Scientific Expertise Beneficial to Business

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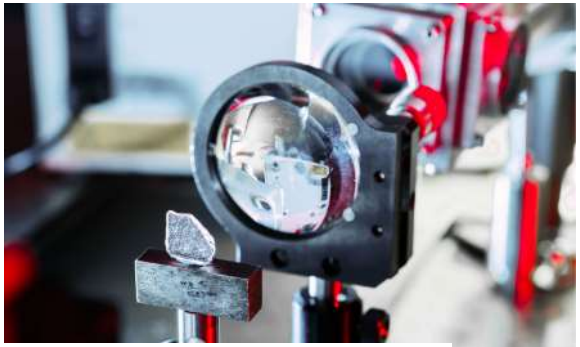
40 Years of Expertise

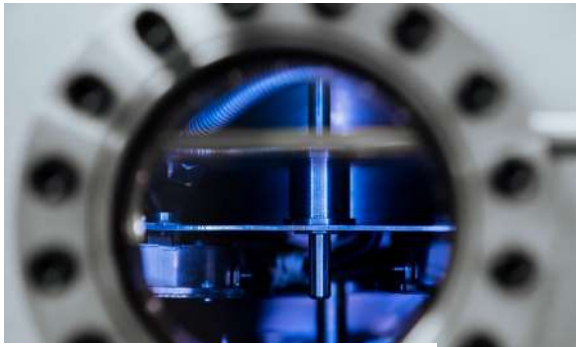
Materials for energy harvesting and storage



Materials for electronics and photonics

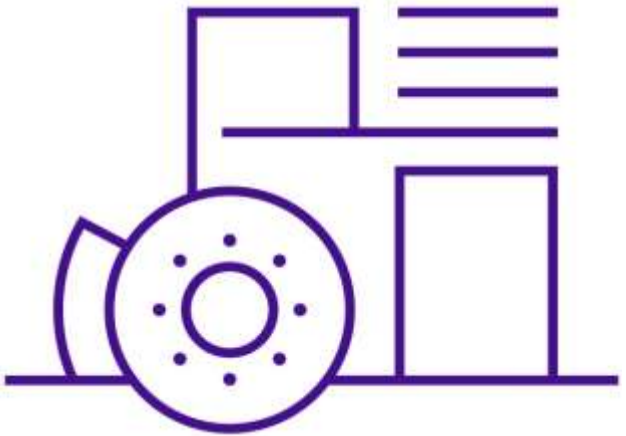
Nanomaterials and ceramics

Theoretical modelling and design



Thin films and coating technologies

Our offer



Innovation, technology and product development
R&D services, testing & characterization
Prototyping and small-scale production
Industrialization up-scaling services

Together with our industrial partners

- Baltic Scientific Instruments – radiation sensors and spectrometers
- RD Alfa MD – radiation resistant microelectronics
- CeramOptec, Light Guide Optics – custom made fiber optic components and products

- EuroLCDs – LCD technologies
- Sidrabe – vacuum coating devices, upscaling
- GroGlass — anti reflective glass
- Schaeffler – in-line coatings systems, antifiction, hardening and other coatings

Sensors

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Sensors

- Sensors competences in:
  - photonics
  - radiation
  - gases
  - liquids
  - temperature
- Wide range of materials and methods
- Client technology development and/or tech transfer
- 40 experts in the field

Examples

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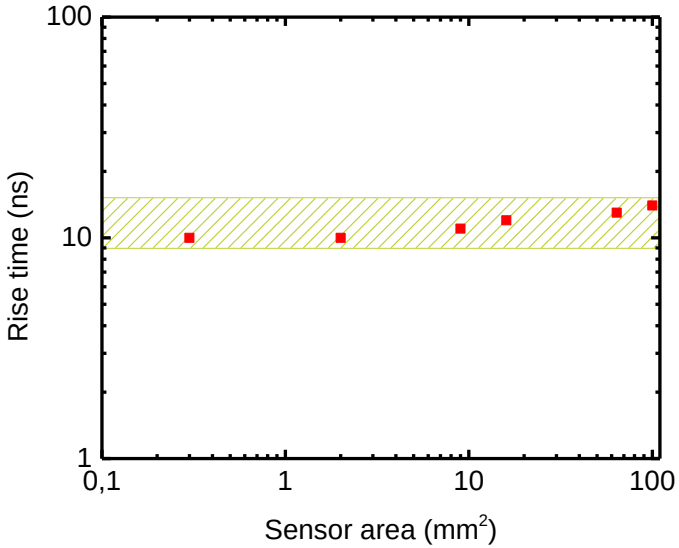
Fast broad spectral range light sensor

