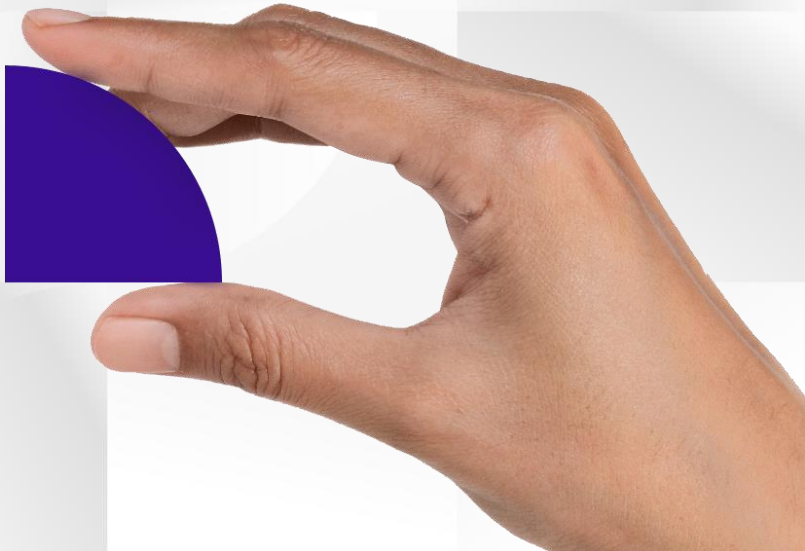
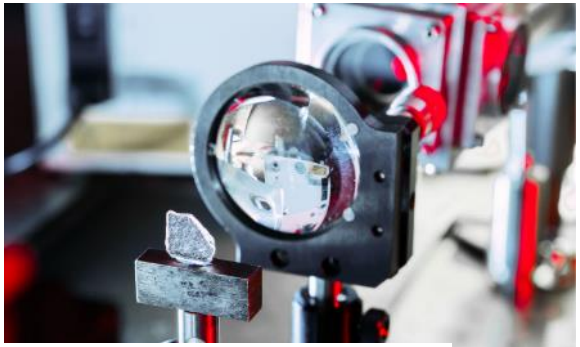
Scientific Expertise Beneficial to Business

materize

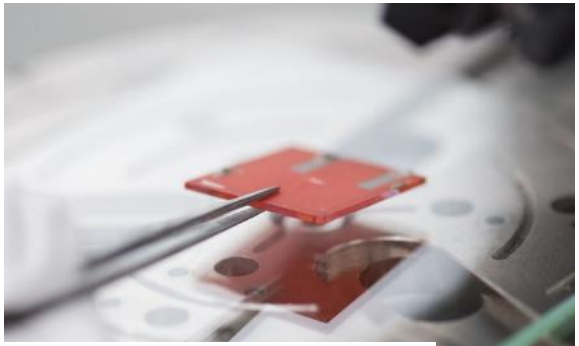


40 Years of Expertise

Materials for energy harvesting and storage

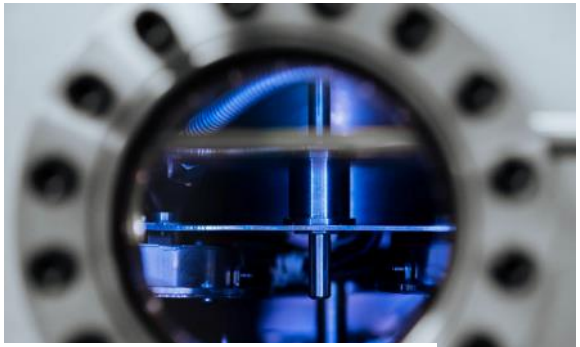


Materials for electronics and photonics



Nanomaterials and ceramics

Theoretical modelling and design



Thin films and coating technologies

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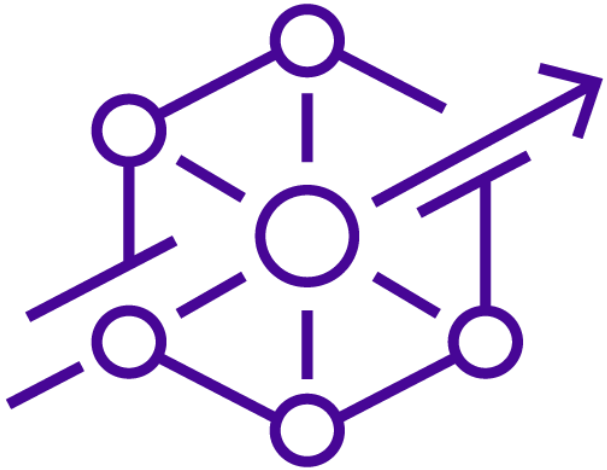
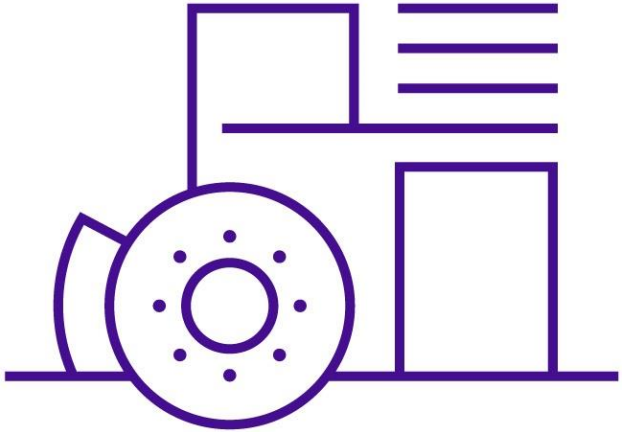


Institute of Solid State Physics UL industry collaboration and innovation platform

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

- Clear message – **We make Scientific Expertise Beneficial to Business**

Our offer



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

Together with our industrial partners

- **EuroLCDs –** custom LCDs
- **Lightspace –** volumetric 3D technology, VR
- **Sidrabe –** vacuum coating devices, upscaling
- **GroGlass —** anti reflective glass
- **Schaeffler –** in-line coatings systems, antifiction, hardening and other coatings
- **Baltic Scientific Instruments –** radiation detection, materials detection
- **RD Alfa MD –** radiation resistant microelectronics
- **CeramOptec, Light Guide Optics –** products based on custom made fiber optic components

