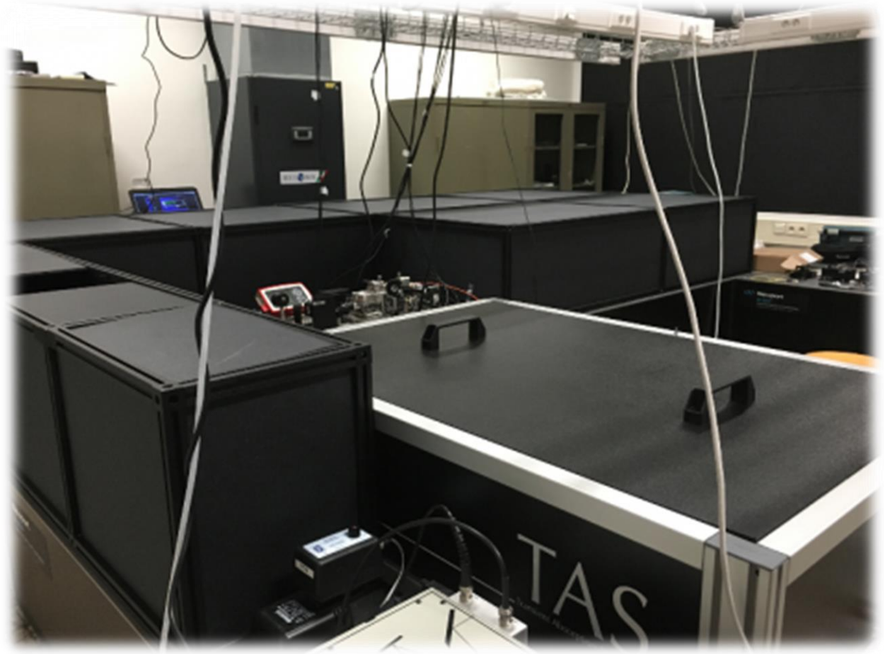
ULTRAFAST OPTICAL SPECTROSCOPY

Oscillator

Newport MaiTai ; 80 MHz @ 800 nm, 1W , 110 fs + SHG/pulse picker

Amplified system

4 mJ pulses @ 800 nm, 110 femtoseconds, 1 kHz



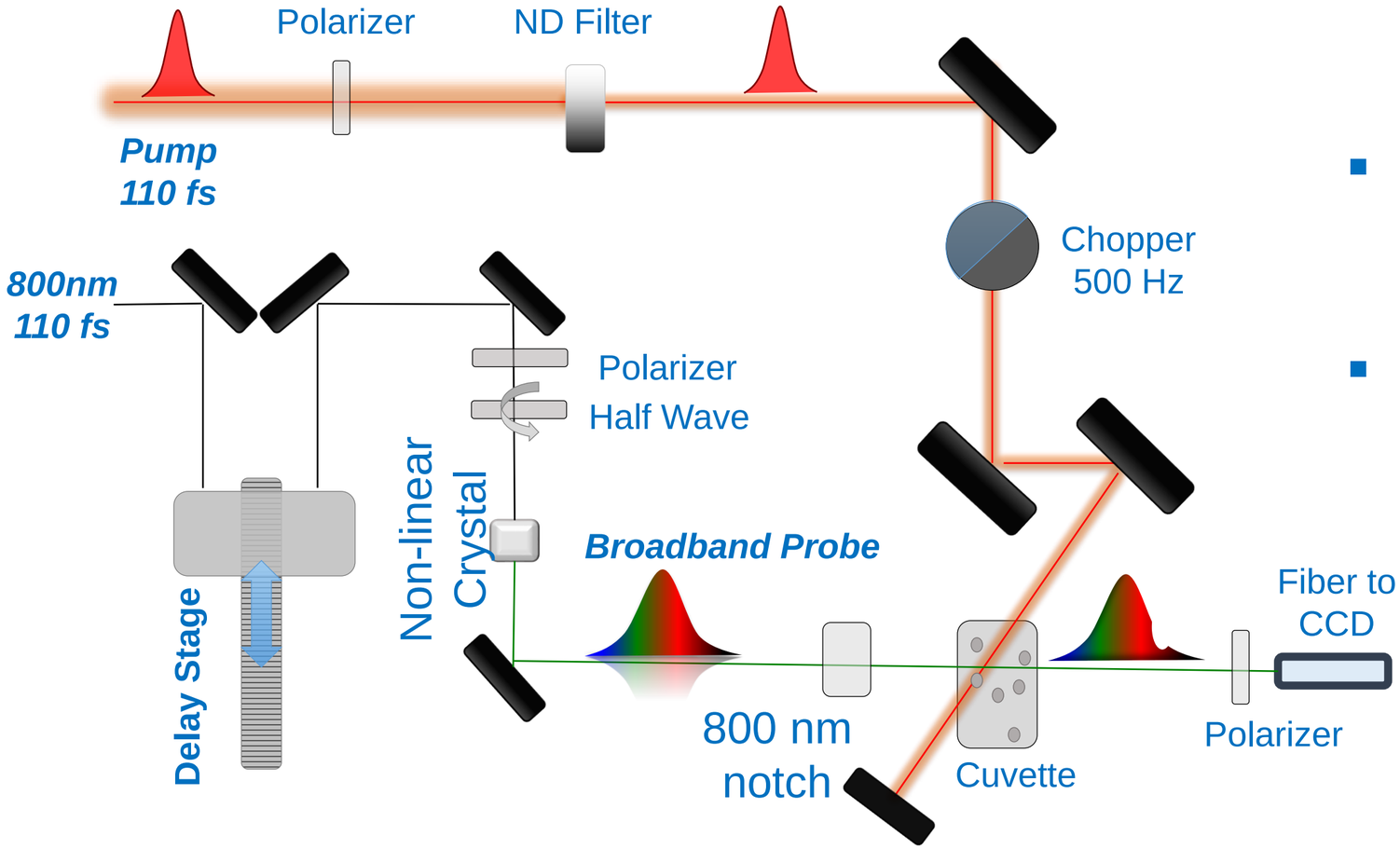
Ultrafast Setups

1. Pump-probe spectroscopy
2. Ultrafast Luminescence

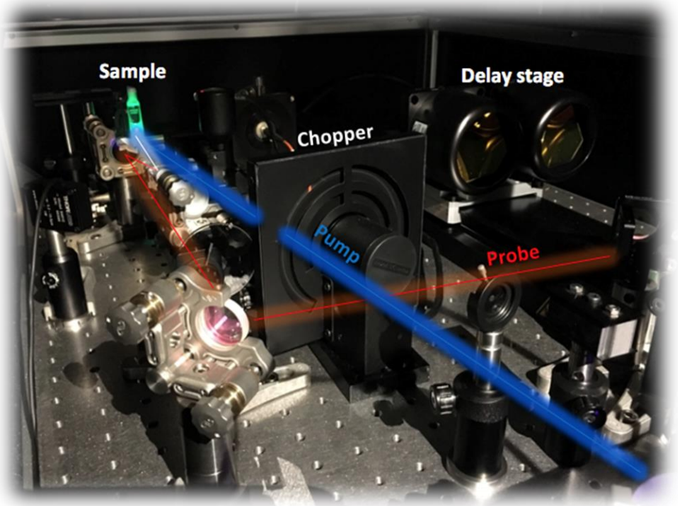
- **Excitation:** 800/400/267 nm and an OPA (280 – 2400 nm)
- **Probe**: 350 – 1650 nm
- **Luminescence:** 350 – 750 nm
- Typical time resolution = 150 fs

nb-photonics
Center for Nano- and Biophotonics
Ghent University

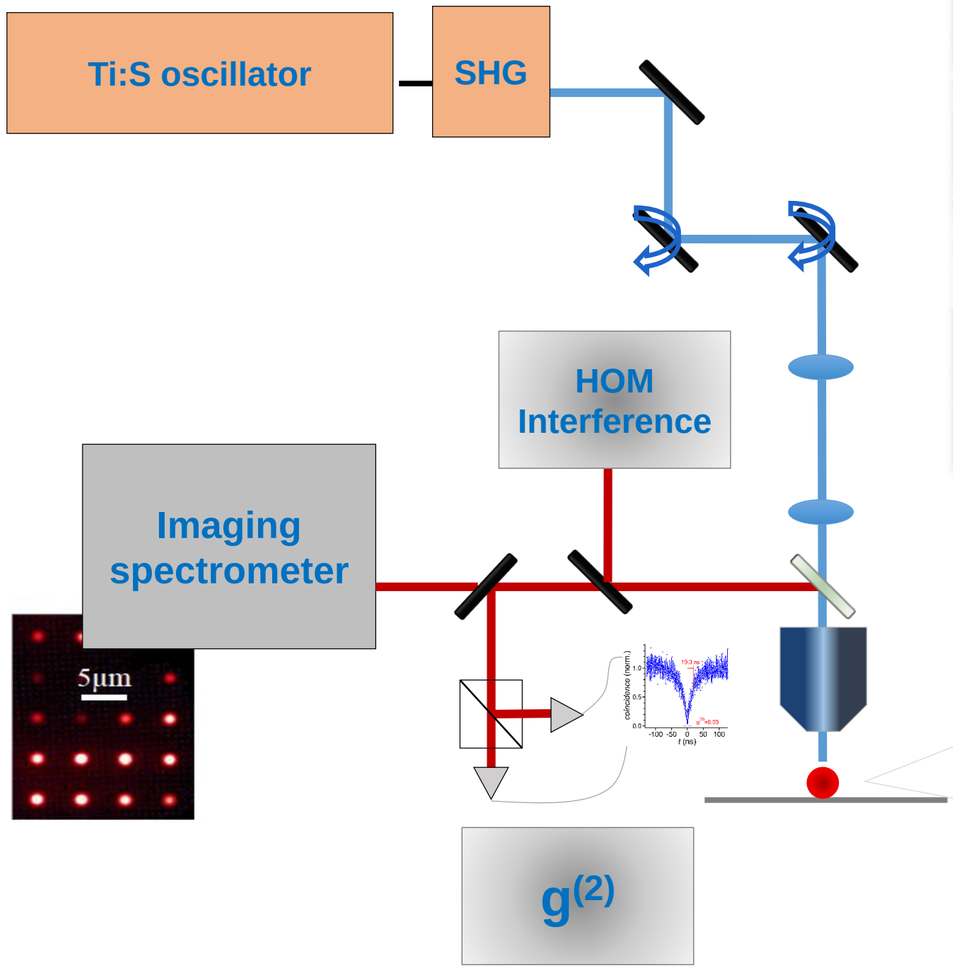
PUMP-PROBE SPECTROSCOPY

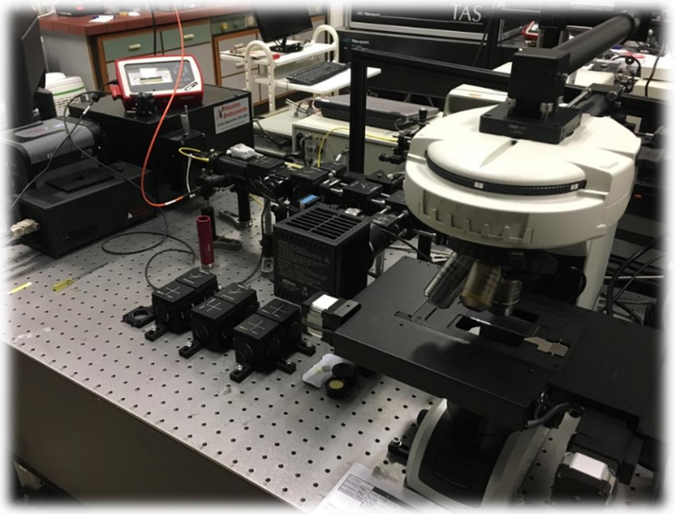


- Study of **carrier dynamics** (charge transfer, non-radiative loss, exciton dissocisation, ...)
- Study of **light-matter interaction** (optical gain, strong coupling, non-linearity, ..)
- **Thin films & dispersions** (epitaxial, nanostructured, dyes, ..)



SINGLE PHOTON SPECTROSCOPY





Devices
Single dots
...

Update 2018:

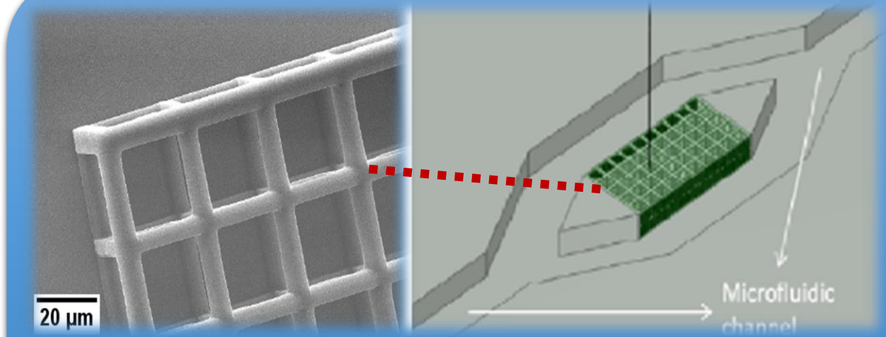
"**Cryostat** for microscopy (4K) and **higher spectral resolution**"

PBM

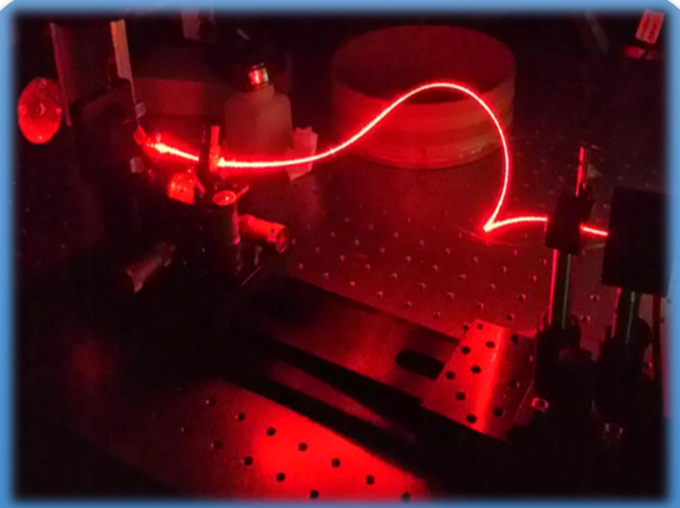
Polymer Chemistry and Biomaterials Group

HYDROGEL APPLICATIONS AND PROJECTS

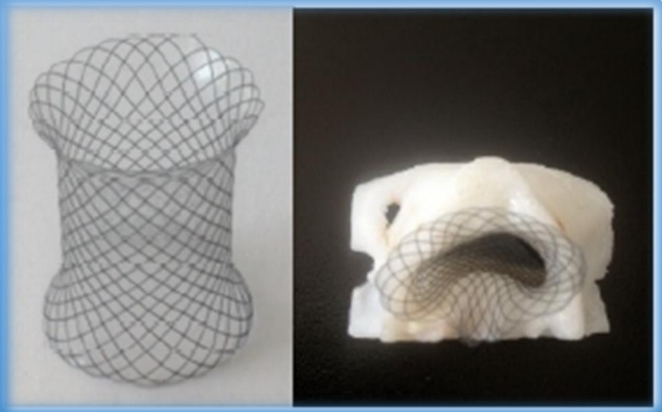
Meniscal applications



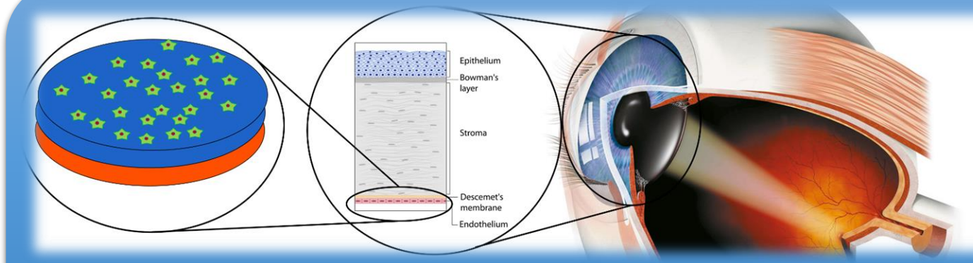
Drug screening applications



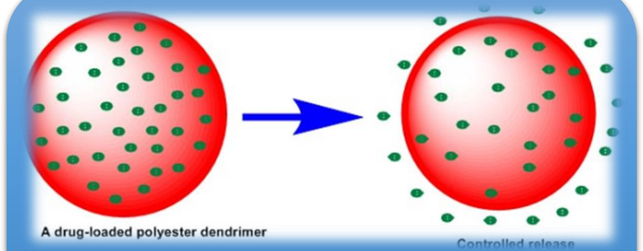
Optical applications



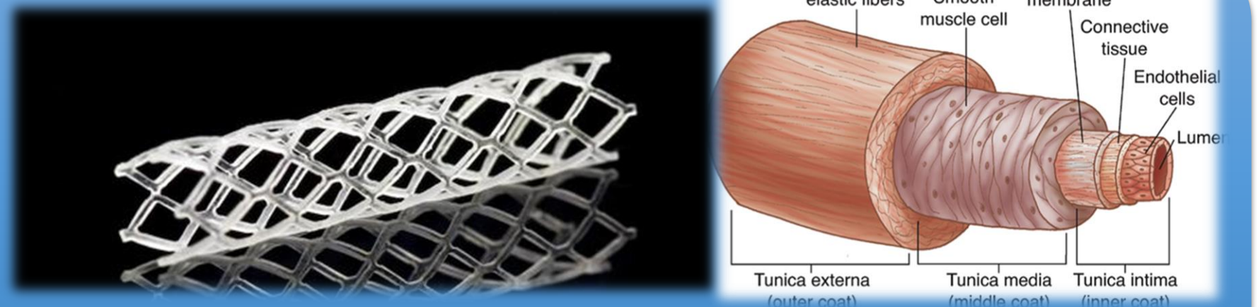
Nose stent



Ocular applications



Adv. drug delivery

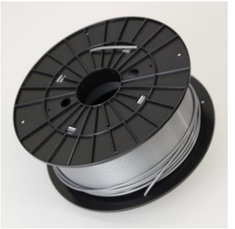


Vascular stent

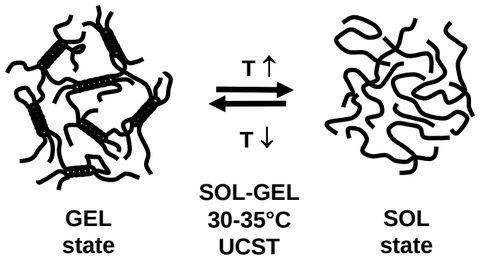
Wound dressing applications

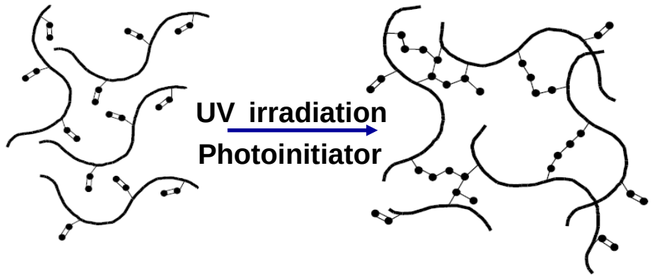
CURRENT MATERIAL RANGE @ PBM

- **Biodegradable polyesters**
  - **Commercial FDA approved: PLA, PCL, etc.**
  - **In-house synthesis PDLLA, PLAMA, PMA, etc.**