- Signal rise time 10 ns
- Maximum frequency: 1 MHz
- Broad spectral range. Measured from 290 nm up to 2000 nm. High confidence it will work up to 3-4 µm and higher
- Sensor active area: 1 cm^2. Speed does not degrade with increase of sensor area
- Linear signal dependence on power
- Patent pending



Performance independence on sensor area

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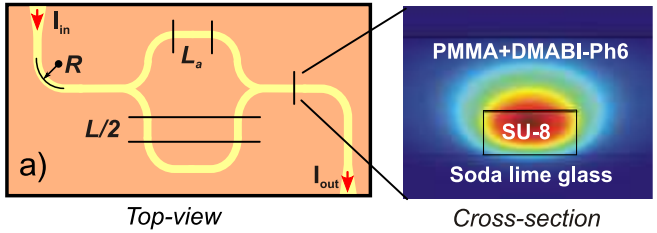
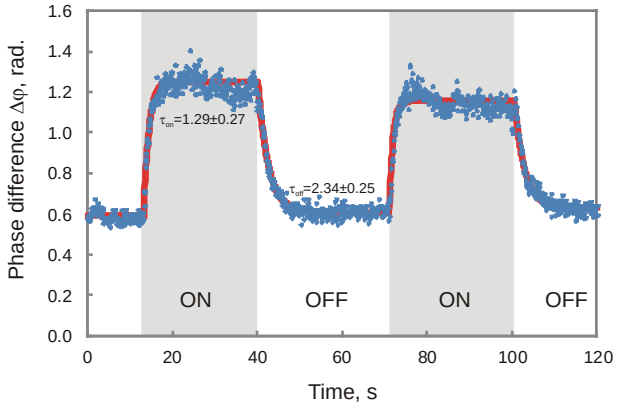
Asymmetrical all-organic waveguide gas sensor

- Stable, light guiding optical waveguide core with high refractive index
- Cladding material that is sensitive to environment and changes its refractive index
- Waveguide device was tested using N_2 gas (OFF state) and N_2 and isopropanol mixture (ON state)





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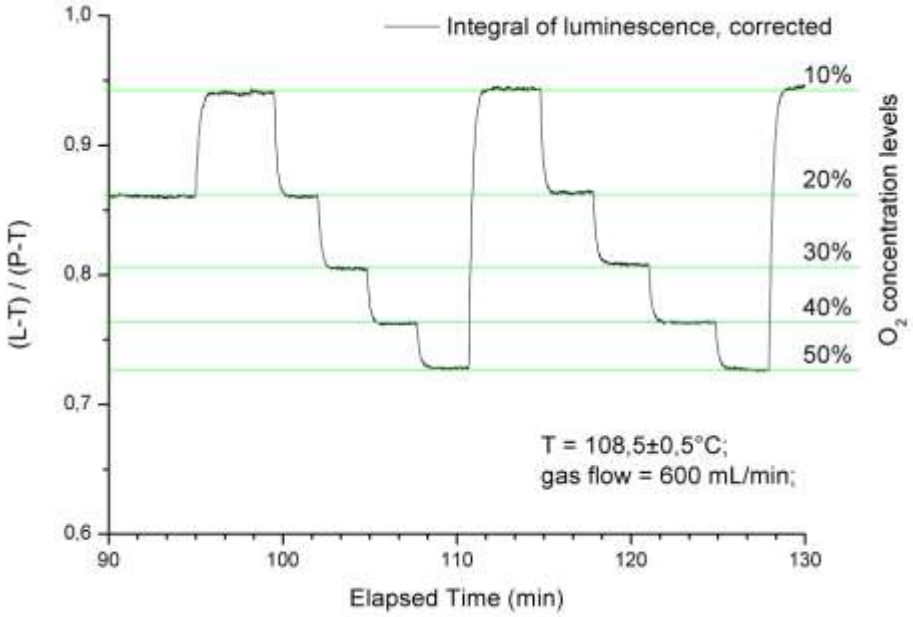
Zirconia based oxygen sensor