Photonics

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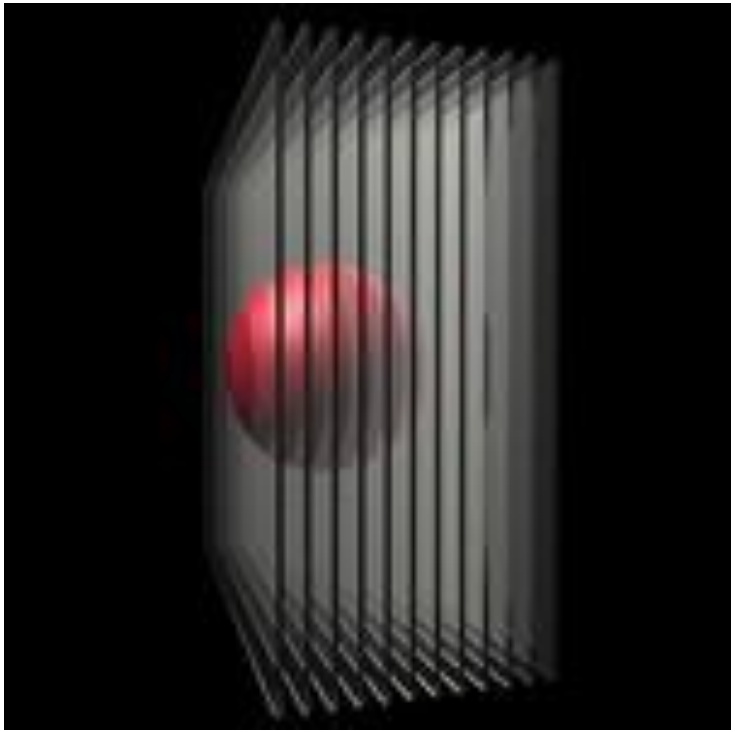
Photonics topics

- Optical thin films and coatings
- Anti-reflective glass coatings
- Optical fiber (for high-power applications, sensing)
- LCD development (materials, lithography)
- OLED development (materials, optimisation)
- HW and visual perception for 3D, AR displays, headsets, head-up displays
- Optical waveguides (non-linear, active)
- Light sensing (including high-speed IR sensing),
- Light conversion (including white light sources, IR visualisation)
- High sensitivity radiation detection
- Phosphorescent coatings on metals
- Spectroscopy
- Lithography

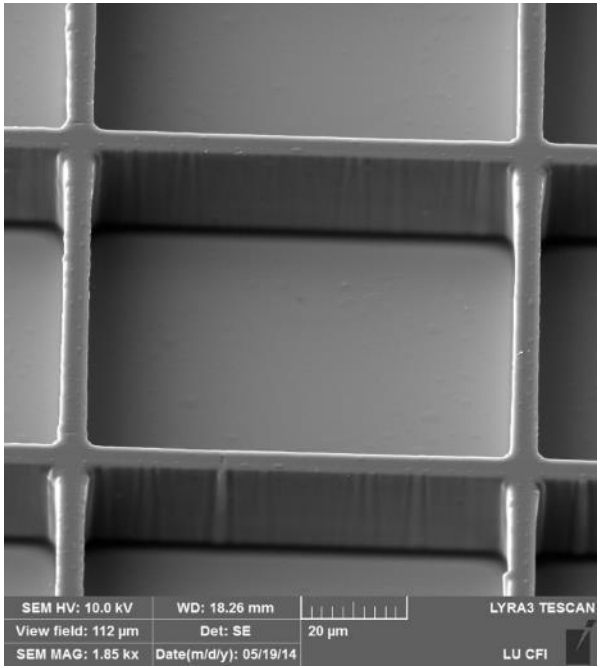
Light Space Technologies

- Development of full parallax 3-dimensional real-time image display for optically deep volumetric 3D images
- Multi-plane 3D volumetric display
- Bench top volumetric 3D image display
- Second generation 3D volumetric displays



EuroLCDs - LCD development

- High voltage liquid crystal display development
- Infrared liquid crystal shutters
- Displays with transparent pixel walls
- Thin film resistance and I-V characteristics, surface morphology, dielectric breakdown, spin-coating deposition, spectral measurements, mask aligner



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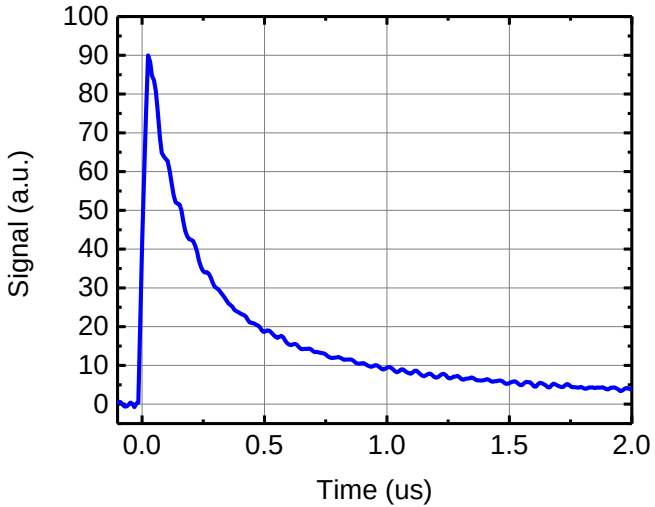
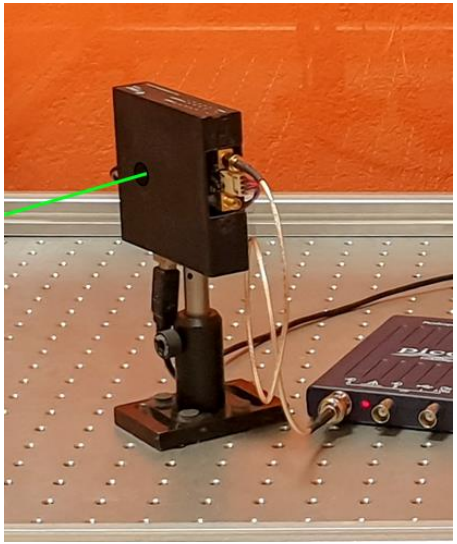
EuroLCDs