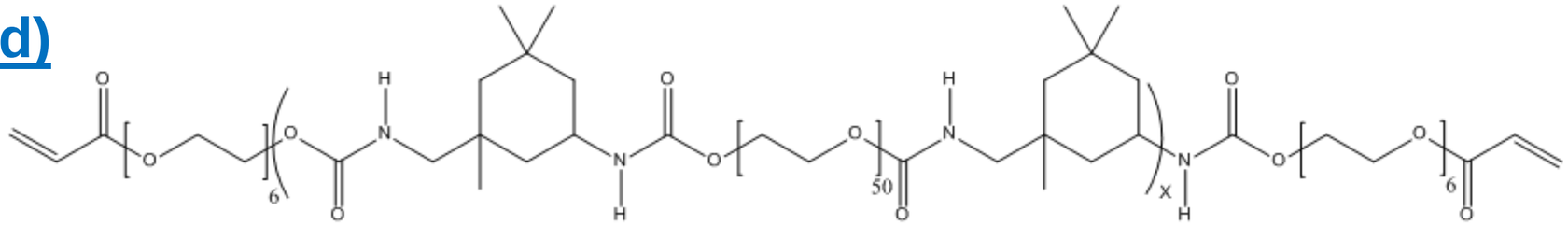


- **Photo-crosslinkable hydrogels: (modified) gelatin, (modified) alginate, etc.**





- **Acrylate end-capped urethane based (AUP) photocrosslinkable macromonomers (patented)**



Acrylate	Spacer	Diiso-cyanate	Backbone	Diiso-cyanate	Spacer	Acrylate

EQUIPMENT TOOLKIT


Spincoater


Plasma

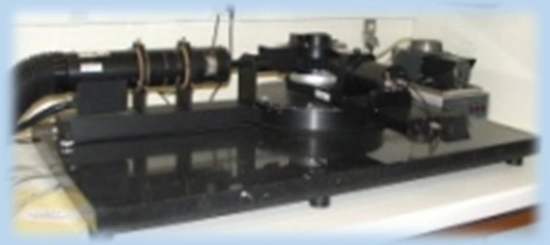
Surface Modification


ATR-FTIR


UV-vis

Chem. Struct. analisys


GPC


DLS/SLS

Molecular weight determination


ATR-imaging


XPS


Ellipsometer


AFM


SCA


QCM

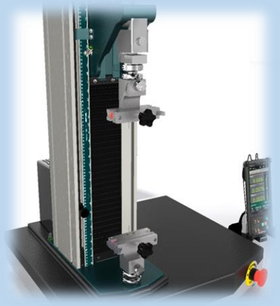
Surface Characterization


DVS


Rheometer


TGA


DSC


Mech. tester


Light microscope

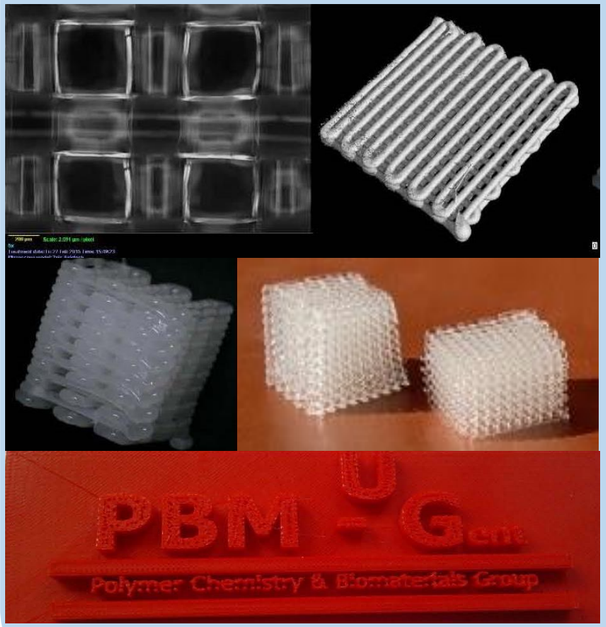

SEM


Texturo

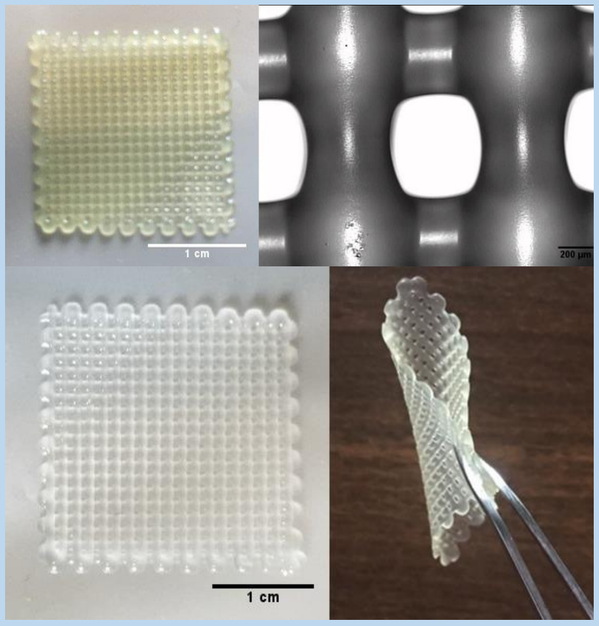
Physico-chemical and mechanical testing

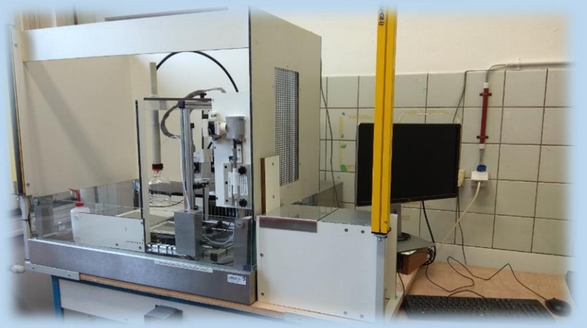
PROCESSING TECHNIQUES

ULTIMAKER

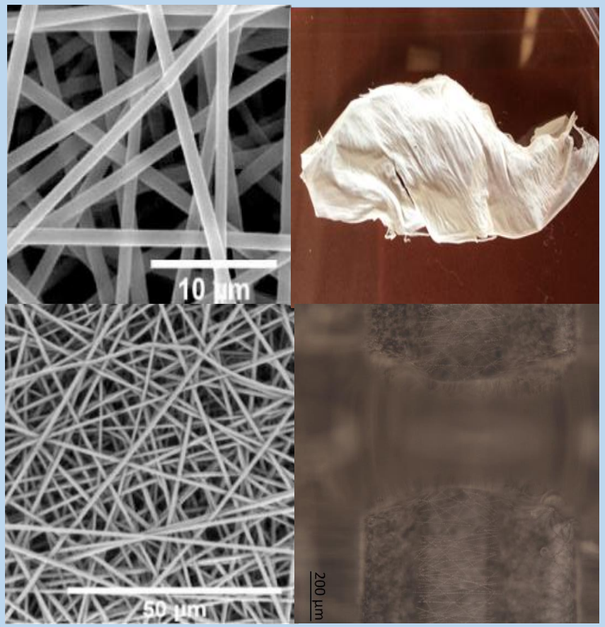


BIOPLOTTER

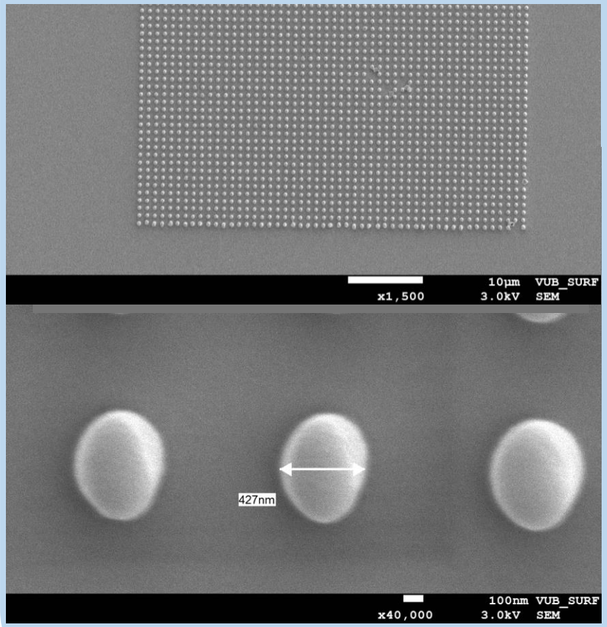




ES & ES/3D



2PP

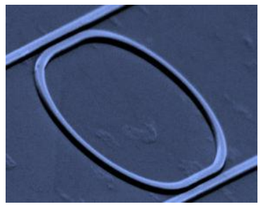
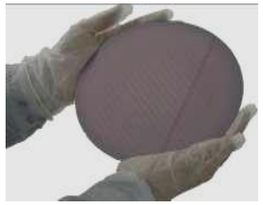
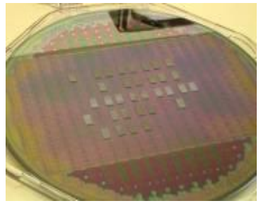


ACCESS VIA B-PHOT (VUB)

PRG

Photonics Research Group

PHOTONICS RESEARCH GROUP

Research Group of Ghent University

- Faculty of Engineering and Architecture
- Department of Information Technology (INTEC)
- Associated laboratory of IMEC
- Member of the Center for Nano- & Biophotonics (NB photonics)

Technology Research

- Photonic Integration: Systems on a chip
- On silicon: “Silicon Photonics”
- Enhanced with new materials:
  III-V, ferro-electrics, graphene, …

Applications

- High-speed telecom and datacom
- Sensing for life sciences: visible and Mid-IR
- Optical information processing

9 Professors

16 postdocs

50 PhD students

10 support staff

20+ nationalities

6 ERC grants

4 spin-off companies

50 journal papers/year

Class 100 clean rooms

M.Sc. Photonics program

GHENT UNIVERSITY · imec

EXPERTISE OF PHOTONICS RESEARCH GROUP

Expertise in relation to research domain (=photonic integration)

- Design of photonic ICs
- Fabrication of photonic ICs (collaboration with imec)
- Testing of photonic ICs
- Applications of photonic ICs (telecom, sensing, life science)

Expertise in relation to infrastructure

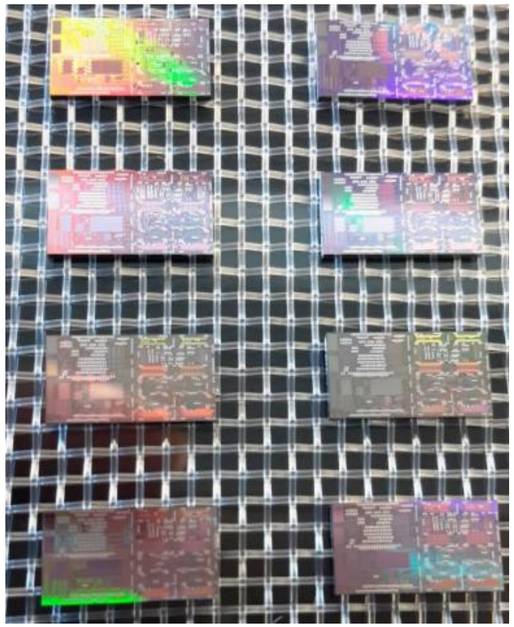
- Optical measurement labs
- Clean room technologies $\Rightarrow$ Namifab