- Based on Eu doped ZrO_2 nanocrystals
- All optical sensor (suitable for explosive environment)
- Room temperature
- Patented prototype
- Biology, medical application, optical probes



Effect of O2 content in nitrogen atmosphere on the luminescence

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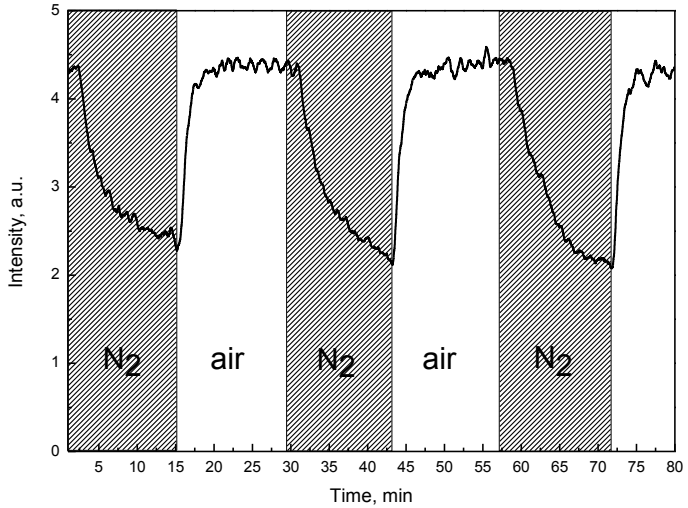
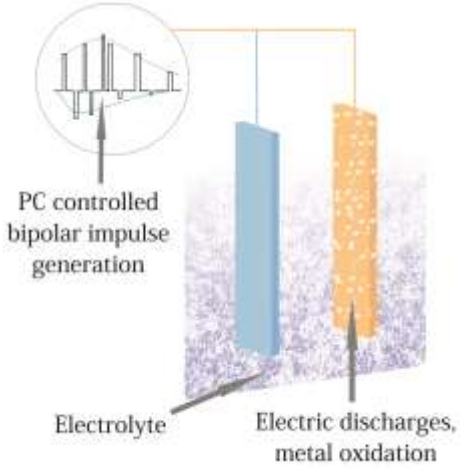
ZnO oxigen sensing coatings

- Sensing material: ZnO
- Luminescent ZnO coatings on metal
- Prepared by PEO method
- Biology, medical application