Light sensor

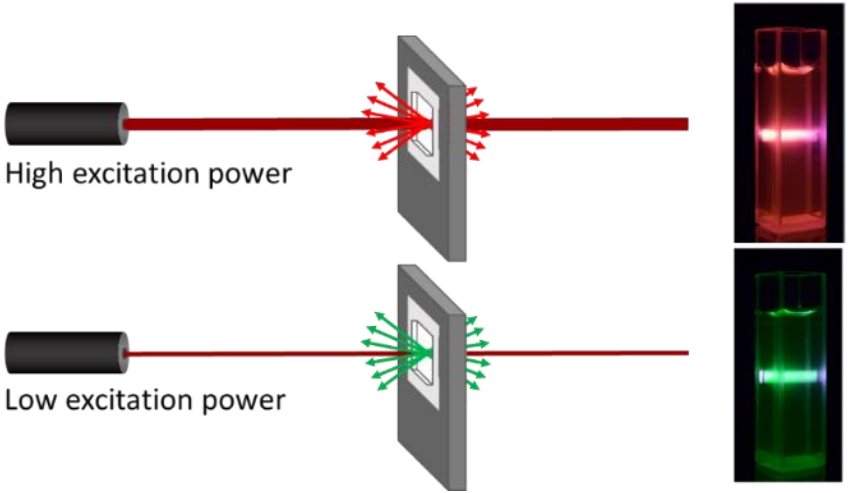
- High-speed (1 MHz) large area (1cm^2) radiation sensor
- Wide and smooth sensitivity of the spectral region
- Innovation commercialization project





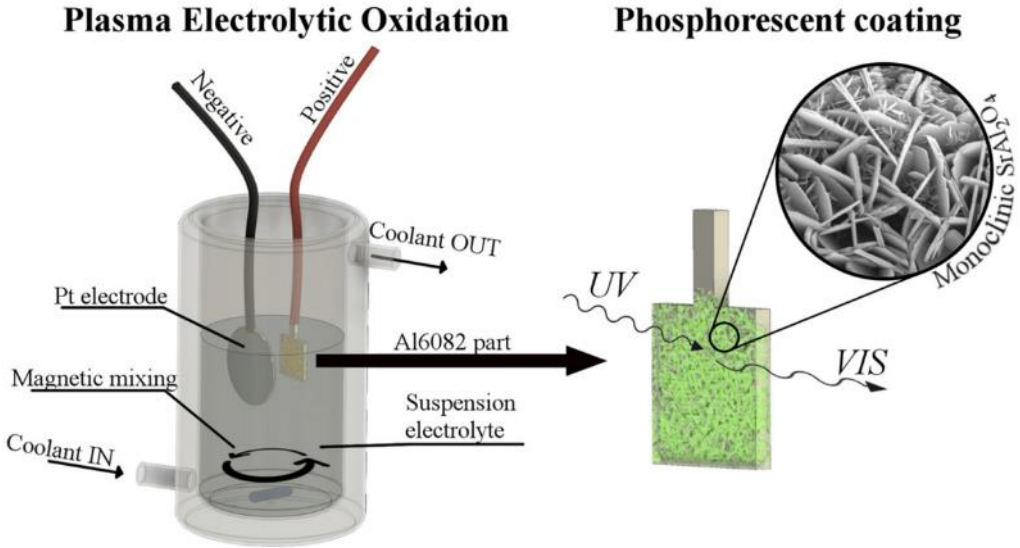
IR visualizer

- Transform invisible infrared (IR) radiation into visible white light
- Sensitive to the intensity
- For laser industry, medicine, defence, manufacturing industry and others



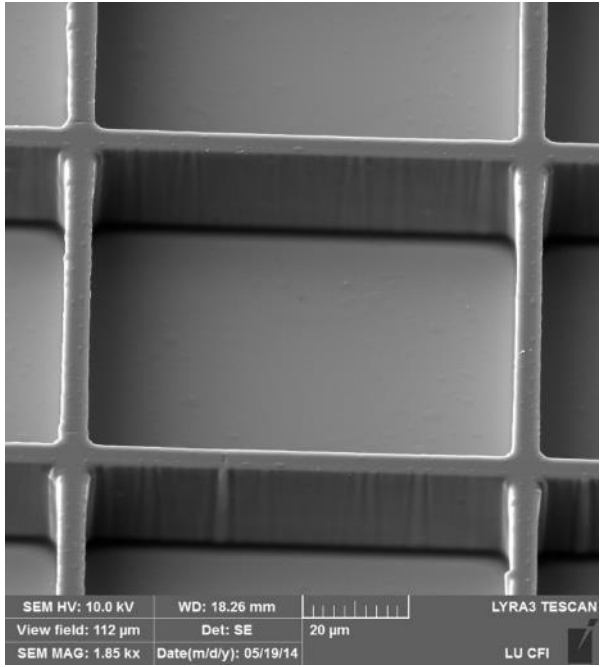
Phosphorescent coatings on metals

- Long afterglow at room temperature
- Broad spectral distribution of luminescence in the visible range
- Energy-efficient coating synthesis



Prototyping

- Fabrication of micro/nano structures and devices
- Dedicated process development group
- Thin film deposition – evaporation, sputtering, ALD, PECVD.
- Lithography
- Dry and wet etching
- Probe station, wire bonding



Other information

Optical fiber development

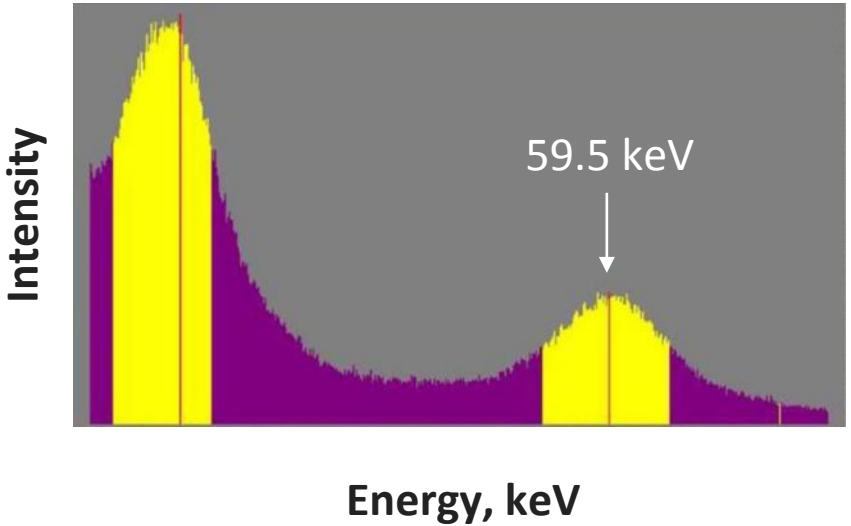
- Customized solutions in fibre optic technology
- Defect research in SiO_2
- Challenging characterization of optical properties