Expertise in relation to general knowledge of optics and photonics

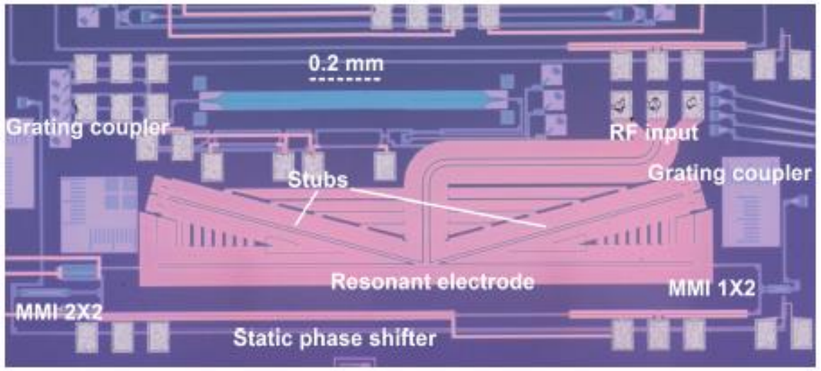
- Consulting

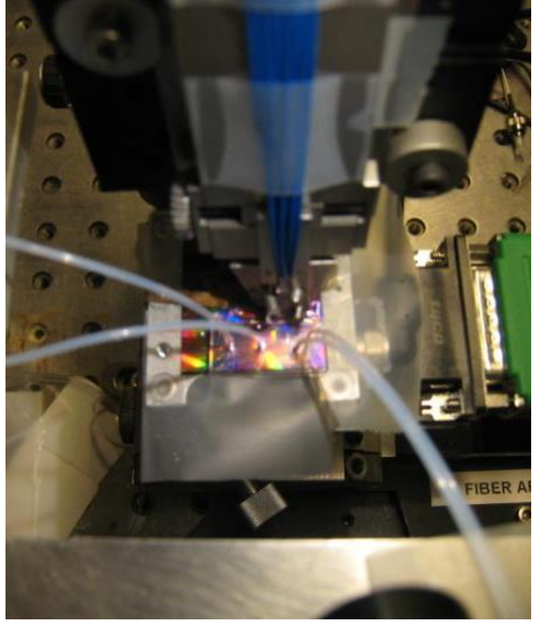
PHOTONIC IC EXAMPLES

Laser Doppler vibrometry

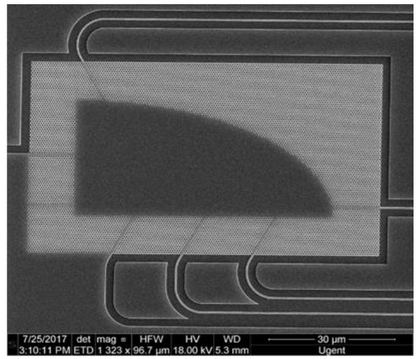


Microwave photonics

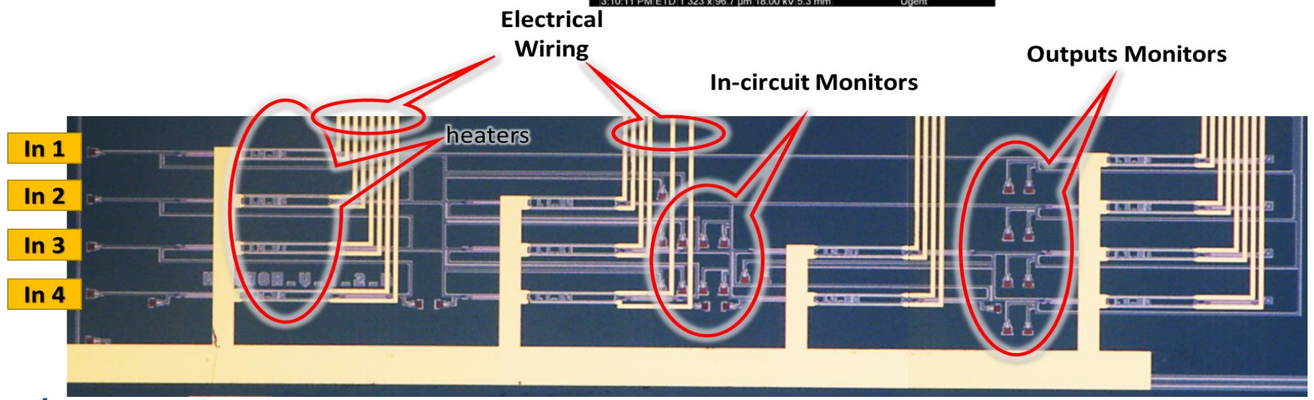




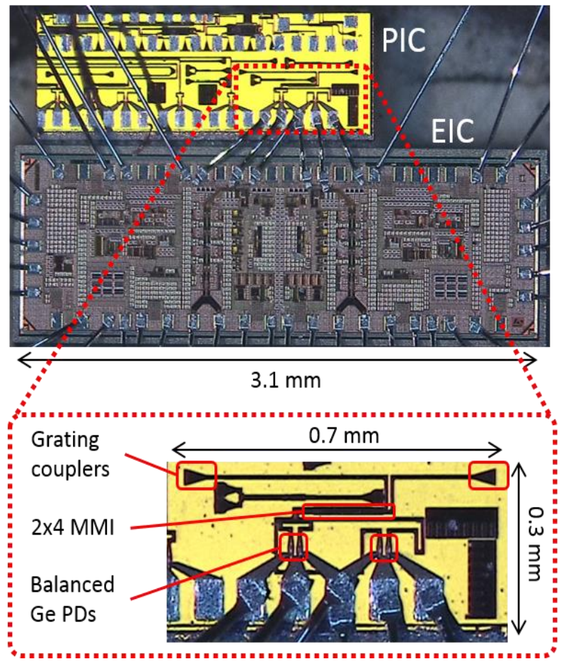
Glucose sensing



Neuromorphic computing



Programmable photonic circuits



40GBaud coherent receiver

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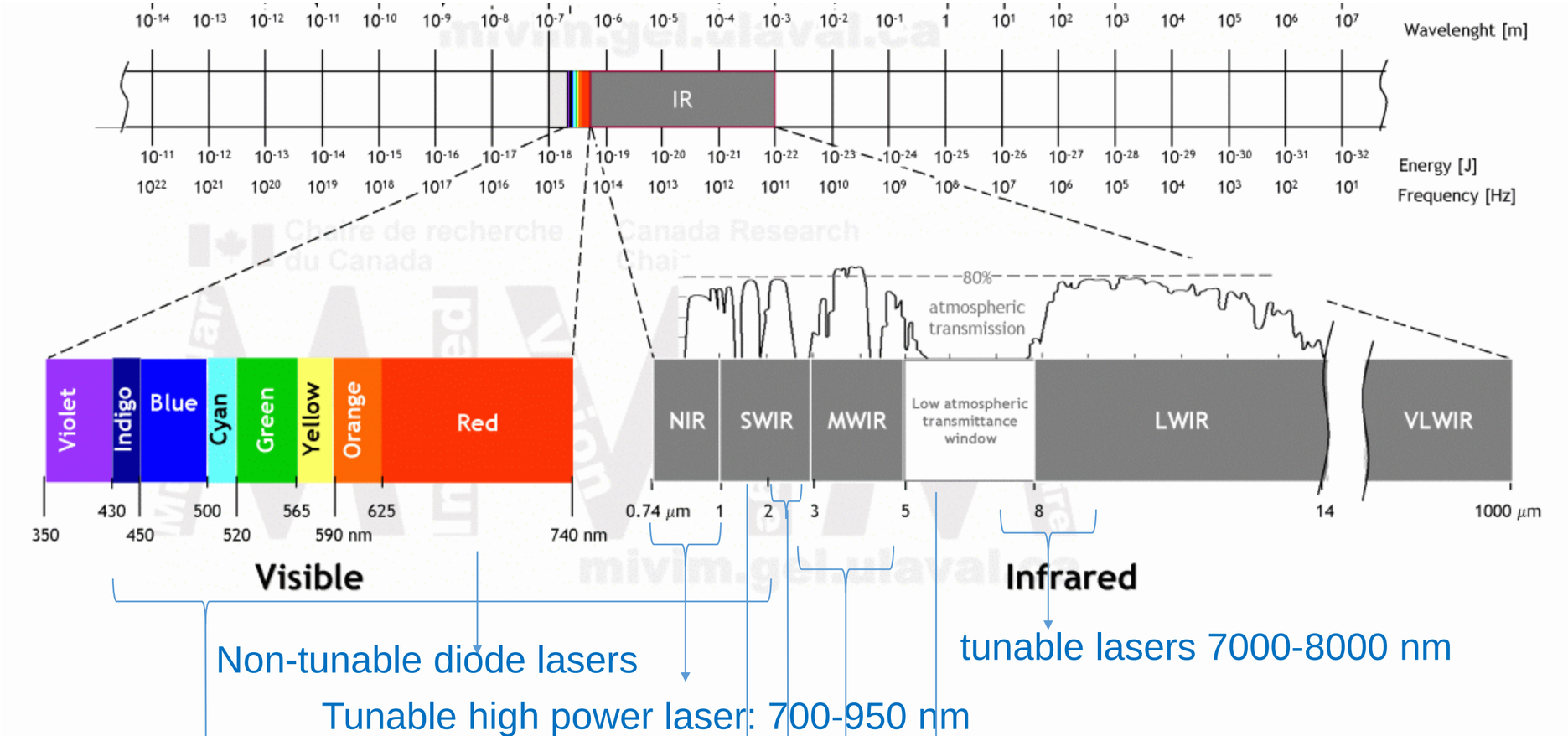
Center for Nano- and Biophotonics
Ghent University

GHENT UNIVERSITY

OPTICAL CHARACTERIZATION - SOURCES



Non-tunable diode lasers

Tunable high power laser: 700-950 nm

High power tunable lasers 1450-1650 nm

High power broadband Supercontinuum source 400-2000 nm

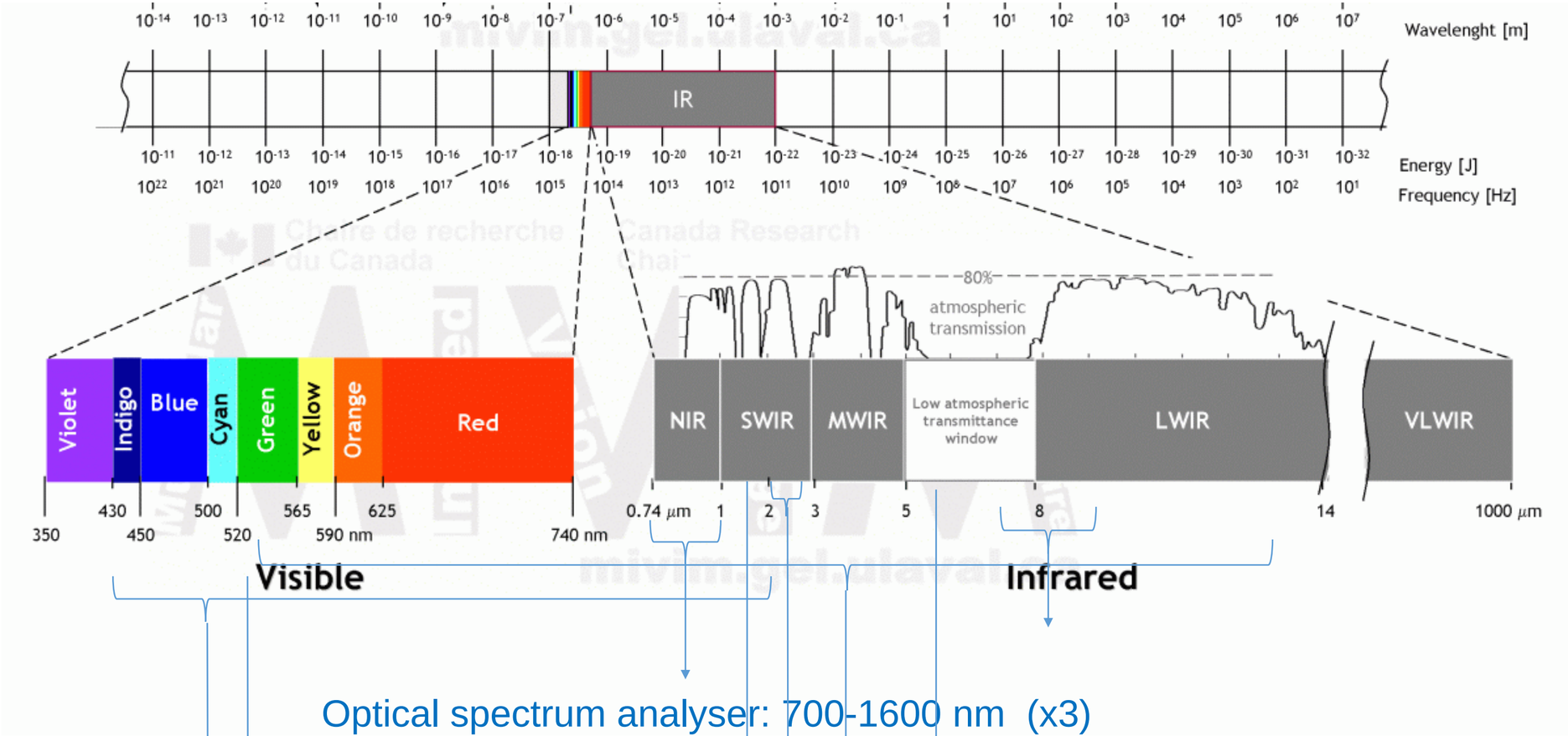
High power tunable lasers 2000-2500 nm

High power tunable lasers 2000-4000 nm

tunable lasers 7000-8000 nm

High power tunable lasers 5100-5300 nm

OPTICAL CHARACTERIZATION - SOURCES



Optical spectrum analyser: 700-1600 nm (x3)

20G-40G photodiodes 1450-1650 nm

Optical spectrum analyser
400-1600 nm

Low power Power detectors 1300-1600 nm

10 bit DAC FTIR 400-10000 nm

very low power Raman detector (500 -1000 nm)

Low power Power detectors 3000-5000 nm

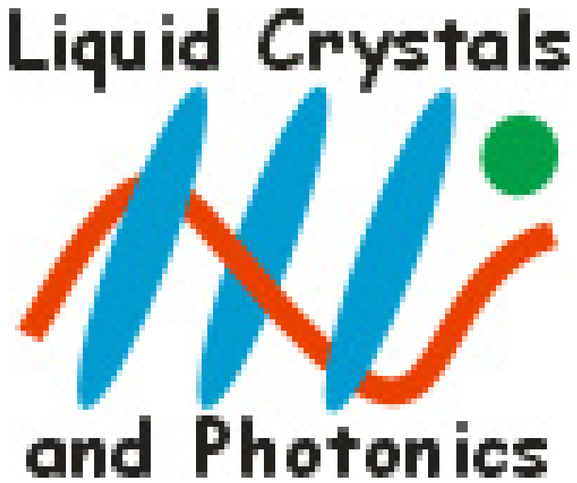
AT TELECOM WAVELENGTHS (1300-1550 NM)

- Various tunable lasers and filters (@1300nm and @1550nm)
- High bandwidth detectors (45 GHz) and receivers (40 Gb/s)
- Erbium Doped Fiber Amplifiers (λ-range: 1530-1610 nm) and Semiconductor Optical Amplifiers (@ 1300nm)
- Optical intensity and phase modulators (40 Gb/s, for 1300 and 1550 nm)
- Plus high speed cables, connectors, probes,....

SIGNAL GENERATION AND PROCESSING

- Pulse Pattern Generators and Error Detectors (Anritsu: 2 x 9.9-12.5 Gb/s, Alnair: 19.5-21 and 39-43 Gb/s)
- Digital sampling oscilloscopes (Tektronix 30 GHz, LeCroy 100GHz scope, with IDLab-Design: Keysight 67 GHz)
- Keysight 32 Gbaud Arbitrary Waveform Generator (with IDLab-Design)
- Electrical spectrum analysers and RF generators up to 44 GHz (Rohde&Schwarz, Agilent)

LCP



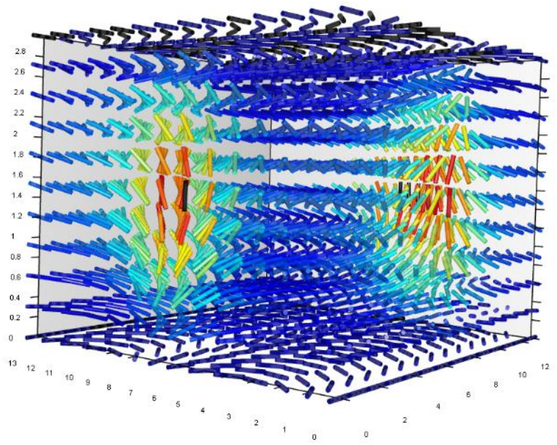
LIQUID CRYSTALS AND PHOTONICS GROUP

Technology	Characterization	Modeling
• Liquid Crystals • OLEDs • Piezo-layers • Thin films • ALD • photo-alignment and phase gratings	• Polarization microscopy • Spectroscopy • E-O switching • Optical trapping microscopy • E-ink switching • Solar cells	• LC director • LC transmission • OLED optics • E-ink switching • Particle trapping • Interference microscopy

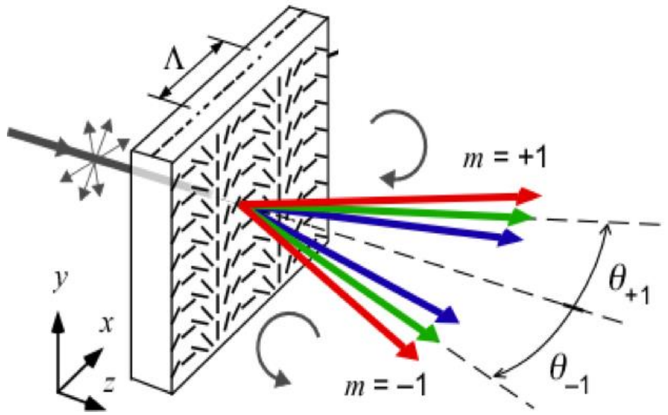
LIQUID CRYSTAL DEVICES

Surface photo-alignment

& 3D structures

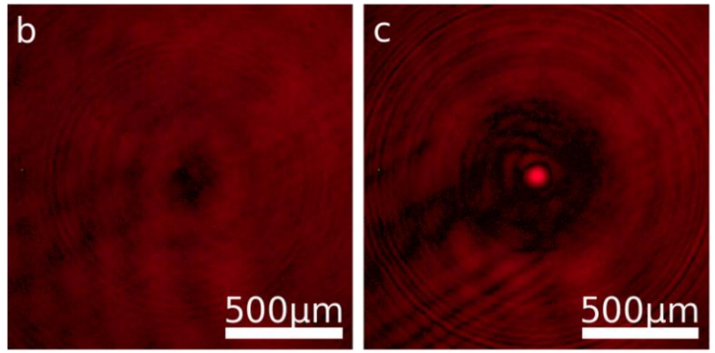


Phase gratings (>95% diffraction)

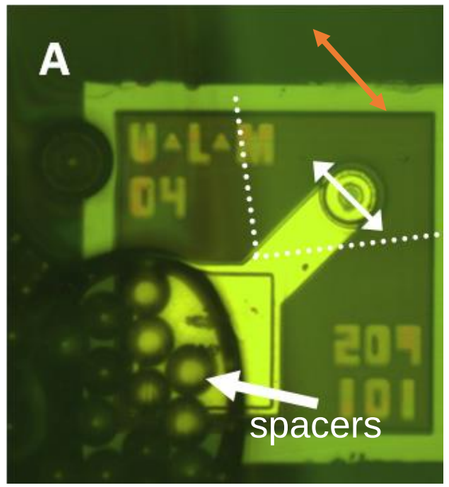


Filters

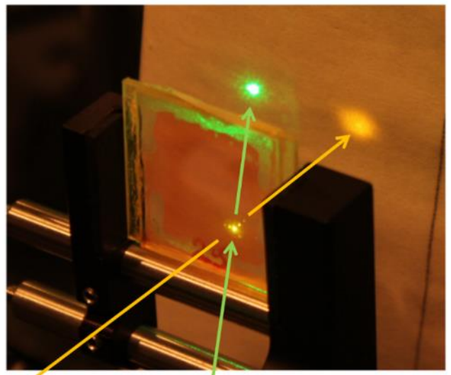
Lenses



VCSEL tuning



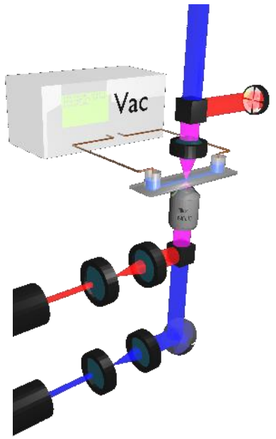
Lasers



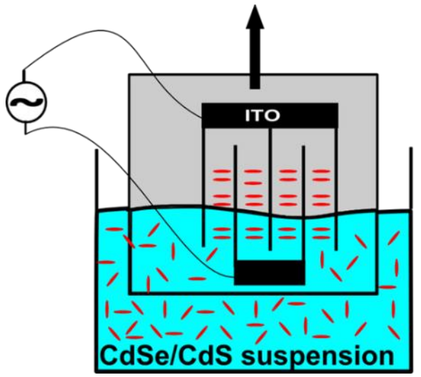
PARTICLE MANIPULATION AND CHARACTERIZATION