ZnO coating luminescence response to oxygen content



Plasma electrolytic oxidation

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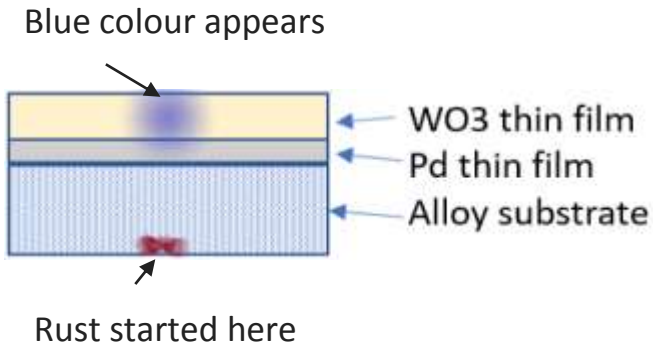
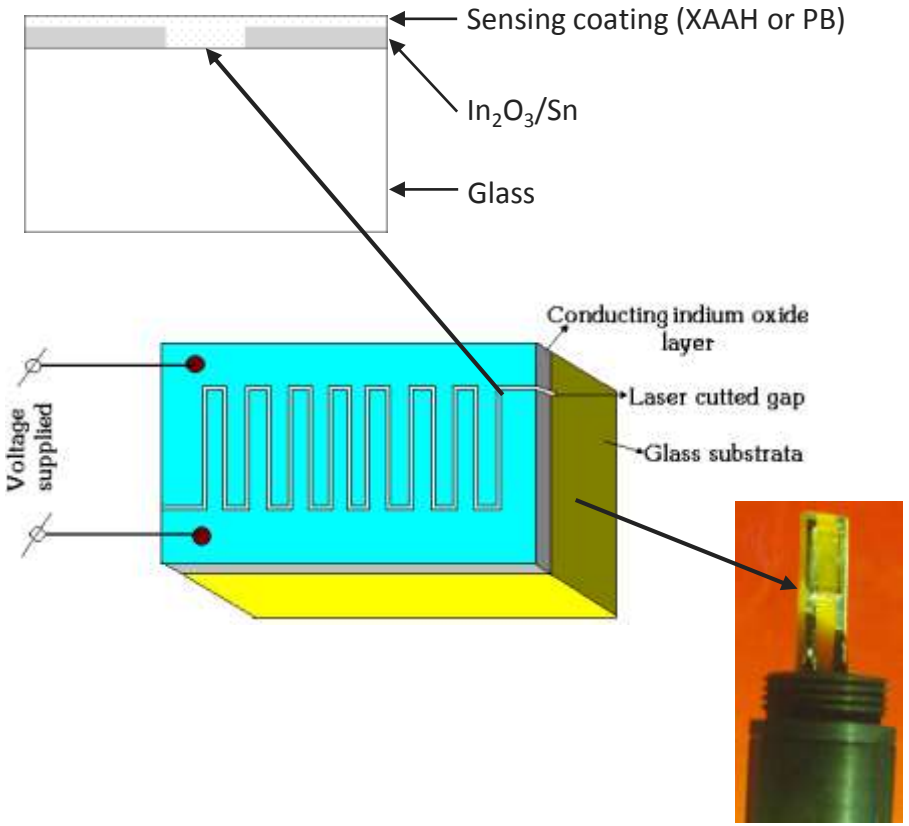
Visual rust indicator

- Determination of the starting point of the rusting process inside the steel tube
- Hydrogen ions are formed in the rusting process, which diffuses very quickly into steel and reaches the surface coating
- Physical vapor deposition



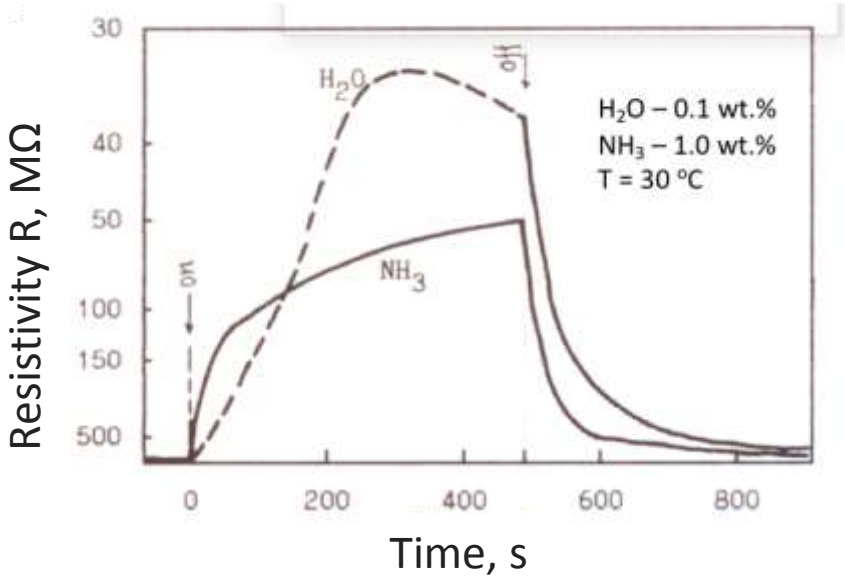
Humidity/gas sensor

- Different coatings changes selectivity for gas sensing
  - XAAH (xerogel of antimonic acid hydrate) for ammonia,
  - PB (Prussian Blue) for ammonia or hydrogen
- Physical vapor deposition for PB
- Blade casting for XAAH



Solid proton conducting β-alumina as gas sensor

- Beta alumina is synthesized from plasma dispersed powders and full cation-exchange cycle done
- Ion exchange in beta alumina does not influence the value of the ionic conductivity, but drastically changes the surface sensitivity in the presence of ammonia and water in environment