Baltic Scientific Instruments

- Development and fabrication of devices for precise spectrometric radionuclide analysis based on semiconductor and scintillation radiation detectors
- Radiation detectors
- Nuclear electronics
- Radiation measurements

Baltic Scientific Instruments - detector

- Optical methods for selection of high-quality detector materials for detectors fabrication
- Ionizing radiation detectors
- Spectra of 241Am radionuclide obtained by TlBr-based detector

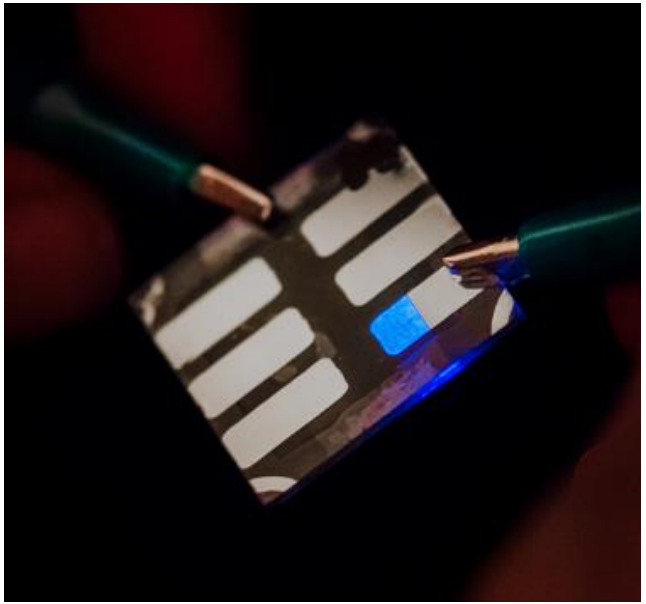


Evoled – OLED development

- Original material (provided by Evoled) characterization

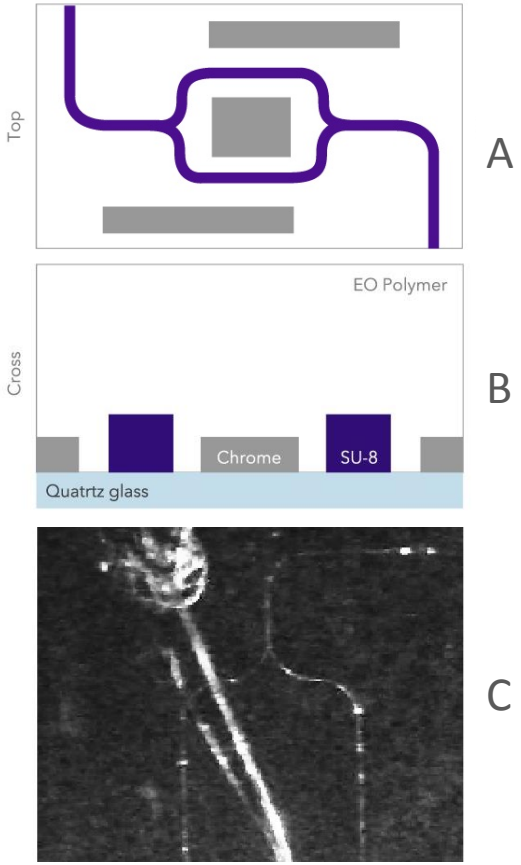
Full cycle of OLED development

- Development
- Prototyping
- Characterization
- Innovation commercialization



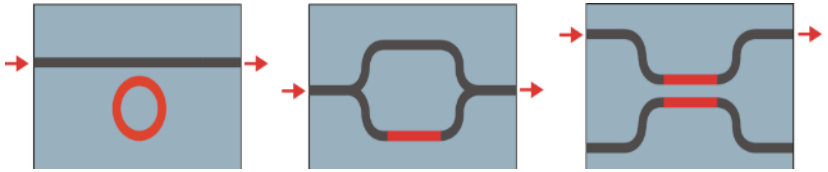
Electro-optical modulator

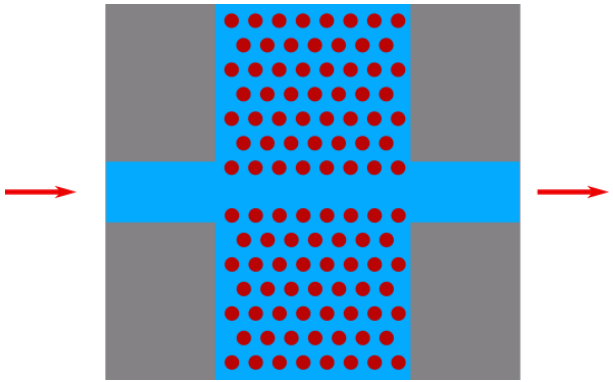
- A novel all-organic EO modulator operating in the visible wavelength range
- Prototype comprises an SU-8 waveguide core, electrodes in the plane with the waveguide core and an EO polymer coating
- A,B – the top and side views of the modulator design. C – device operation with excited first mode in the MZI. Published [at Optics Express]



Optical waveguides

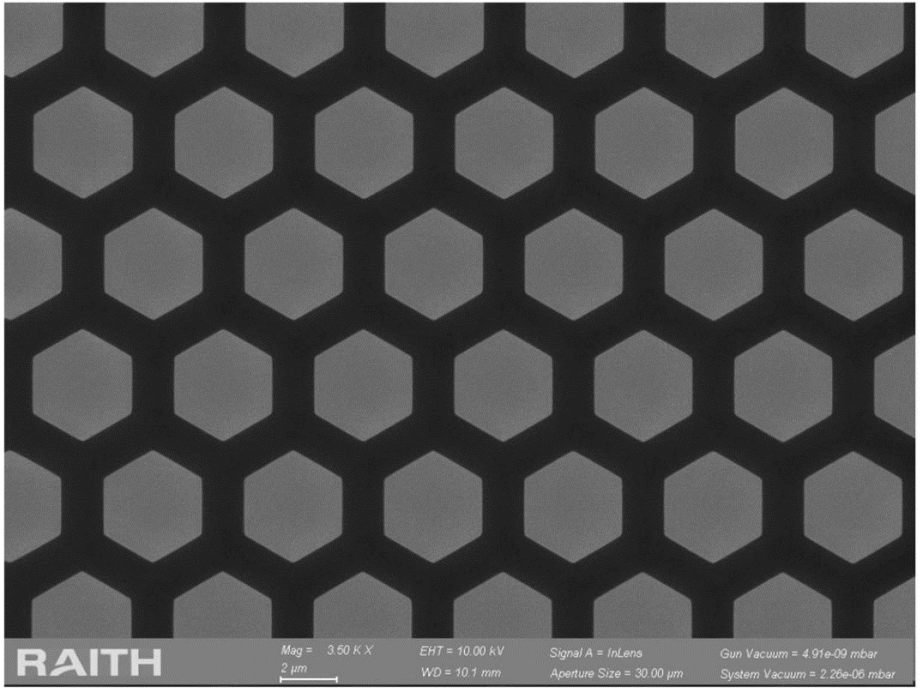
- Study of third-order nonlinear optical properties
- Formation of waveguide structures from SU-8 using lithography
- Electro-optical modulator prototype
- Waveguide structures for full optical switching
- More details at http://lom.cfi.lu.lv/