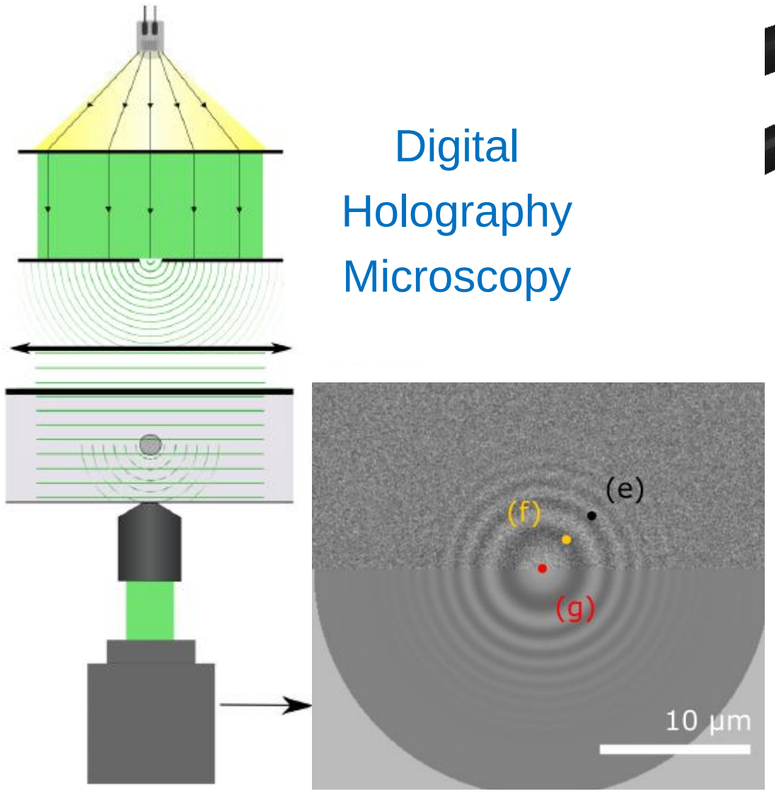
- Fluorescence/Confocal microscopy
- Optical tweezers
- Advanced illumination
- particle scattering, transport simulation

Optical manipulation of colloidal particles



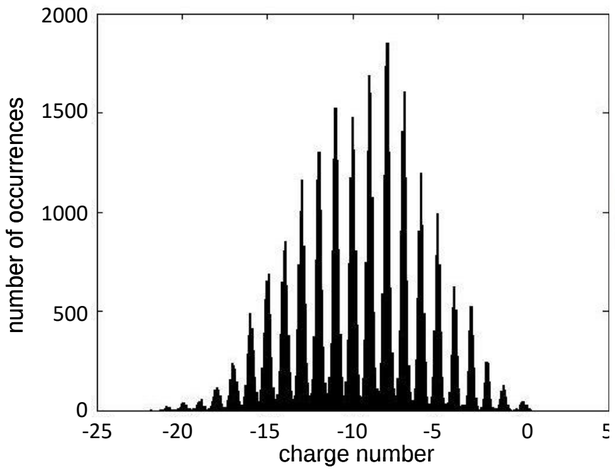
particle orientation

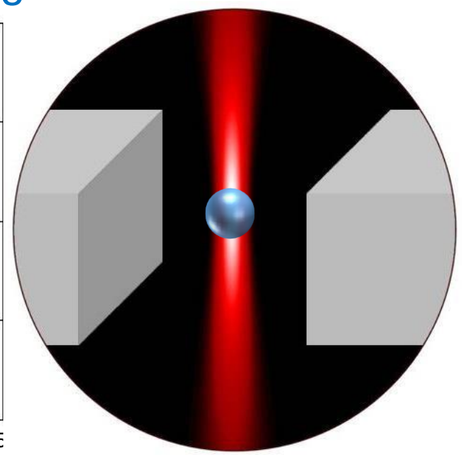




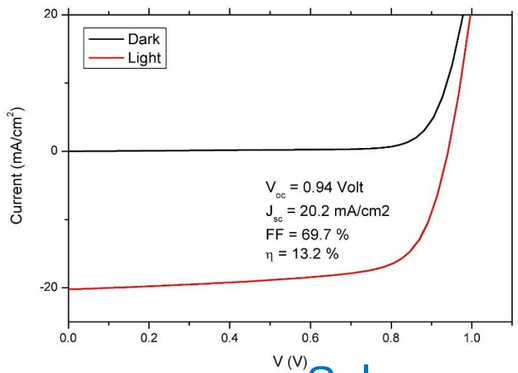
Digital Holography Microscopy

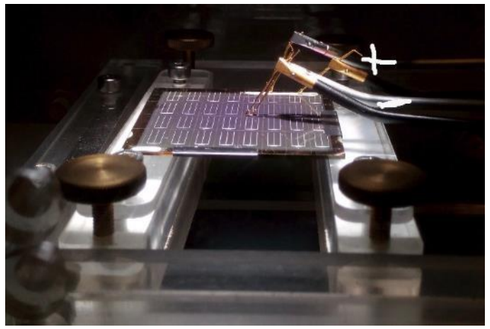
Accurate force and charge measurements



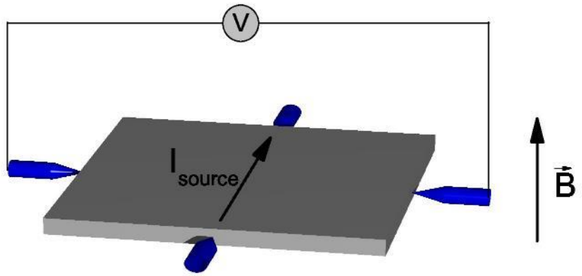


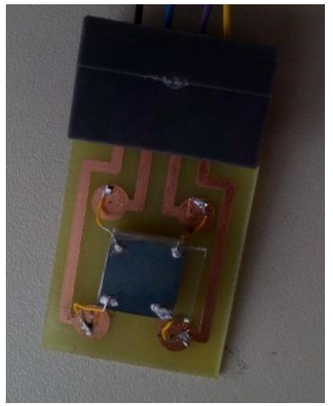
CHARACTERIZATION OF SOLAR CELLS



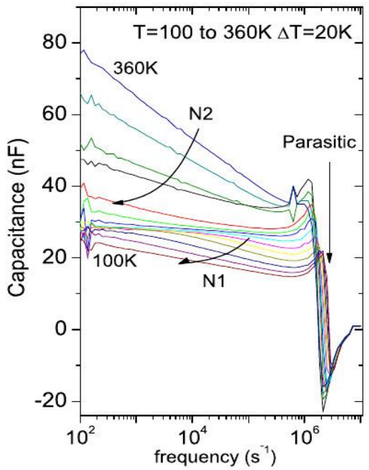


Solar spectrum simulator

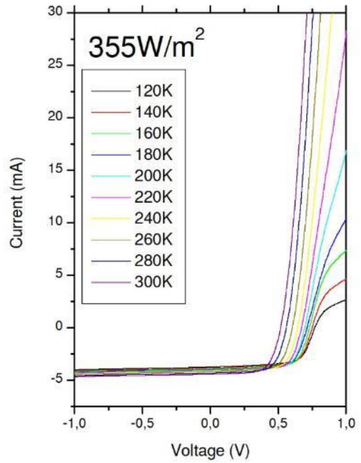




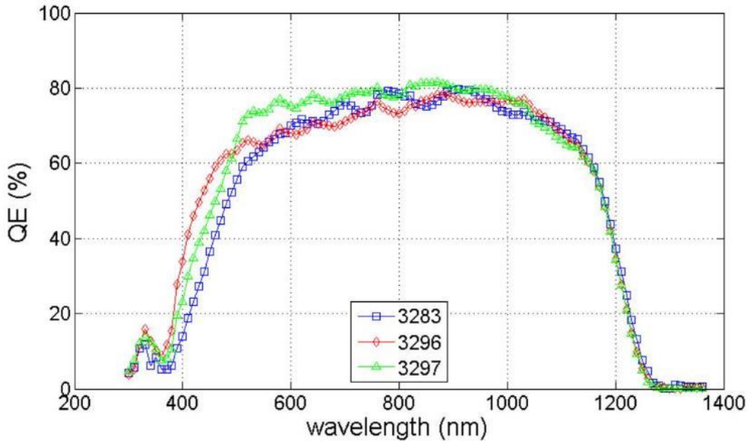
Resistivity and Hall measurements



Admittance spectroscopy

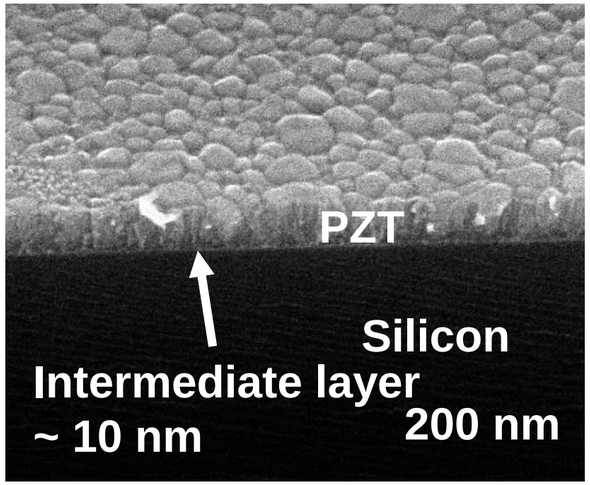


IV as a function of light Intensity and temperature



External Quantum Efficiency measurements

PIEZO-ELECTRIC MATERIALS



PZT (= $PbZr_xTi_{1-x}0_3$)

High quality thin film on glass or Si

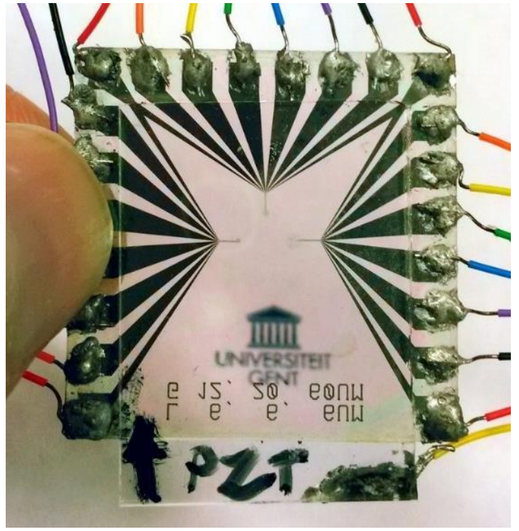
Piezo-electric

Ferro-electric: high dielectric constant

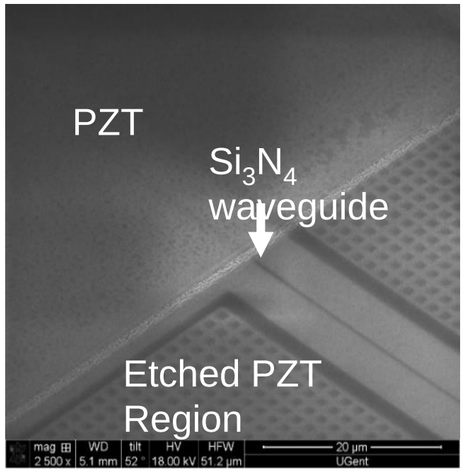
Strong electro-optic effect

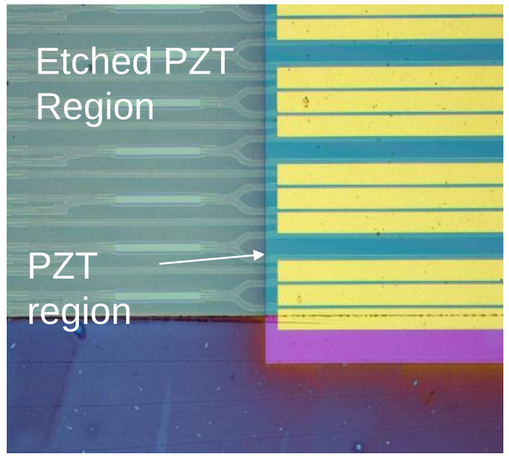
Strong optical nonlinearity

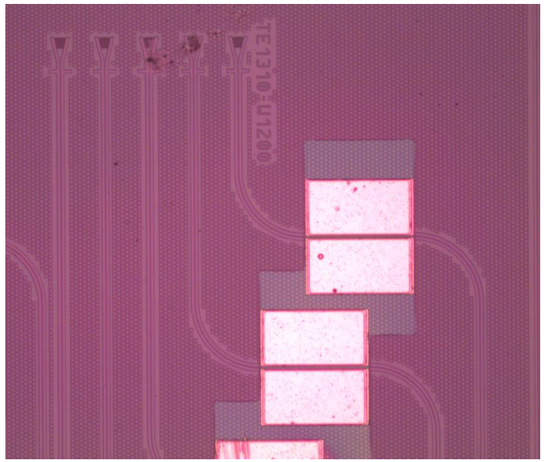
PZT in liquid crystal lenses



High speed electro-optic modulators on SiN or Si waveguides

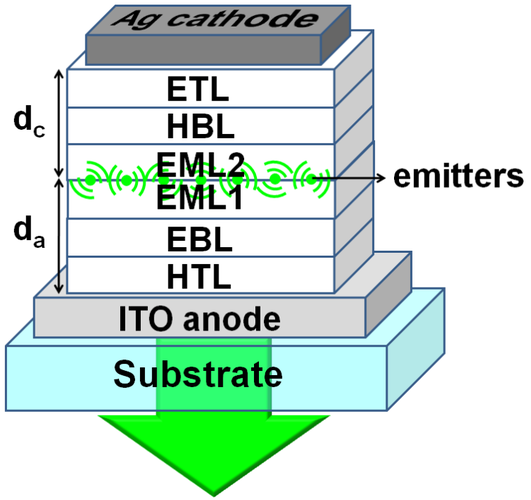


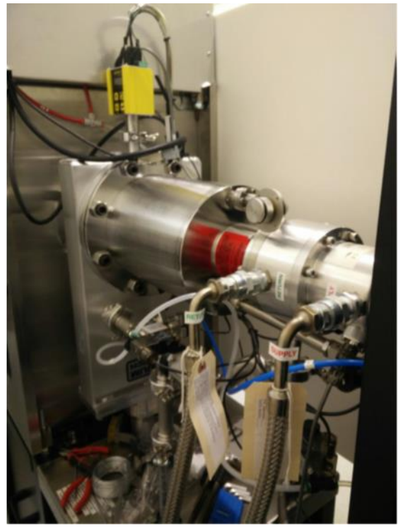


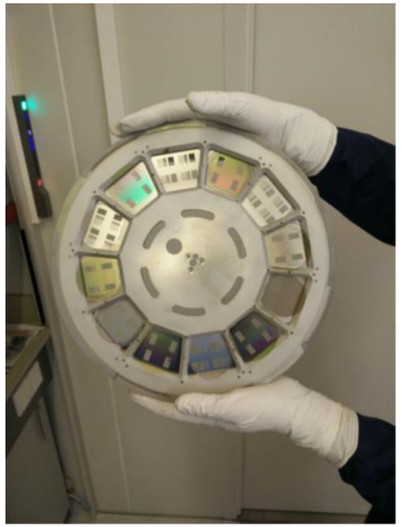


ORGANIC LIGHT EMITTING DIODES (OLEDS)

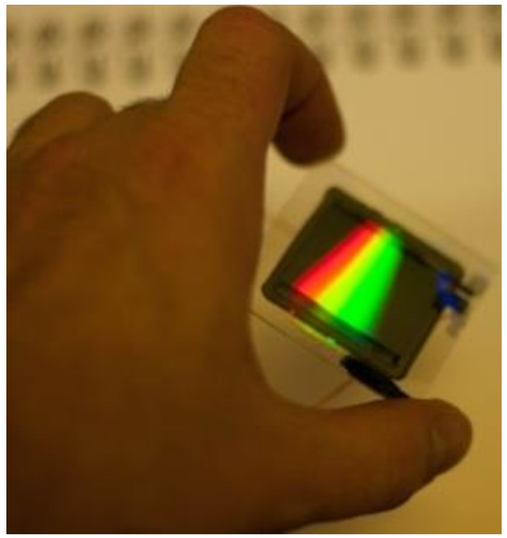
OLED deposition

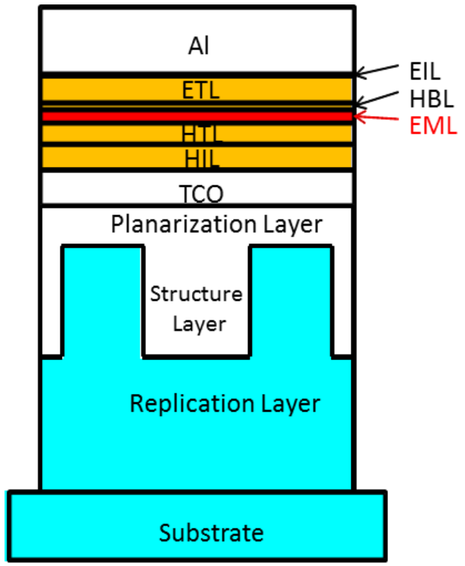






Improve light extraction
by diffraction grating





Nano & Biophotonics

EXPETISE AND RESEARCH

NanoBioTechnology group (A Skirtach). Now at the Campus Coupure -> Campus Proeftuin (naast Ghelamco arena).