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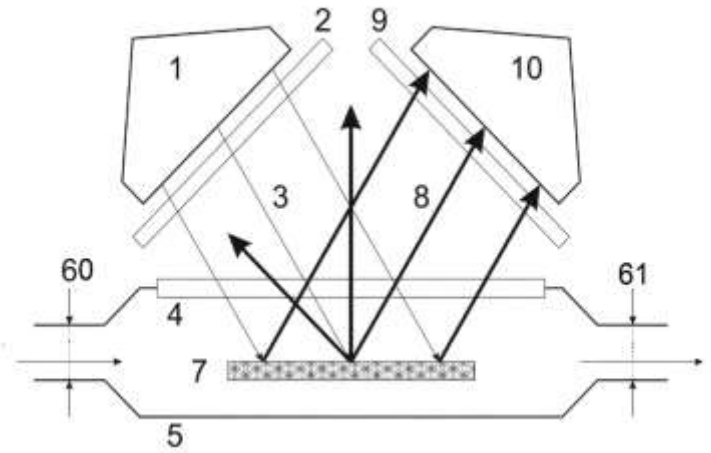
AlN based oxigen sensor

- Active material AlN
- Working principle: luminescence measurements
- For oxygen level detection in gas mixture
- Patented

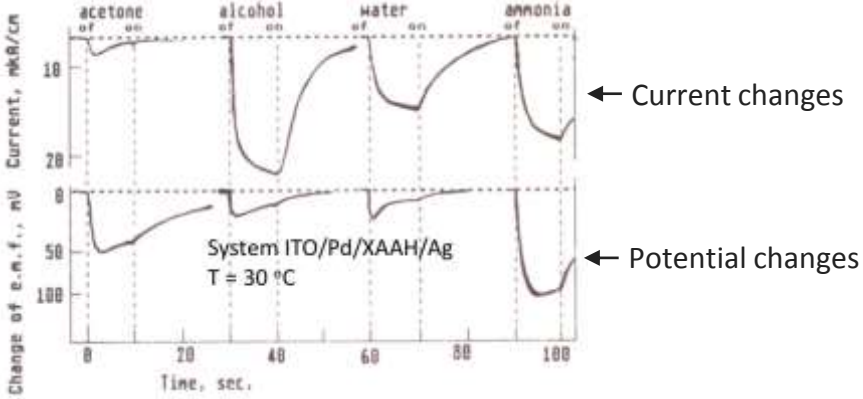


A scheme (cross-section) of AlN nanomaterial use for control of oxygen gas concentration in gas mixtures. 1- light source, 2- light filter, 3- exciting light, 4- quartz window, 5- housing, 60/61- inlet/outlet, 7- active media, 8- luminescent light, 9- light filter, 10- recording system.

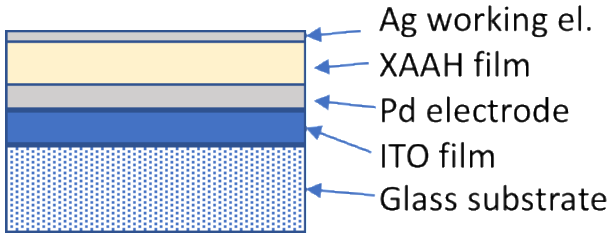
Antimonic acid hydrate as gas sensor

- XAAH layers are suitable materials for potentiometric and amperometric sensors, and it is possible to change selectivity by selecting definite material for a working electrode (1)
- Xerogel of $Sb_2O_5 \cdot nH_2O$ (XAAH) was prepared by hydrolysis of $SbCl_5$ followed by slow drying which turned it into the xerogel film (2)

(1)



(2)