Lithography

- Optical lithography (direct laser writer, mask aligner)
- E-beam lithography - ultra high resolution Raith eLINE Plus (<10 nm)
- Various applications incl., micro lenses, photonic crystals, micro and nano structures



eBeam lithography service

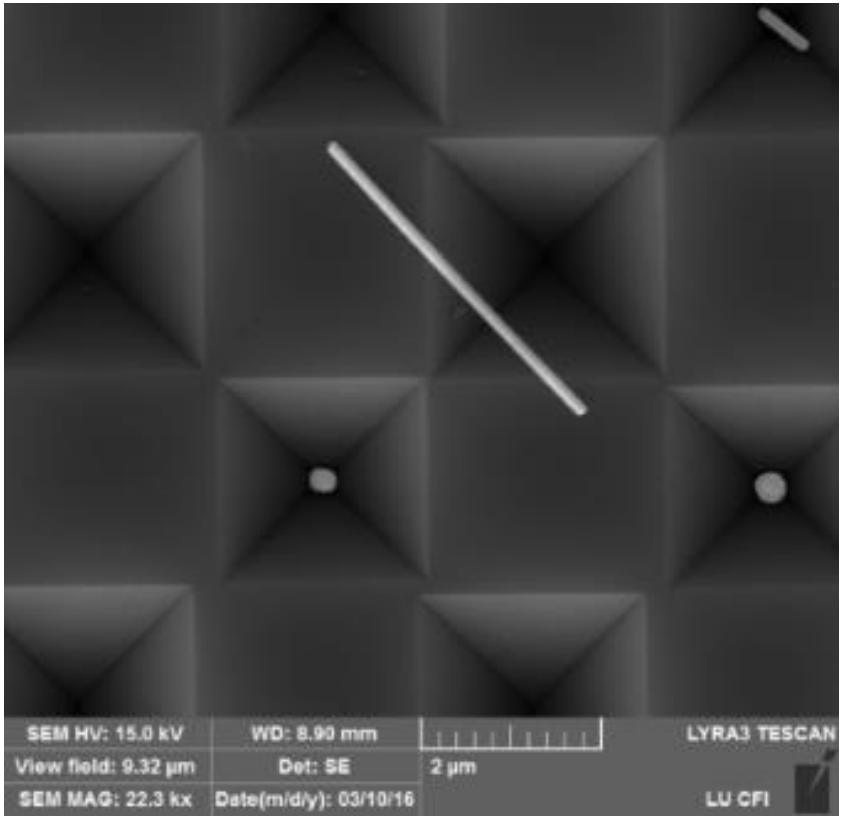
- Electron beam lithography service based on ultra-high resolution Raith eLINE Plus system
- Ability to manufacture structures with resolution down to 10 nm with quick turnaround time
- Pattern design and accept designs in various formats including GDS II, dxf etc
- Traxx and periodixx features allows to pattern large stitch-free structures
- Positive (950 PMMA) and negative (ma-N 2403) resists available, other type resists available on request
- Mix and match with photolithography
- Pre and post processing: substrate cleaning, thin film deposition, metallization, wet etching and other
- Key technical data:
  - Beam energy range: 20 V to 30 kV
  - Spot size: 1.6 nm
  - Minimum feature size < 10 nm
  - Writing field size: 0.5 µm to 2 mm.
  - Field stitching < 40 nm
- Sample holders for samples starting from small pieces up to 4 inch wafers

Atomic layer deposition

- Veeco/Ultratech Savannah - thermal deposition
- Materials available: Al_2O_3, HfO_2, ZnO, AZO, TiO_2 and many others on request (ITO, ZrO_2, WO_3, V_2O_5, CeO_2 etc.)
- Exposure Mode™ deposits films with ultra high aspect ratio (>2000:1)
- Stacks of two materials
- Substrate size: 100 mm diameter x 6.4 mm height
- Substrate temperature: up to 400 ^oC
- Ozone generator and Low vapor pressure delivery

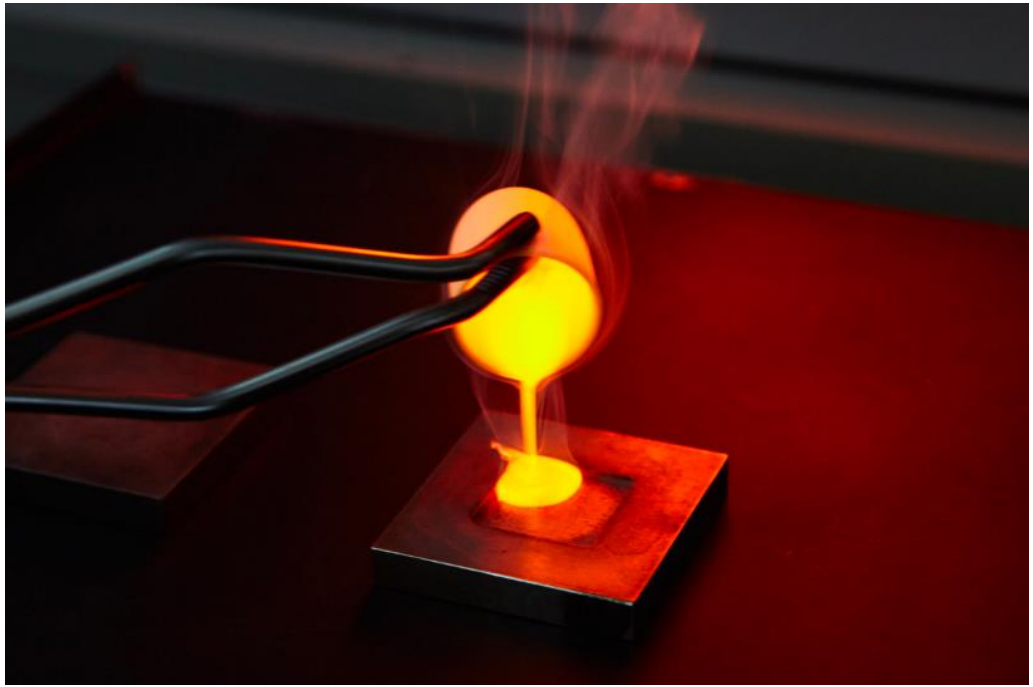
Nano structuring

- Nanomaterials
- 0D nanoparticles
- 1D nanostructures (nanowires, nanotubes, nanofibers)
- 2D nanostructures (layered materials)