Nano-Bio-materials

– Particulate (nano- and micrometer) drug delivery carriers.

Research activities in the area of microcapsules and particles stem from earlier activities of prof. Skirtach, while he was still at Max-Planck Institute, where the polymeric capsules had been invented. The capsules are made by sequential deposition of polymers on the surface of particles, which serve as templates and which are subsequently removed (by dissolution) without affecting the polymeric shell. Different application areas of microcapsules are currently pursued, particularly noticeable are those in biomedicine. The group of prof. Skirtach pursues development of next generation of drug delivery carriers and other applications in biomedicine and bio-engineering.

– Coatings for cell growth and tissue engineering.

An essential novelty, which is unique to our group, is to combine research on films with that on particles for creating novel surfaces and: a) assuring drug delivery; b) controlling the release; c) enhancing and controlling mechanical properties for facilitating cell and tissue growth. Two types of coatings are investigated: those based on polymers and those based on hydrogels. Cell adhesion studies are aimed at the end goal – designing of versatile coatings for tissue engineering.

Microscopy

– The Faculty of Bioscience Engineering and University possesses a state of the art imaging center. Two recent developments at the Faculty have important implications for this area. First, the Light Microscopy Division (LiMiD) has been setup at the Faculty coordinated by the Department of Molecular Biotechnology, to which the applicant's group belongs. The center is focused on fluorescence microscopy techniques, more specifically fluorescent bright-field and confocal light microscopy. Together with a scanning electron microscope (SEM), these developments are directed towards establishment of a more broad image acquisition facilities at the Faculty and University-wide.

EXPETISE AND RESEARCH

– Microscopy (1): LiMiD (with input from W. De Vos)

WIDEFIELD MICROSCOPY

NIKON TE-2000

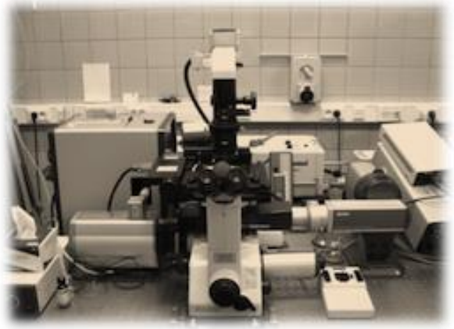
AUTOMATED ND ACQUISITION
MICROMANIPULATION

NIKON Ti

ROUTINE SCREENING
AUTOMATED ND ACQUISITION

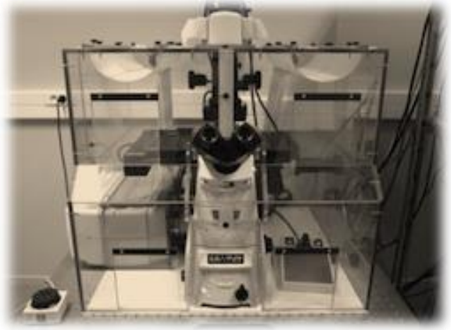
CONFOCAL MICROSCOPY

BIORAD RADIANCE

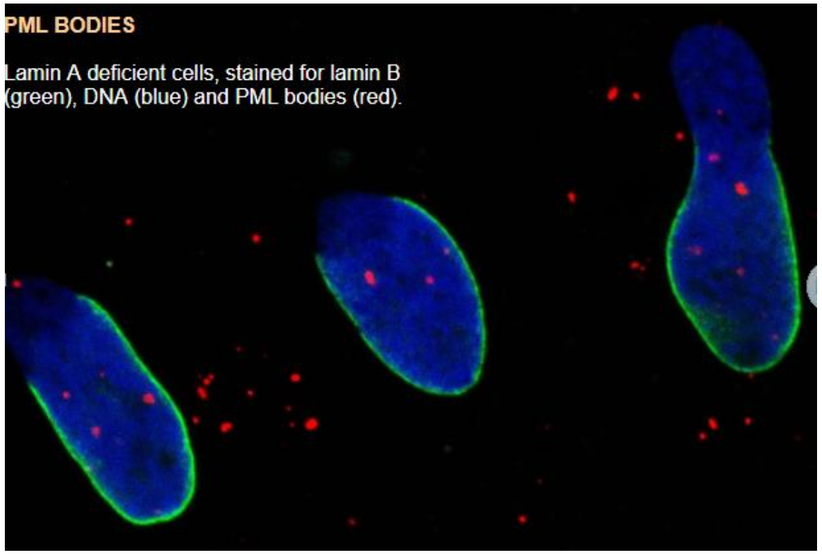


SIMPLE CONFOCAL APPLICATIONS
TWO-PHOTON: DEEP TISSUE

NIKON A1r

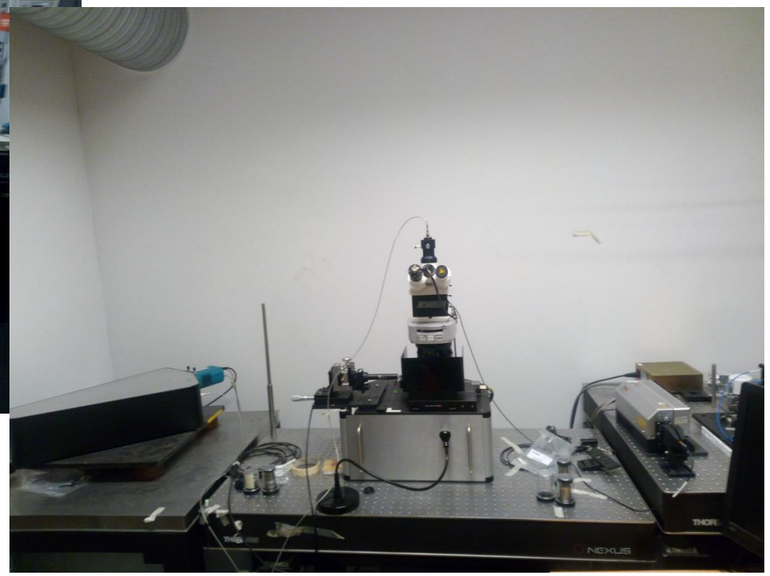


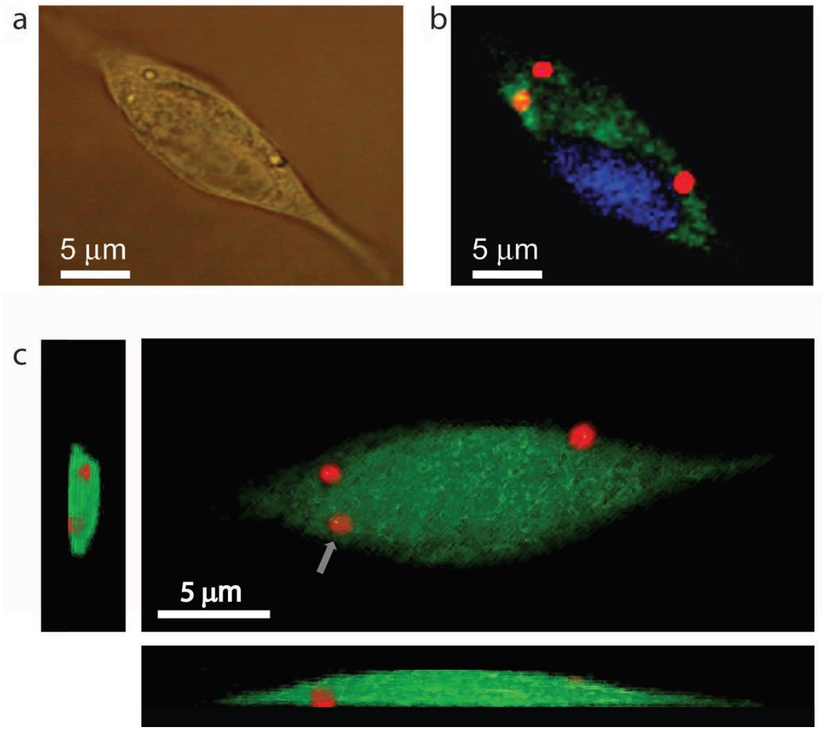
LIVE CELL IMAGING
ADVANCED CONFOCAL APPLICATIONS



EXPETISE AND RESEARCH

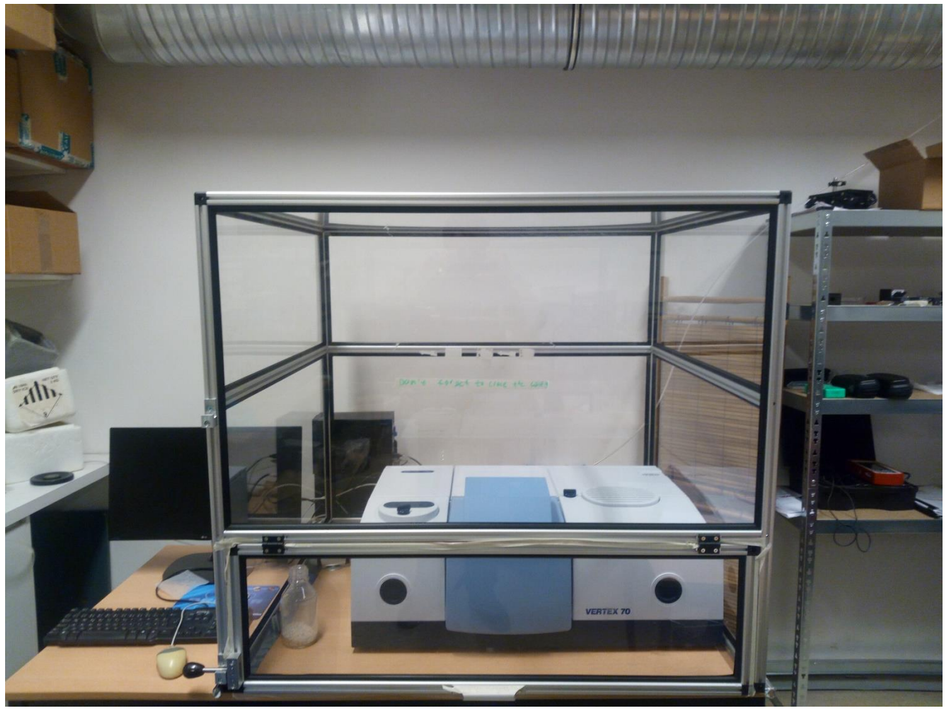
- Microscopy (2): Raman – MODULAR <- equipped with an optical table