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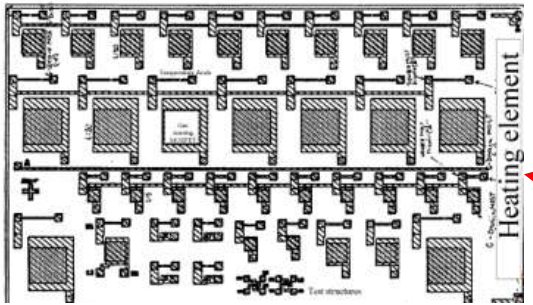
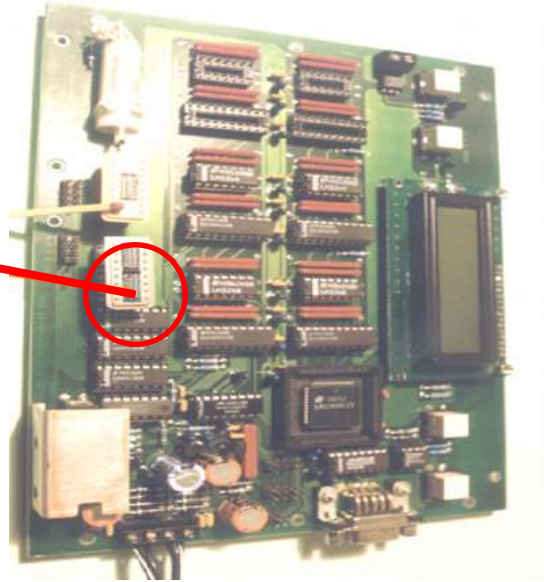
FET gas sensor matrix and “Electronic Nose”

- Micro-system prototype for the mobile artificial sensing instruments (gases/smells)
- Selective FET sensor matrix
- Each sensor different (based on temperature gradient method)





In cooperation with Riga Technical University and Linköping University

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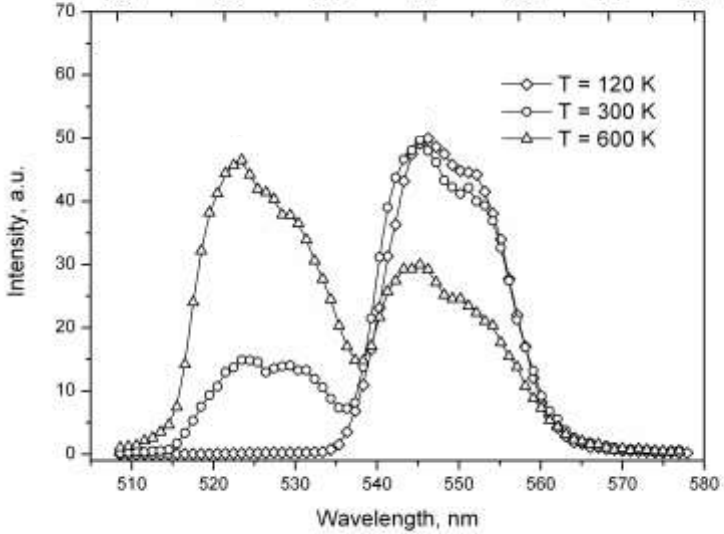
All optical temperature sensor

- Measurement of the fluorescence lines intensity ratio (FIR) method
- No limitations for harsh or corrosive environments
- Not affected by interference from electromagnetic fields



Upconversion luminescence spectra of Er^{3+} doped oxyfluoride glass excited at 980 nm measured at different temperatures

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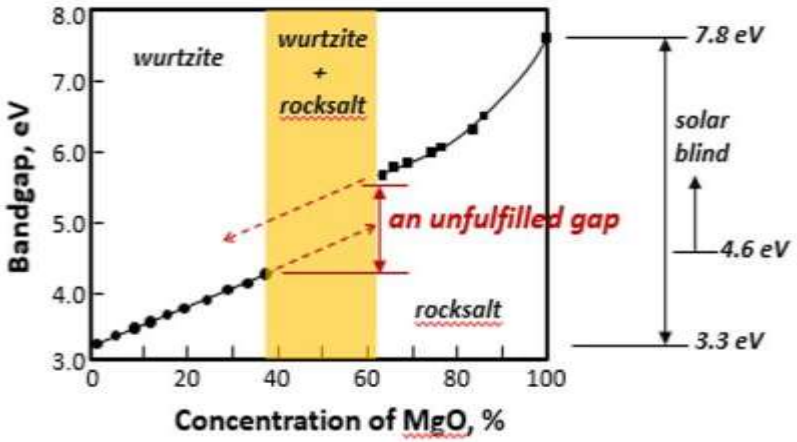
Materials for solar-blind UV sensors