Chemical synthesis

- Original crystal synthesis
- Melting
- Casting
- Thermal treatment
- Characterization

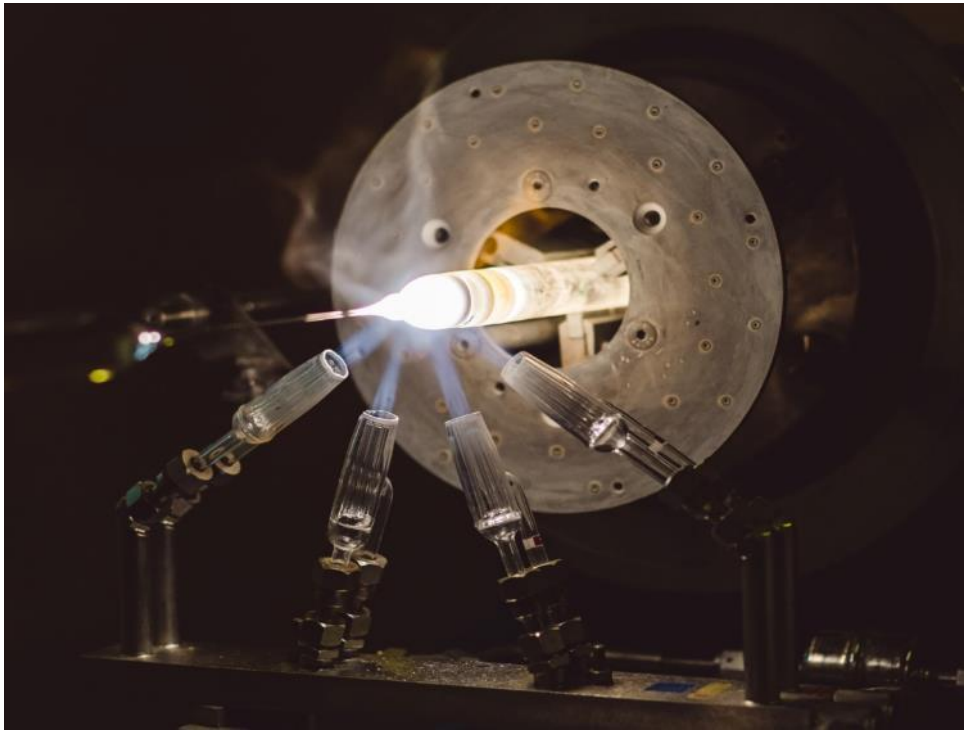


EuroLCDs

- Own research, industrialization & manufacturing facilities
- Development of customized solutions
- World's fastest optical shutter technology (<0.1ms)
- Bi-stable low energy consumption display
- Manufacturing technology of smart (switchable) glass products

Ceramoptec

- Customized solutions in fiber optic technology
- From individual fibers to ready-to-use cable assemblies
- Precision-made solutions in-house, from preform manufacturing to finished cables and bundles

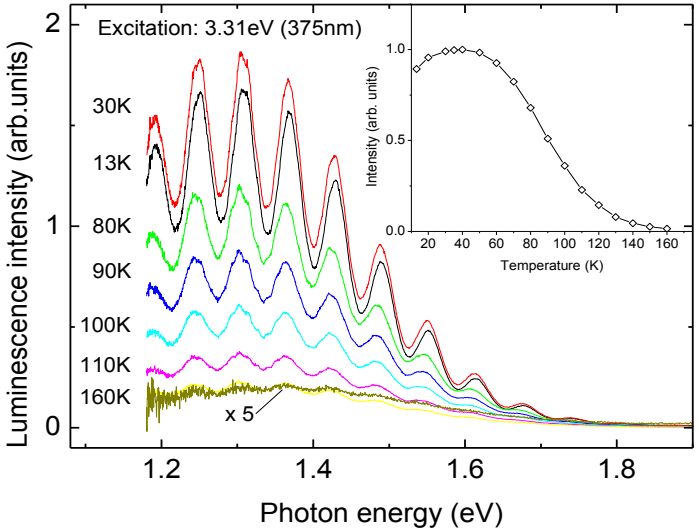


Light Guide Optics international

- Develops, manufactures and supplies fibers, fiber bundles, cables and laser delivery systems
- Full range of silica multimode optical fibers with excellent transmission in the ultraviolet–visible spectroscopy (UV-Vis) and infrared (IR) region

Optical properties of SiO_2

- Luminescence is proved as sensitive and selective method for Cl_2 contamination determination in SiO_2.
- Cl_2 luminescence has remarkable intensity at ease accessible LNT (T=78K).
- Simple method for discrimination of Cl_2 defect type in optical fiber waveguides



UV or blue light excitation source (LED or laser)

optical fibber waveguide in LN (T=78K)