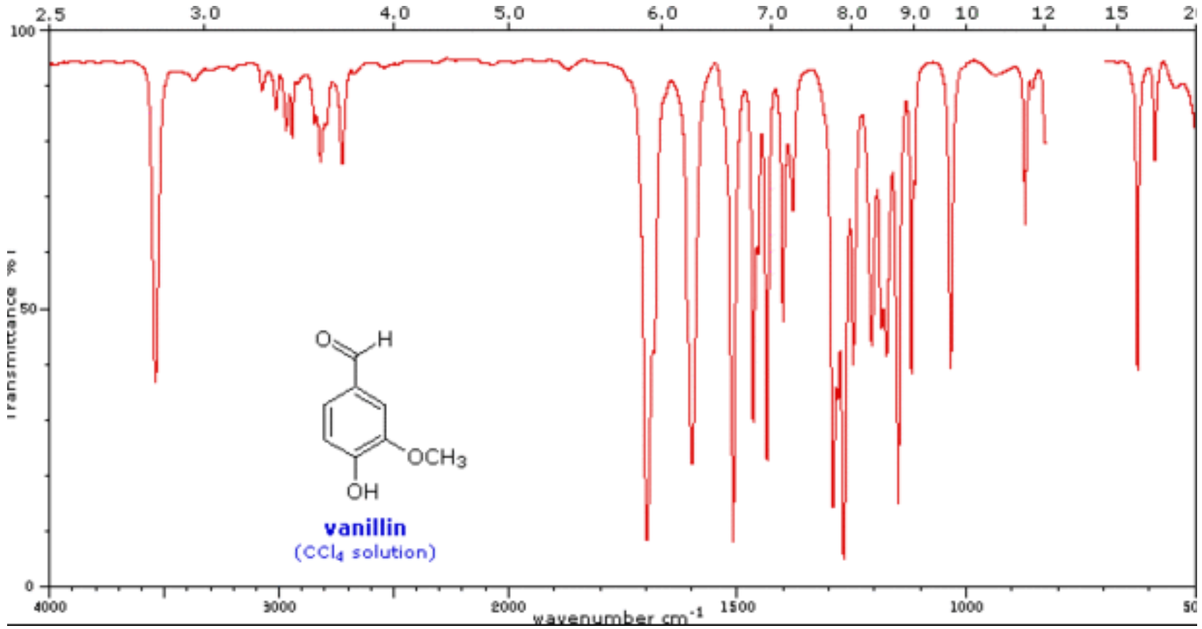




EXPETISE AND RESEARCH

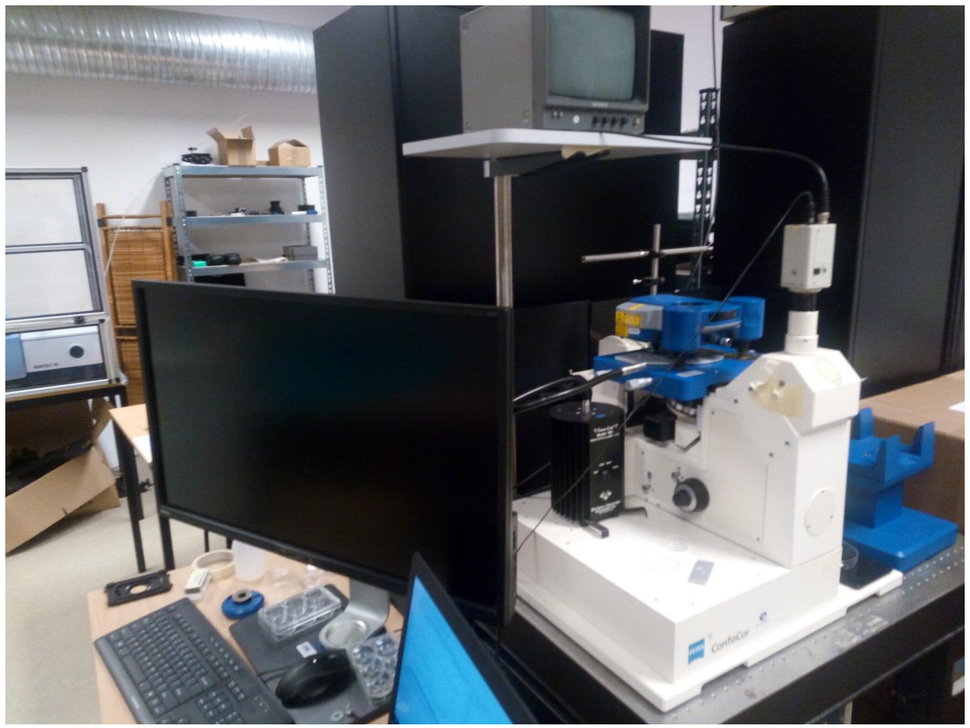
– Microscopy (3): FTIR



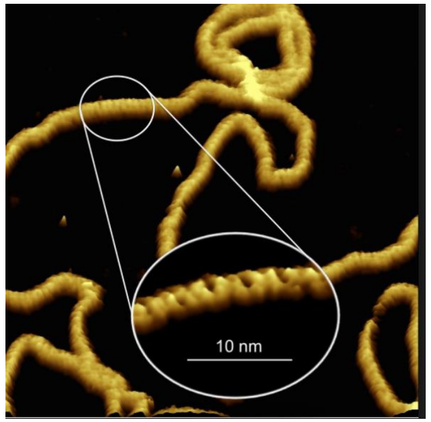


EXPETISE AND RESEARCH

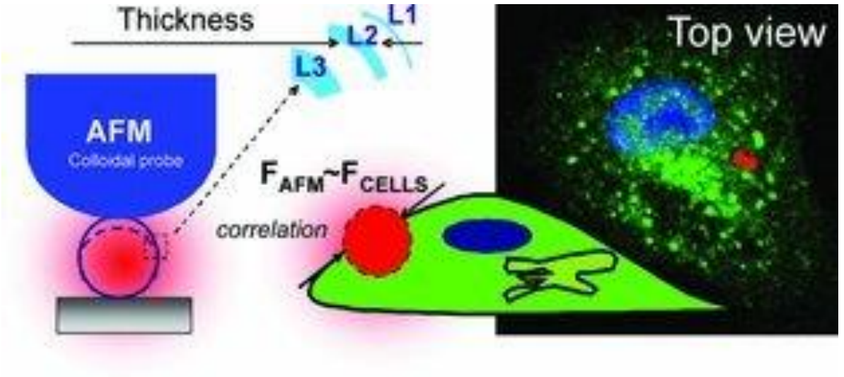
– Microscopy (3): FTIR



Nanotopography



Mechanical properties



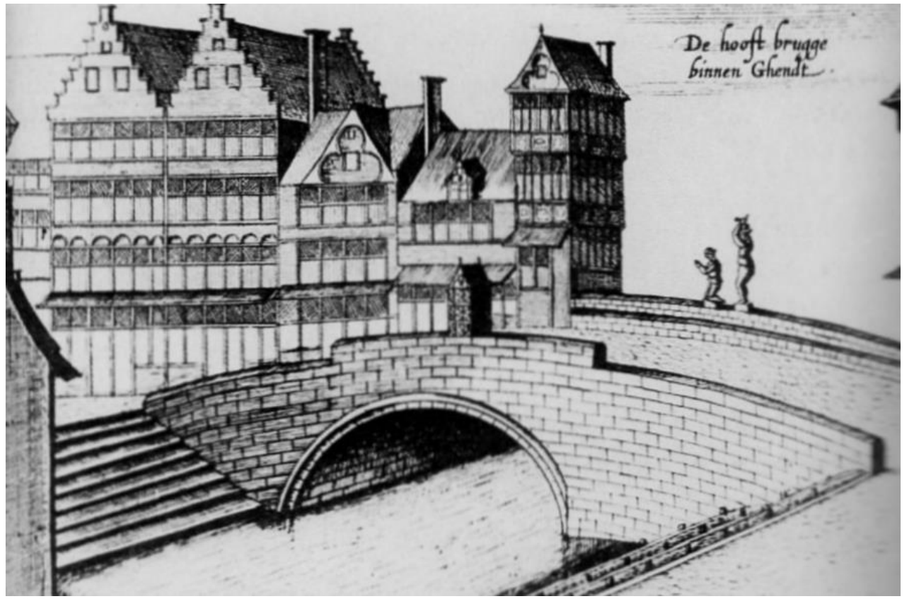
EXPETISE AND RESEARCH

– Approach

Could be a partner on measurement and Nanosciece

Could be a partner on Biotechnology

Could also be a *bridge* between measurement & medicine, biology, plants



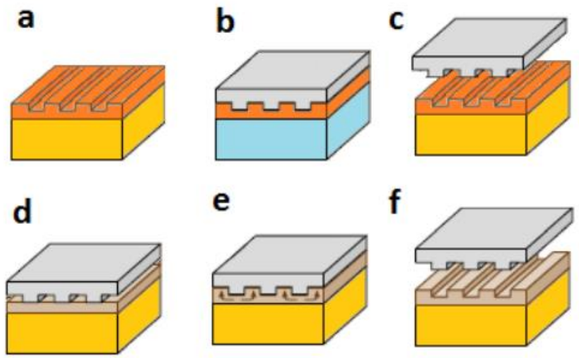
Thank you for attention!

CMST

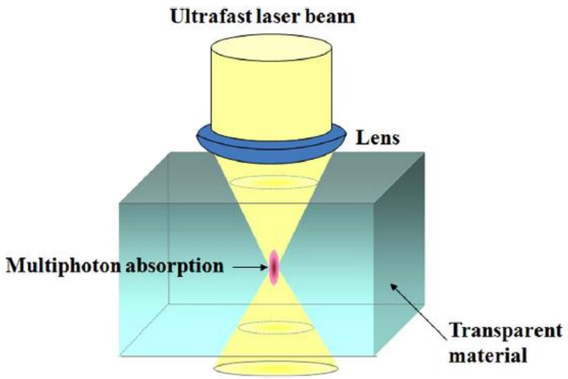
Centre for Microsystems Technology

CENTRE FOR MICROSYSTEMS TECHNOLOGY

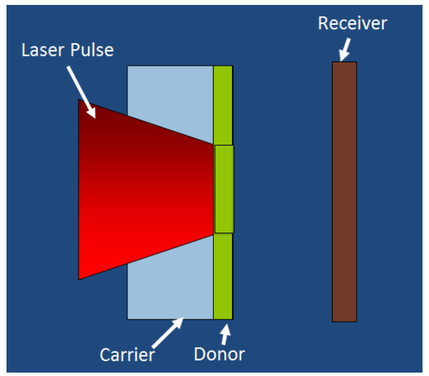
Expertise on printing technologies for photonics fabrication



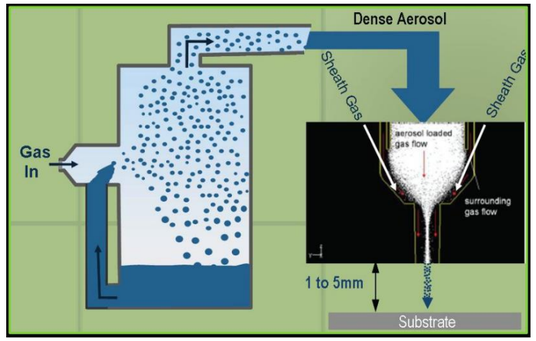
micro-/nano-imprinting: polymer photonics



femtosecond laser direct writing: 3D glass photonics



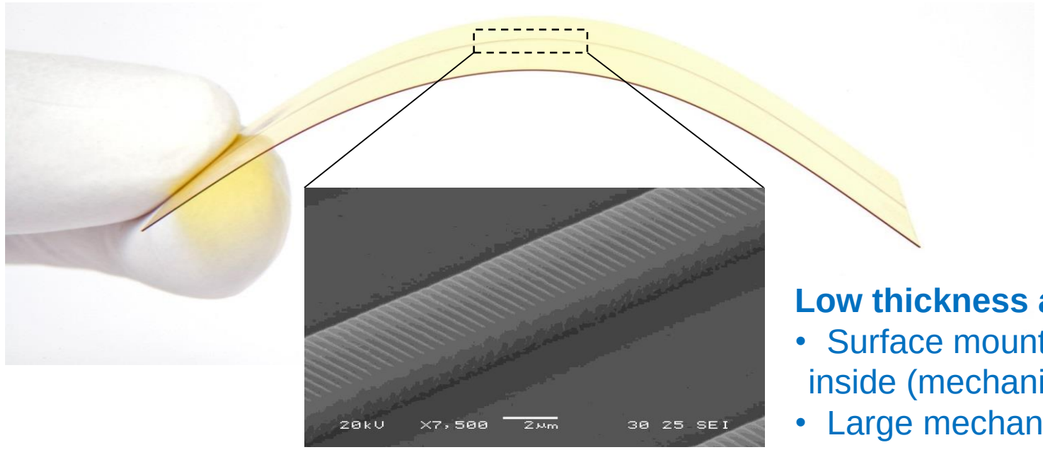
laser transfer printing: material or component assembly



aerosol jet printing: photonics-electronics integration

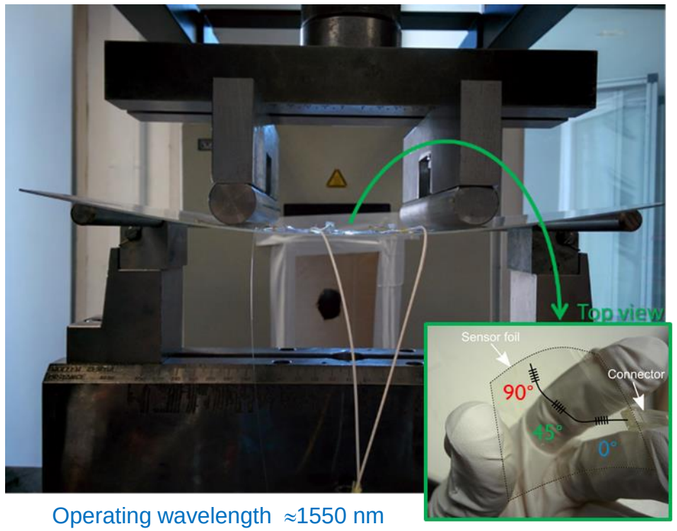
POLYMER NANOPHOTONIC SENSORS

Ultra-thin foil-based sensors for measuring e.g. strain, pressure or temperature



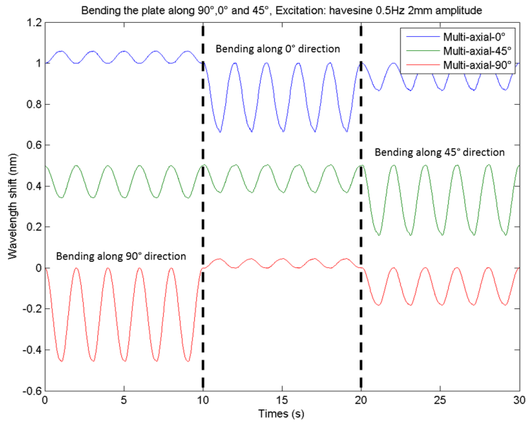
Low thickness allows:

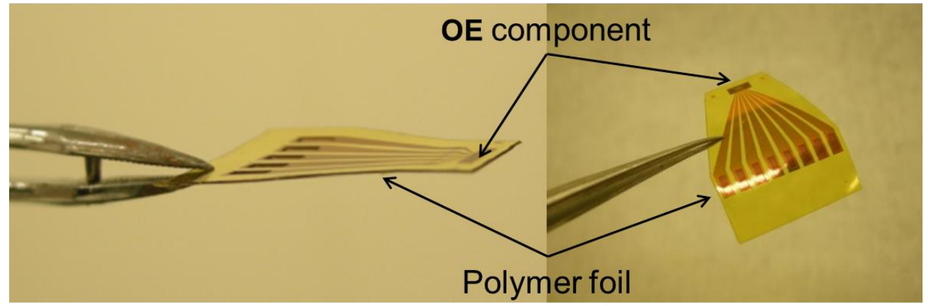
- Surface mounting or embedding inside (mechanical) structures
- Large mechanical deformations



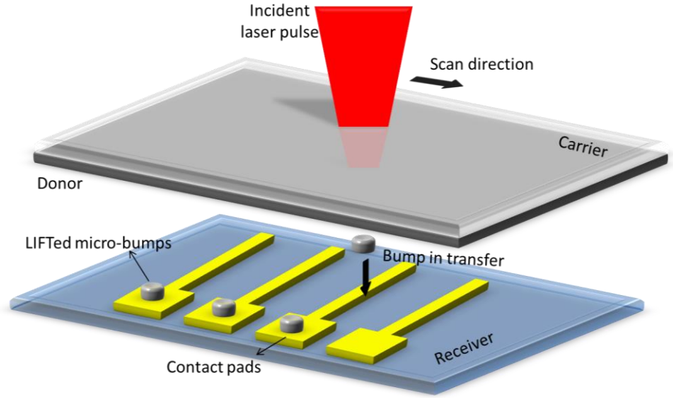
Operating wavelength ≈1550 nm

3 sensors: 0°, 45° and 90° oriented





Photodiode / laser integration in thin foils



(laser based) flip-chip integration

Optical sensor ⇄ **Miniaturized Readout**

In collaboration with UGent / MaTCh

nb-photonics Center for Nano- and Biophotonics Ghent University

GHENT UNIVERSITY

3D GLASS PHOTONICS

Monolithic integration of microphotonic waveguides and microfluidic channels in fused silica