- ZnMgO materials with tunable band gap – significantly enhance the ability of the sensor to detect signals at different energies simultaneously
- For ozone detection, detectors for water purification, determination of pollution levels in any biological agent
- In collaboration with National Sun Yat-sen University, Taiwan



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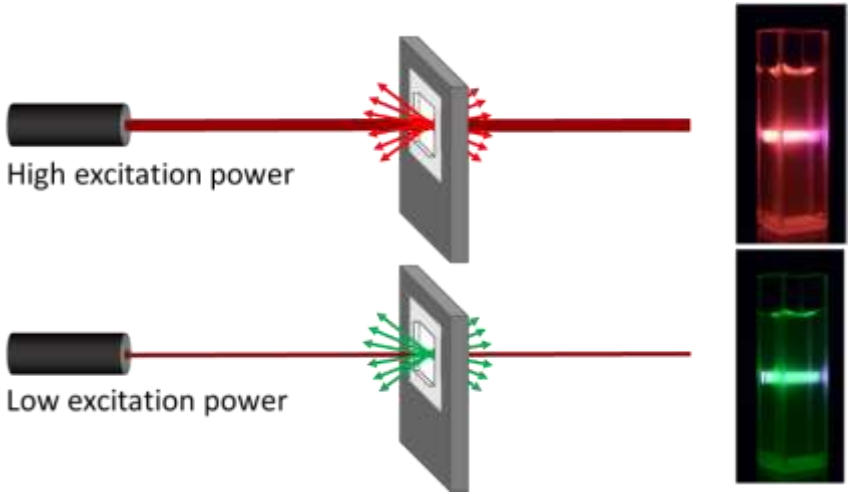
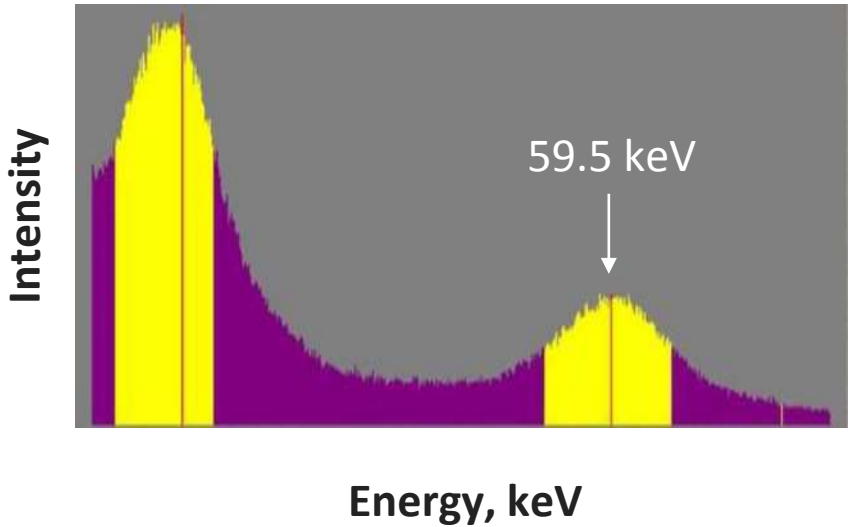
IR light visualizator

- Transform invisible infrared (IR) radiation into visible light Eye-pleasant white light
- For laser industry, medical application, military (defence), manufacturing industry



Radiation spectrometer

- Spectra of ^{241}Am radionuclide obtained by TlBr-based detector
- High sensitivity
- In cooperation with Baltic Scientific Instruments



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Welcome to collaborate

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More on our expertise
and case studies
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Other slides

Materials

- Glass ceramics & nanocomposites
- Up-conversion materials
- SiO_2 glass (fibres, bulk)
- Organic materials (OLED, OPV, lasers, lightguides)
- Nanomaterials (0D…2D)