IR detector

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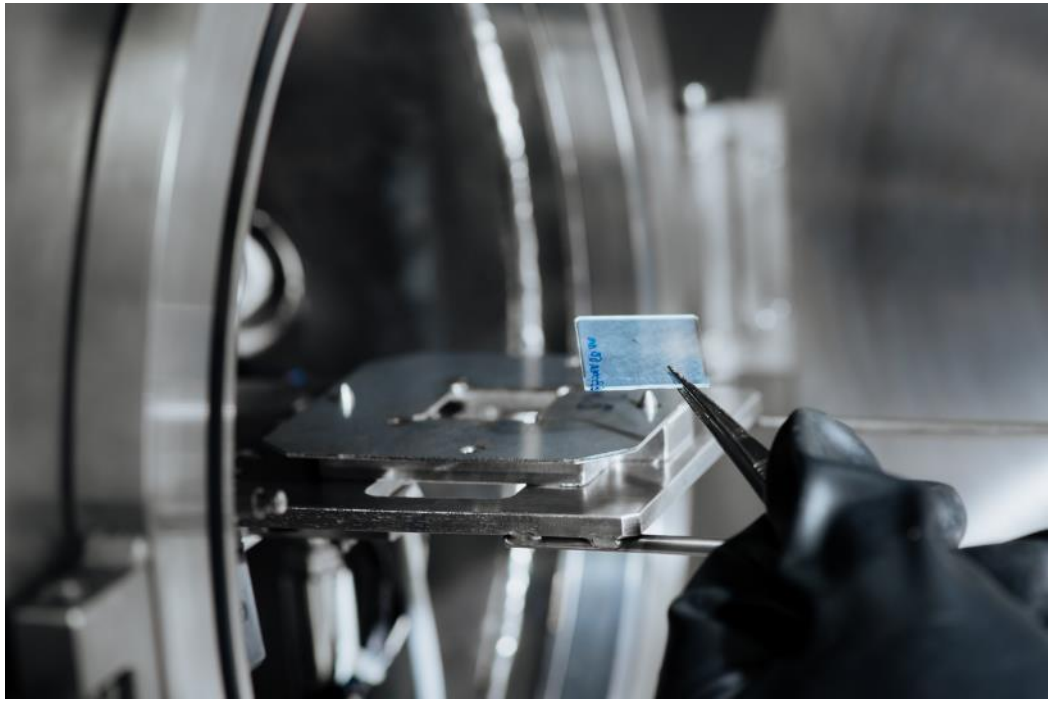
Thin films

- Magnetron sputtering
- Low temperature evaporation
- High temperature evaporation
- E-beam evaporation
- Wet casting



Sidrabe

- Development & implementation of thin film technologies
- Customized vacuum coating systems
- Roll-to-roll systems for different materials, large 3D object in-line and batch coating systems, powder coating systems, cluster laboratory systems, systems for solar & battery applications

Sidrabe: Customized R2R coaters

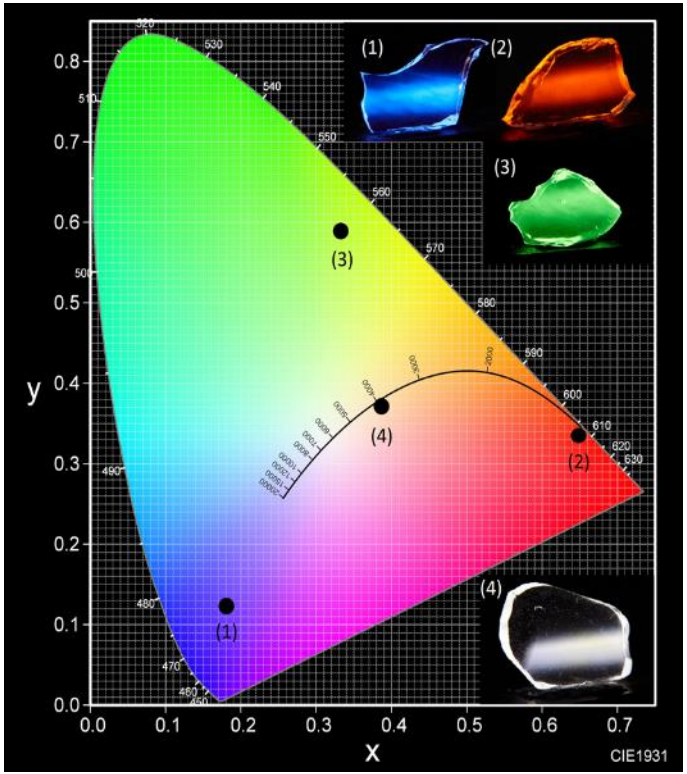
- AC/DC magnetron, e-beam & resistive evaporation, PECVD
- single and double side single layers as well as multi-layer stacks
- heating/cooling system of the process drums
- multi-compartment chamber design
- metal (magnetic and nonmagnetic) or ceramics target material
- free web span during several runs, using reverse winding
- low and smooth tension force profile for transportation

Groglass - glass coatings

- Anti-reflective & other high-performance coatings on glass and acryl
- Material and structure analysis (SEM-FIB, TEM) of thin coatings

Light convertors

- Glass ceramics
- Eye-friendly white light
- Long-term durable
- Applicable in the light sources



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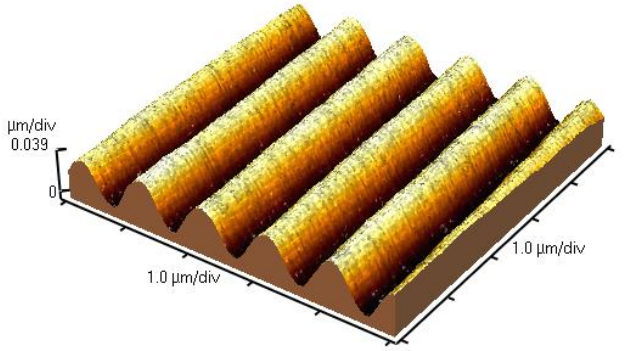
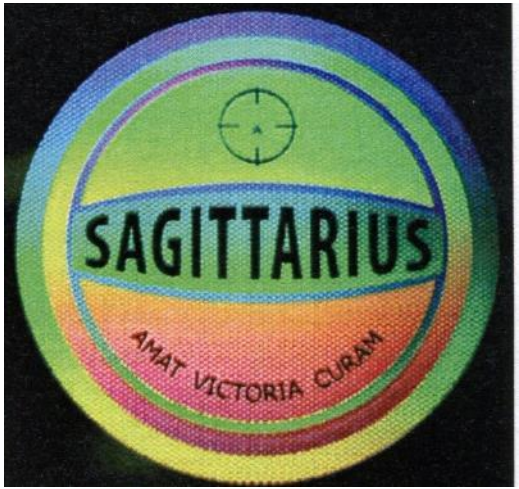
Holographic recording

- Molecular glasses for holographic recording
- Surface-relief grating formation during holographic recording
- No chemical etching
- Electrochemical Ni-shim growing for printing





Evoled

- Materials for OLED with high luminescence efficiencies
- Innovative thin film deposition method – Mixed-Ligand Complex Formation-Decomposition
- The MLCFD method allows to use inexpensive solution deposition to obtain thin films