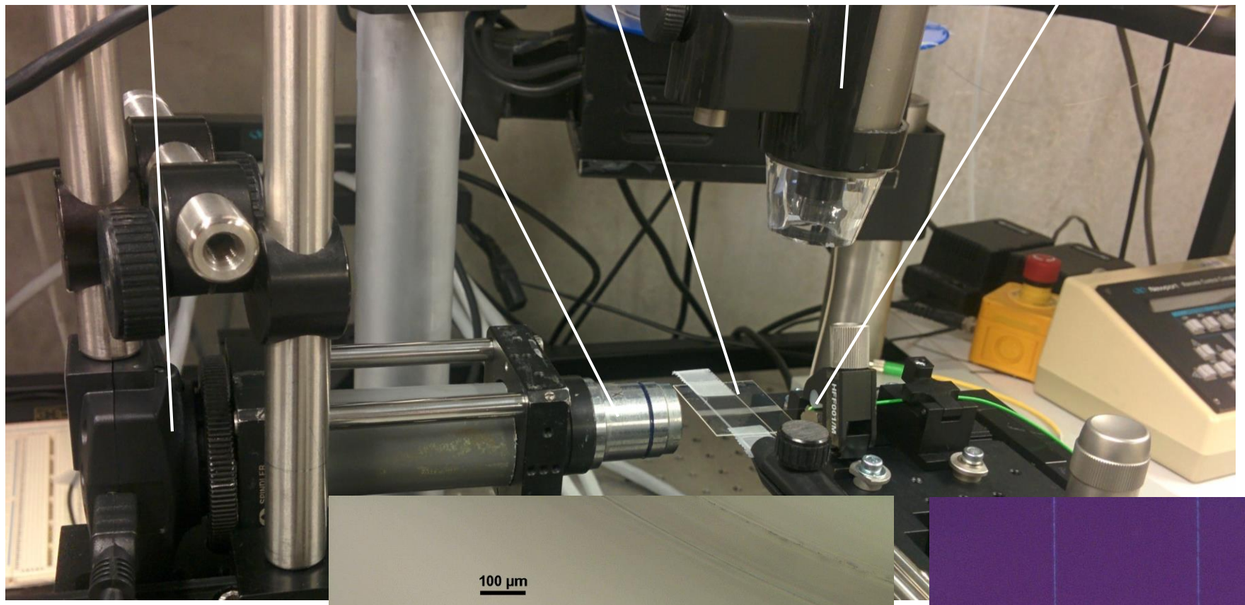
Side camera

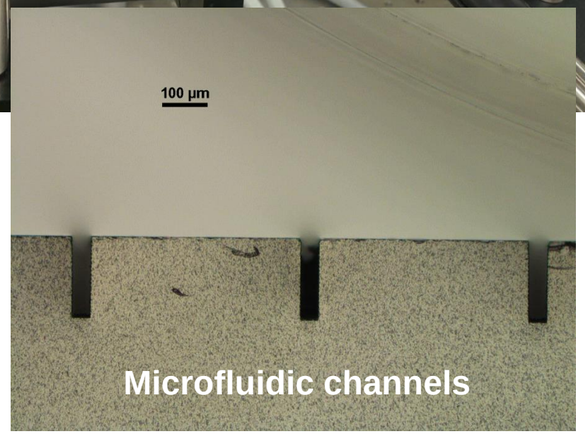
Objective

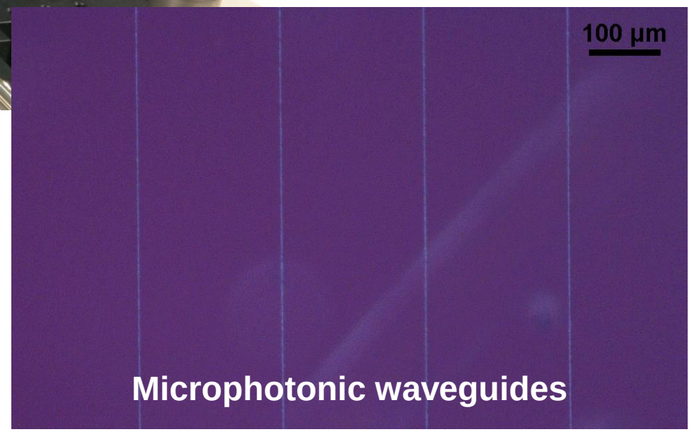
Printed WG

Top camera

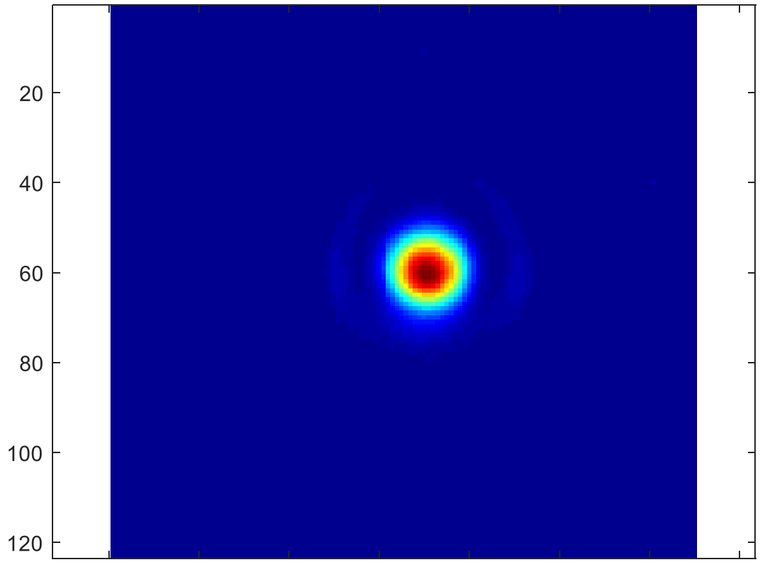
SMF IN





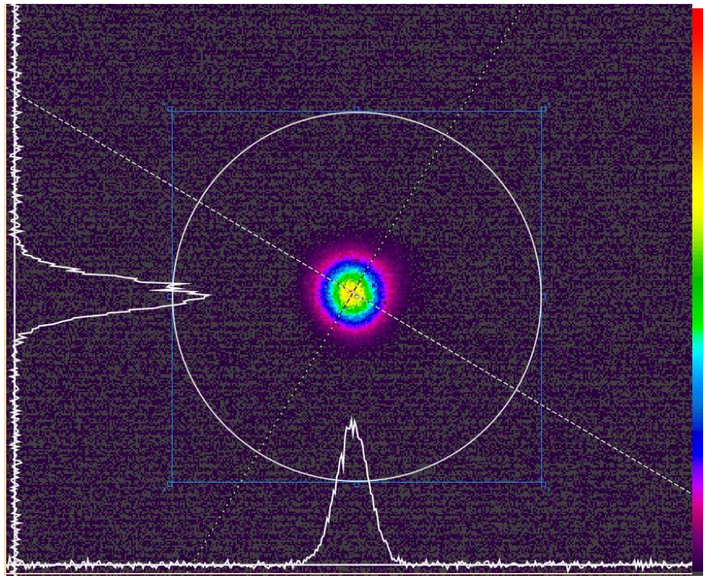


Xenics XEVA822 IR camera with x100 objective



10.4 µm MFD @ 1550nm

Spiricon SP620U Beam profiler

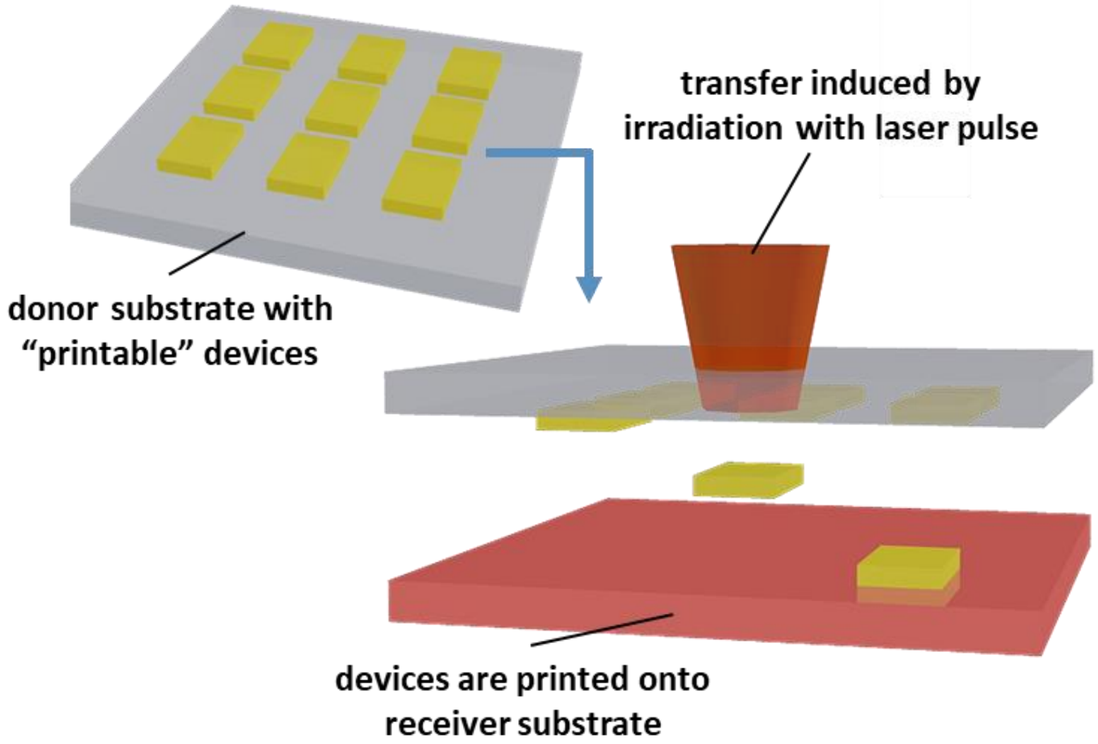


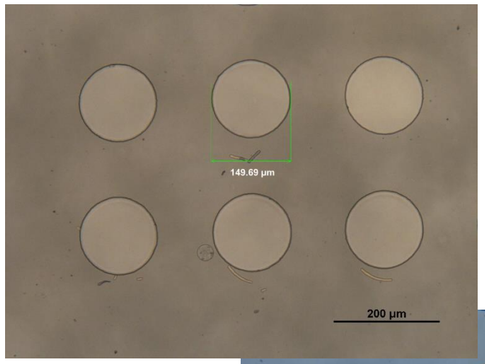
7 µm MFD @ 635nm

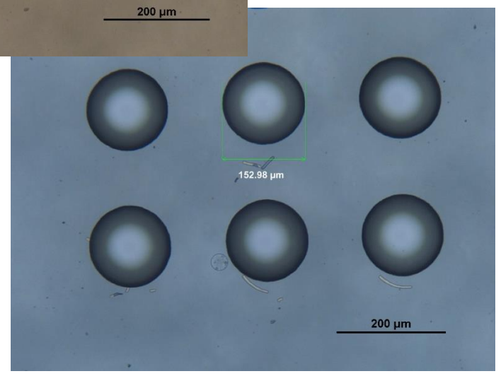
In collaboration with UGent / PRG

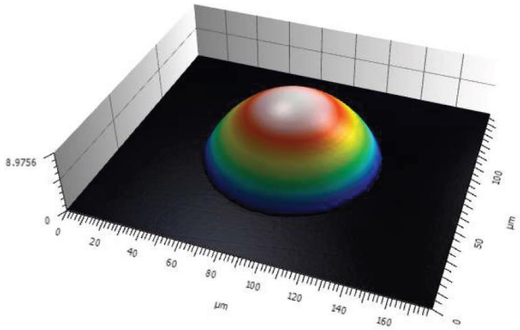
MATERIAL OR COMPONENT ASSEMBLY

Laser-induced forward-transfer for selective and high-speed transfer and assembly



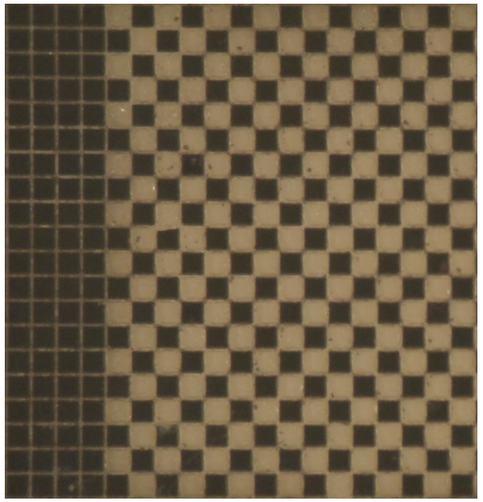


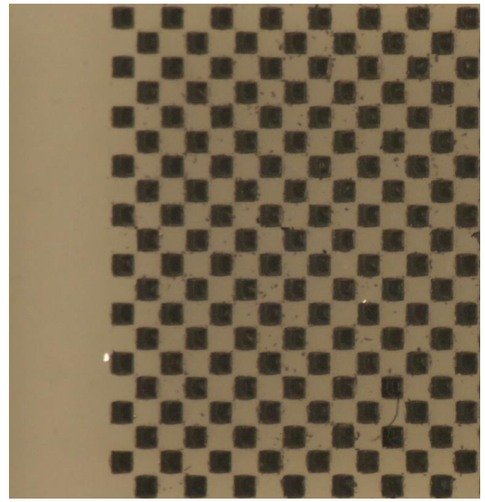




Transfer of polymer disks, forming spherical shaped lenses after thermal reflow on the receiver

In collaboration with UGent / PRG

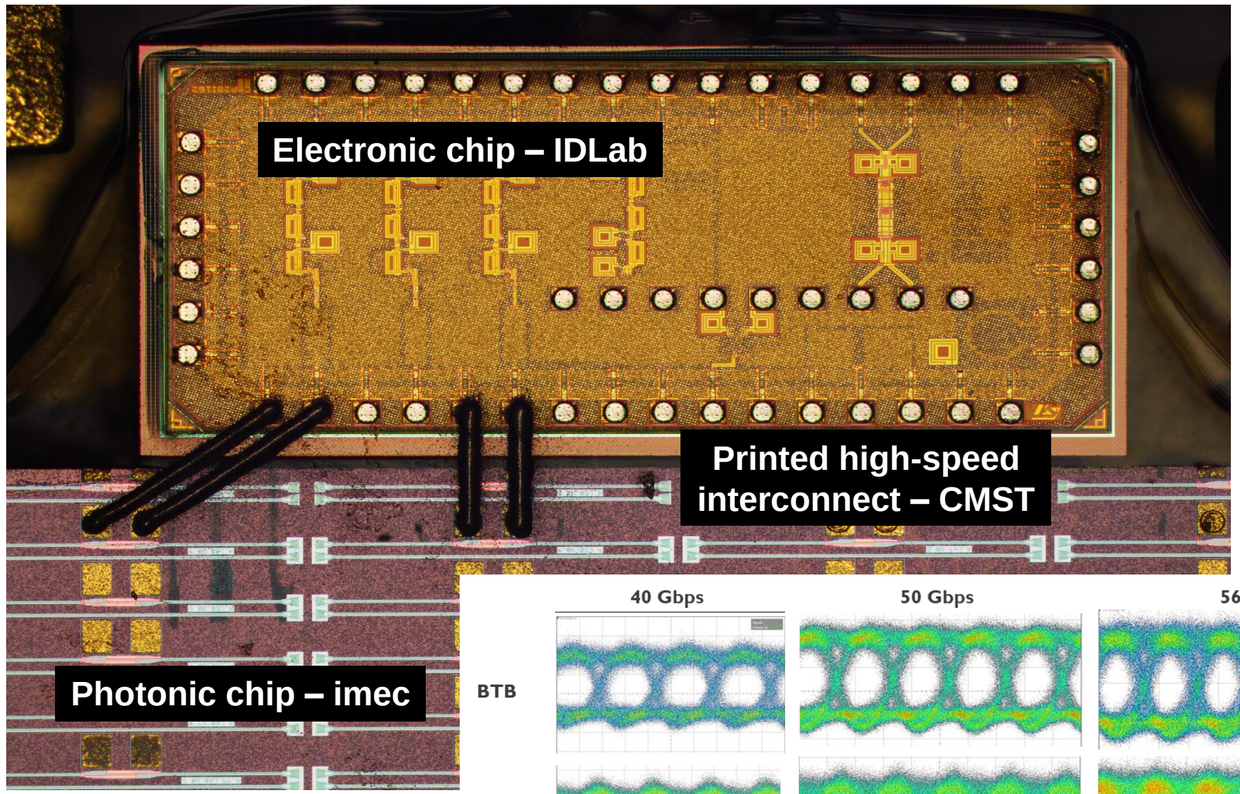


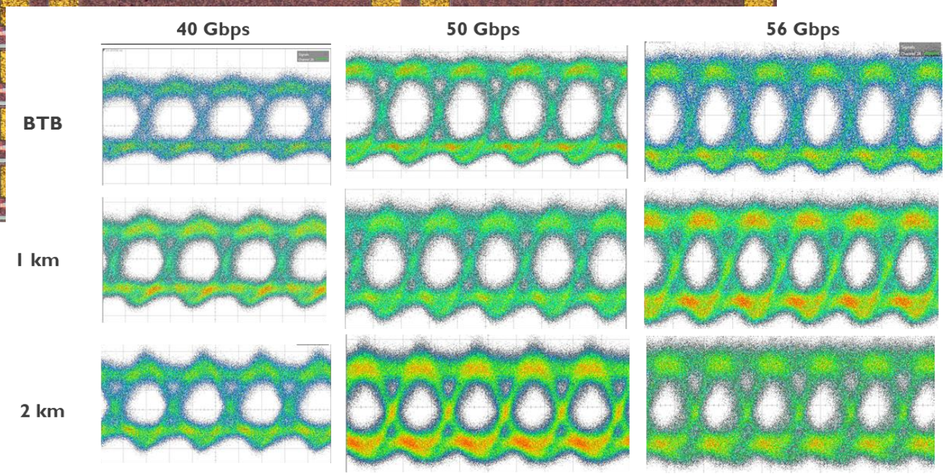


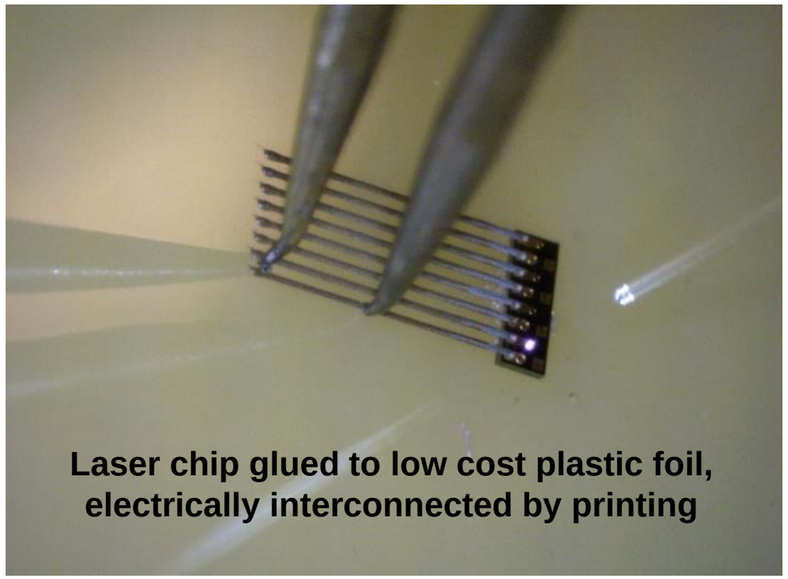
Donor and receiver substrate after transfer of thin silicon chips in checkerboard pattern (200 micron size)

PHOTONICS-ELECTRONICS INTEGRATION

Aerosol jet printing for very short, non-planar, or unconventional metallic interconnections.







In collaboration with UGent / IDLab / PRG

NaMiFab

NAMIFAB - EXPERTISE CENTRE FOR NANO- AND MICROFABRICATION

NAMIFAB EXPERTISE CENTRE

NaMiFab UGent (BOF funding):

→ Is an **expertise centre for Nano-and Microfabrication**.

→ Our mission: Open up state of the art test and **research infrastructure for the entire UGent research community**, working in diverse domains.

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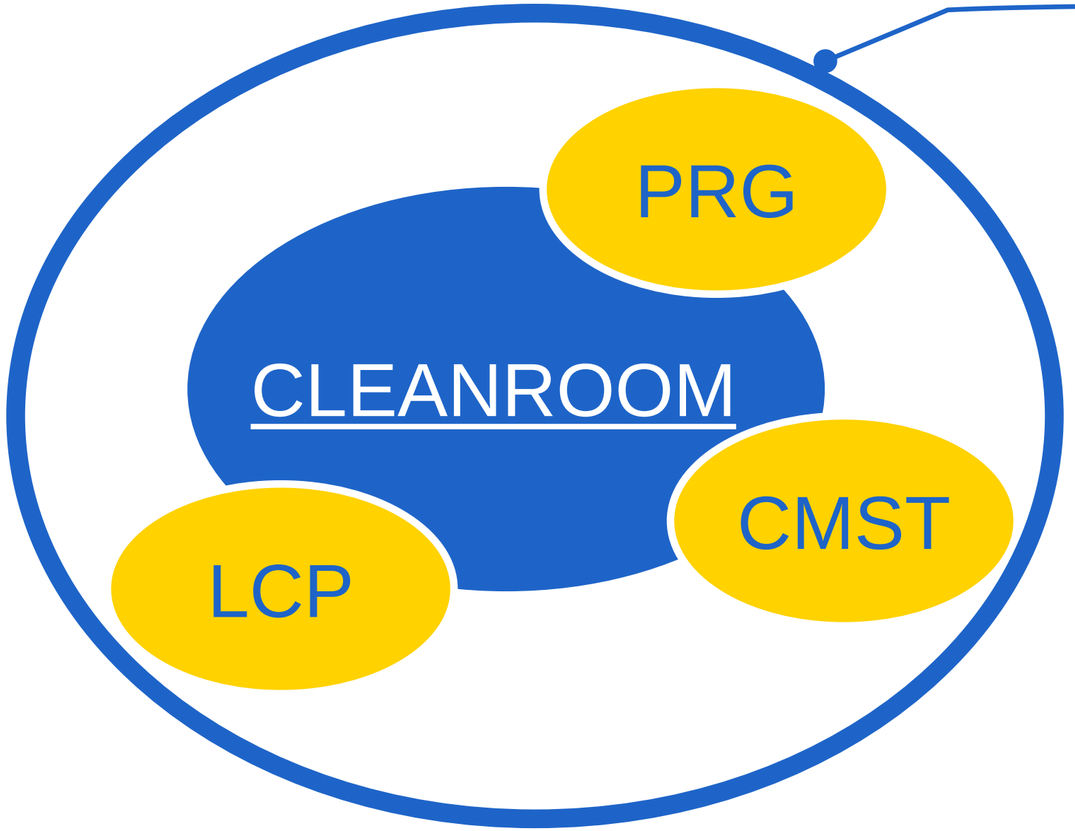
nb-photonics
Center for Nano- and Biophotonics
Ghent University