Characterization

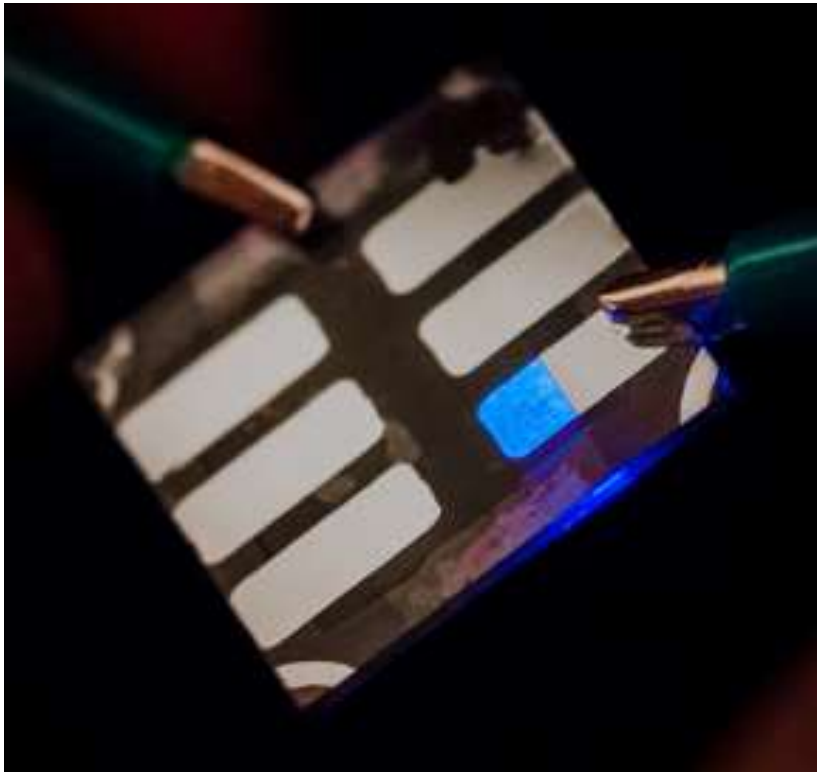
- Optical spectroscopy
- EPR spectroscopy
- Morphology analysis
- Electron microscopy (SEM, TEM)
- XRD & advances structure analysis
- Electrical & dielectric analysis

Technology

- Thin film fabrication
- Chemical synthesis
- Lithography
- Nano structuring
- Prototyping laboratory: 680m^2
  ISO class 7-8 cleanroom

Prototyping

- Cleaning and surface preparation
- Dry etching
- Bonding and packaging
- Thermal processes
- Wet chemistry



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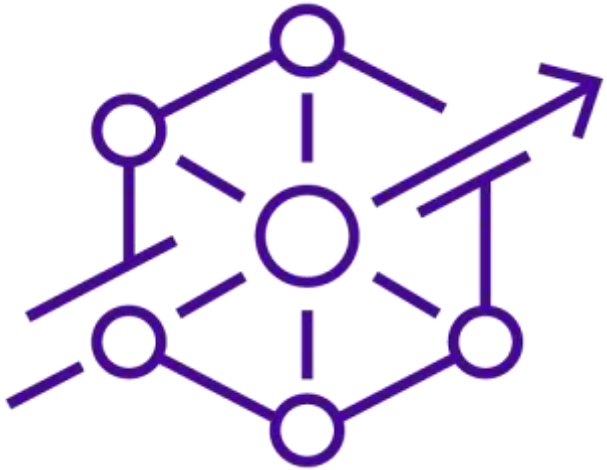

Institute of Solid State Physics UL industry collaboration and innovation platform

- **Single point of contact** customer experience
- Talk with industry in **business language**
- **Pro-active** business / industry style projects management

- **We make Scientific Expertise Beneficial to Business**

Materize context

- Based in Latvia
- **Strong national innovation** eco-system player
- Strongest national materials research and innovation center
- **40 years** in material science from complex oxides to organic semiconductors
- Deep expertise in spectroscopy
- Prototyping laboratory with 680 m2 of **ISO class 7-8 cleanroom** facility
- 200 employees / **100 PhD**

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Latvia Context

- **Member of European Union, NATO**, OECD, WTO
- EURO zone since Jan-2014
- Population – 2M, Baltics – 7M
- GDP annual growth – **4-5%**
- **100+** direct flight connections, including Israel
- **High stability and growth** rating –
  by S&P, Moody's, World bank, IMF

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What We Do

Prototyping and small scale production

Research and development of functional materials

Single point of contact

Theoretical material design and modelling

Environment for innovations