GHENT UNIVERSITY

NAMIFAB EXPERTISE CENTRE

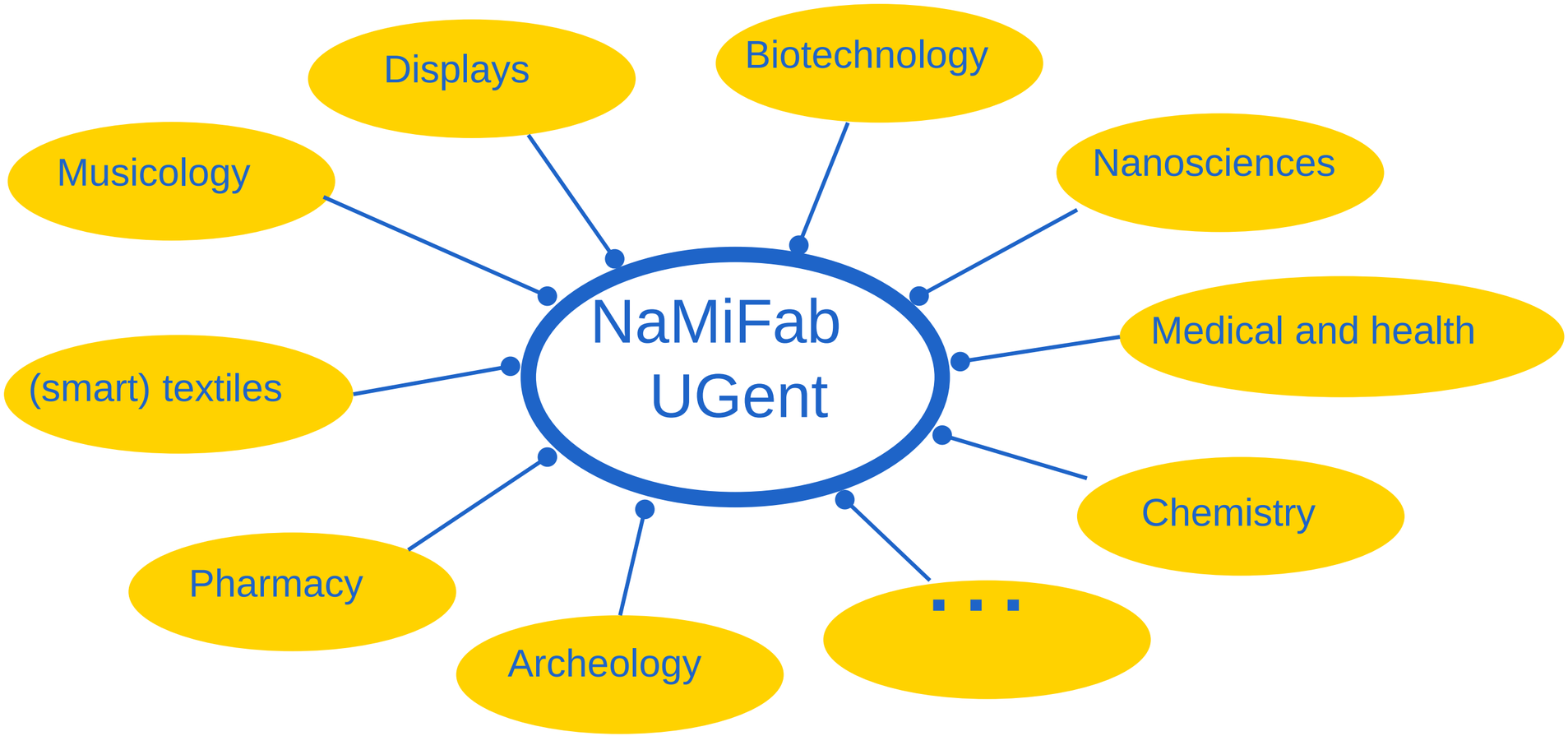
NaMiFab UGent



Expertise Centre for Nano- and Microfabrication

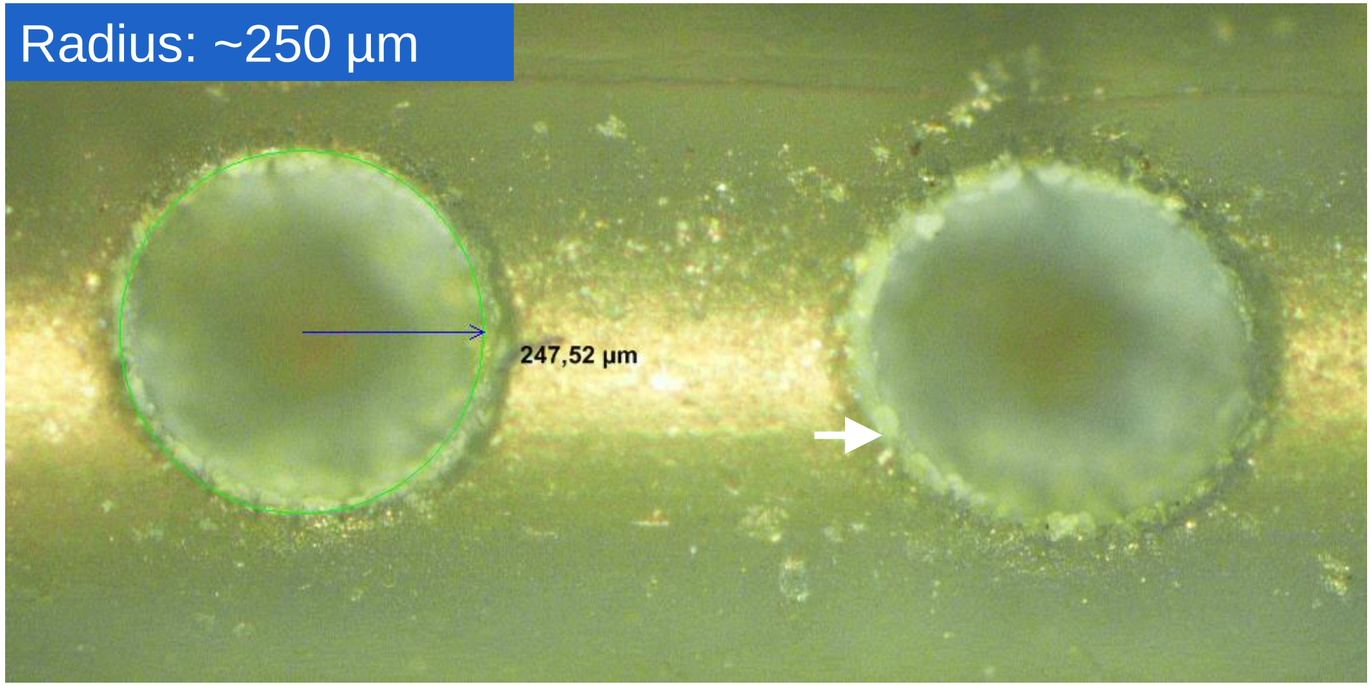
PRG: Photonics Research Group
CMST: Centre for Microsystems Technology
LCP: Liquid Crystals and Photonics Group

NAMIFAB EXPERTISE CENTRE



USE CASE EXAMPLES

Different lasers available for
laser structuring, cutting, drilling and welding applications on a variety of substrates



Perforations in a PDMS catheter (0.4mm wall thickness)
(Biofluid, Tissue and Solid Mechanics for Medical Applications group)

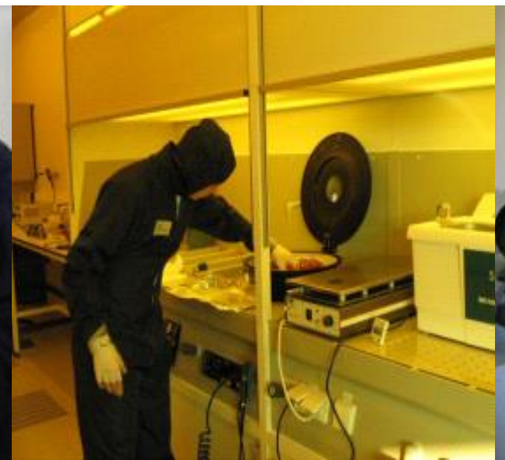
NAMIFAB EXPERTISE

→ Knowhow and infrastructure for designing, realizing and inspecting nano- and microsystems of very diverse shape, dimensions and complexity

→ List of test and research infrastructure on www.ugent.be/namifab/en/infrastructure

→ Summary of posibilities on next slides as a reference





NAMIFAB EXPERTISE

Nano- and microfabrication technologies:

Photolitography (pattern definition)

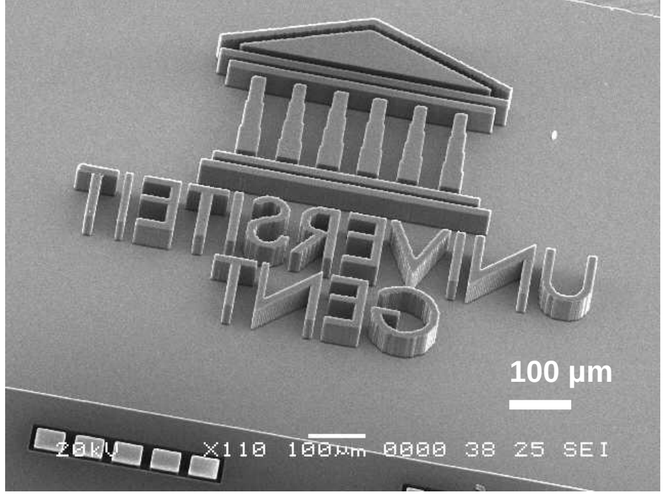
→ Photomask alignment and exposure (resolution down to 800nm)
→ Laser direct imaging (resolution down to 1µm)
→ Electron beam lithography (resolution down to 10nm)

Layer deposition

→ Spin coating
→ Plasma deposition
→ Sputter deposition
→ Electron beam evaporation
→ Thermal evaporation for deposition of organic layers
→ Atomic layer deposition (aluminium oxide)

Etching

→ Development, etch and strip line for flexible PCBs
→ Plasma etching (RIE, ICP, Oxygen)
→ HF-vapor etching



Plasma deposition

Thermal evaporation

Flexible PCB processing

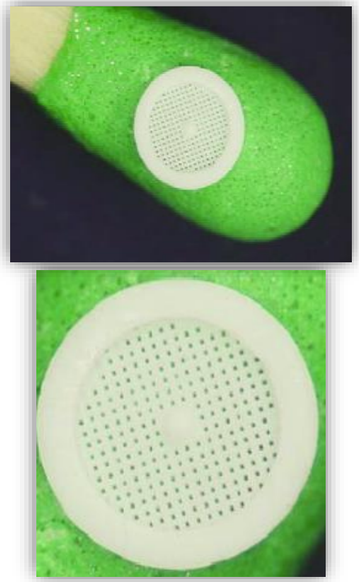
Plasma etching

NAMIFAB EXPERTISE

Nano- and microfabrication technologies:

Material structuring

→ Laser structuring, cutting, drilling and welding on a variety of substrates
→ Microinjection moulding of small parts (<1g)
→ Dicing, lapping, polishing
→ Lamination, imprinting
→ Vacuum forming

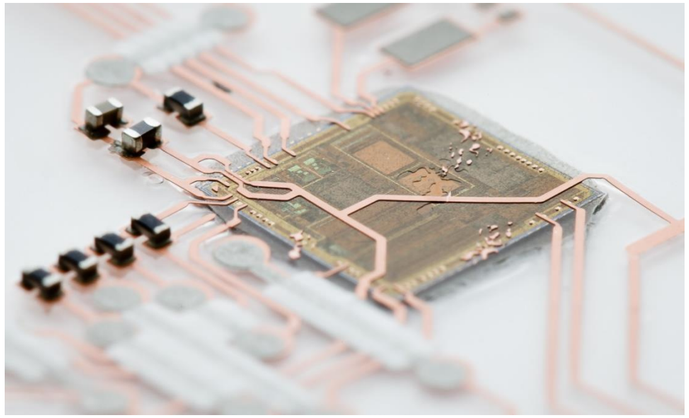


Micromoulding

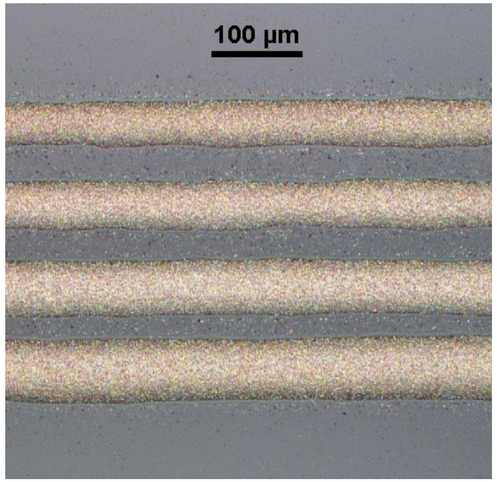
Vacuum forming

Assembly

→ Die and flip-chip bonding (± 5µm accuracy)
→ Accurate (± 1µm) placement of chips and toher 3D structures
→ Micro-Transfer-printing (µTP)
→ Wafer bonding
→ Automated needle dispensing
→ Screenprinting
→ Reflow soldering
→ Wire bonding
→ Aerosol-jet printing (print metallic conductive inks)
→ Liquid crystal device assembly



Assembled smart label



Jet printed silver tracks

NAMIFAB EXPERTISE

Sample inspection:

Microscopy

→ Optical microscopy (mm to µm size features)
→ Electron microscopy: SEM, FEG-SEM with in situ FIB
→ Au & C coating for SEM

Profilometry

→ 3D optical profilometry
→ Step height measurement (stylus 2.5 or 25 µm)

Cross sectioning

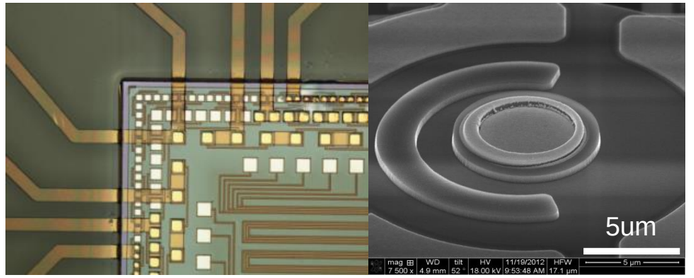
→ Sample molding in resins followed by grinding and polishing
→ Ion beam polisher
→ FIB local cross sections integrated in a FEG SEM instrument

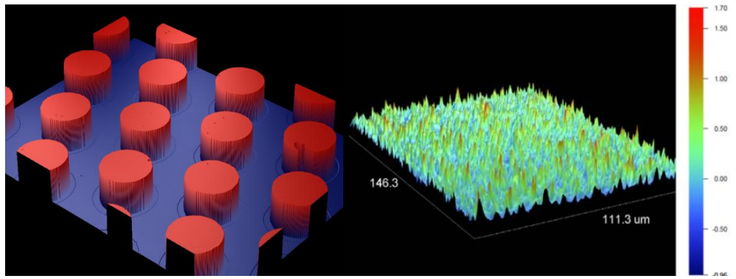
Surface analysis

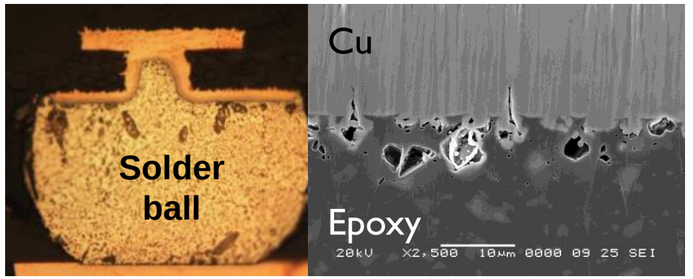
→ Contact angle
→ Soldarability, Critical Cleanliness Control

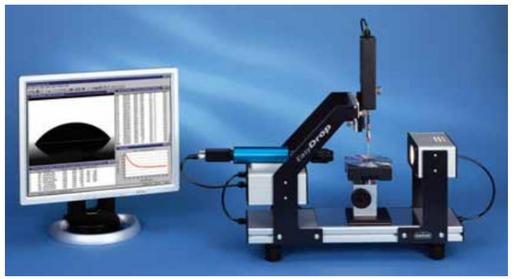
Material analysis

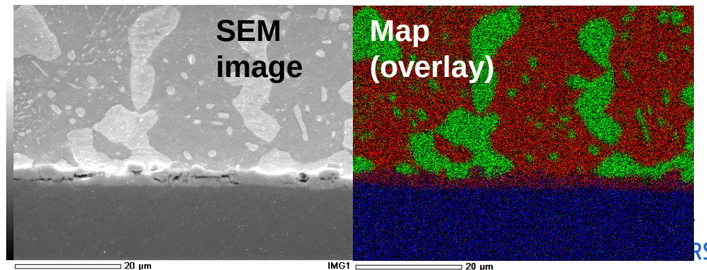
→ SEM+EDS











NAMIFAB EXPERTISE

Reliability testing and failure analysis:

Mechanical testing

→ Peel test (90º & 180º)
→ Component shear and pull testing
→ Stress/strain measurements
→ Standardized washing tests

Climate chamber testing

→ Temperature storage (37 - 200 ºC)
→ Temperature-humidity testing (10 – 95 °C, 10 – 98 % RH)
→ Temperature cycling (-70 °C to 180 °C) with in-situ resistance measurement

Universal Testing Machine (INSTRON)

Universal Bond Tester

Humidity testing

Thermal cycling