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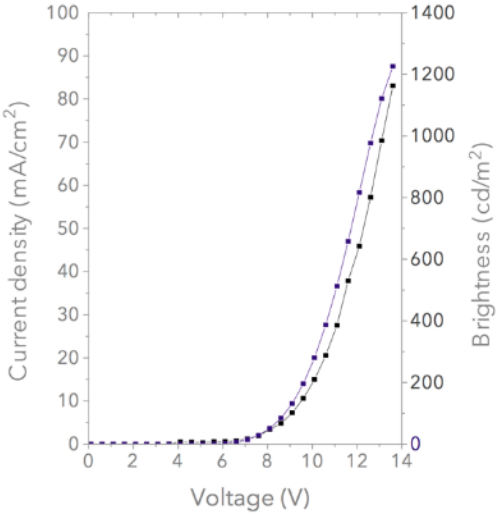
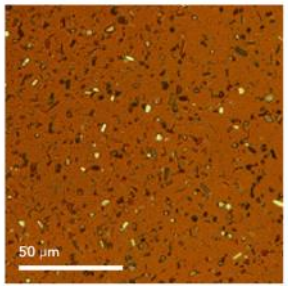
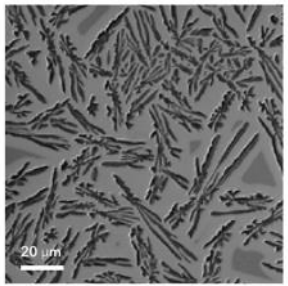
New emitters for OLED

- Original materials
- Luminescence spectra measurements
- Photoluminescence quantum yield determination
- Charge carrier mobility determination
- Analysis of morphology







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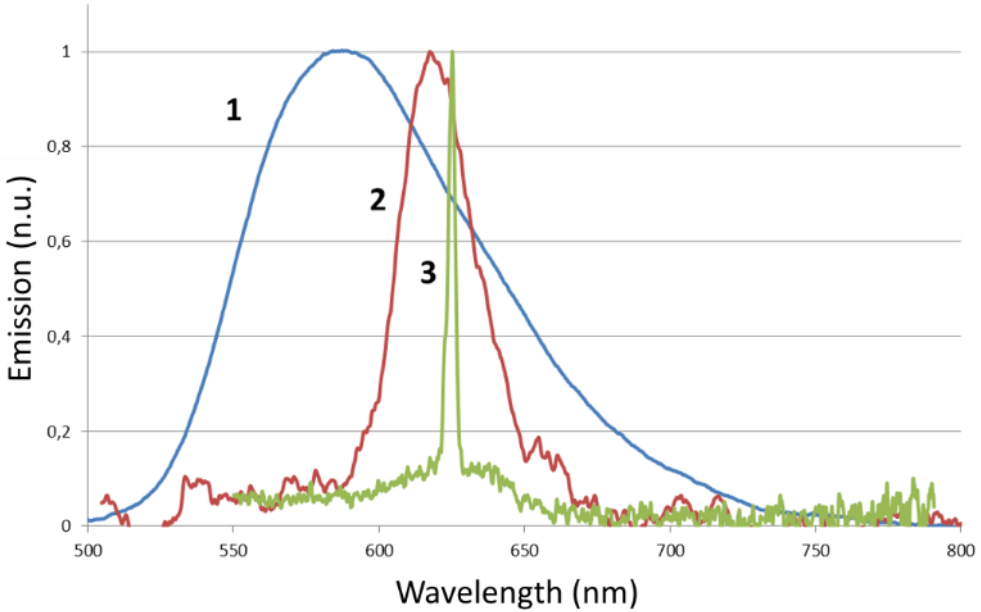
Light-amplification systems

- Original organic materials
- Optical characterisation (1)
- Amplified spontaneous emission (2)
- Organic solid-state laser (3)



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ISP Optics Latvia

- Optical components including spherical, aspherical and diffractive coated IR lenses
- Custom optomechanical assemblies and coatings.
- In-house grown FTIR materials including NaCl and KBr

Sidrabe - vacuum system development

- Thin film deposition cluster tool jointly developed with Sidrabe

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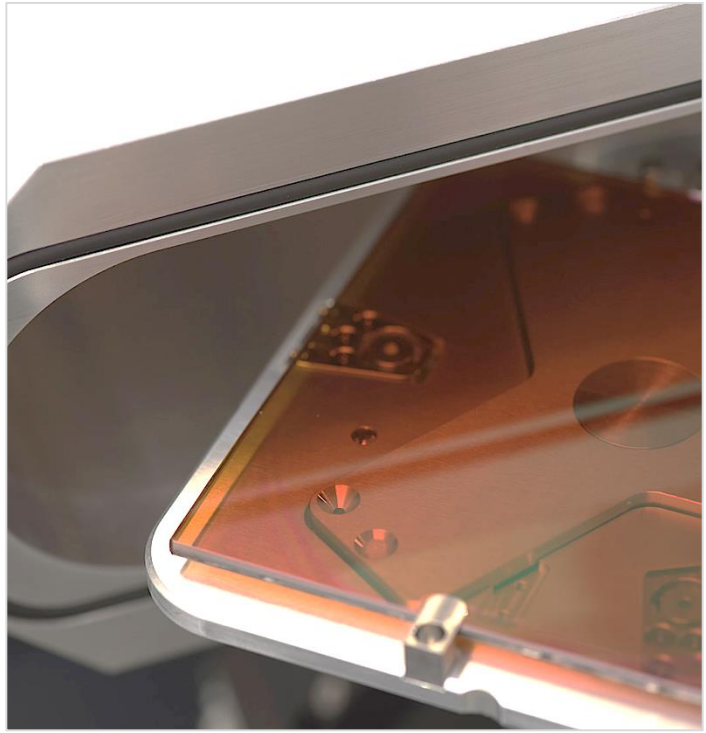
SIDRABE

Materials

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

Applications

- Light guides
- Light modulation/switch
- Emitters
- Sensors
- Dosimetry (γ-… x-ray)



Characterization

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

Technology

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

Industry partners in photonics

Web links 1/2

- **Materize** – https://www.materize.com
- **Sidrabe** - https://www.sidrabe.com/
- **GroGlass** – https://www.groglass.com/
- **Light Guide Optics International** – https://www.lgoptics.com/home-en/
- **CeramOptec** – https://www.ceramoptec.com
- **Baltic Scientific Instruments** – http://www.bsi.lv/en/

Web links 2/2

- **RD Alfa MD** – https://rdalfa.lv/en/
- **EuroLCDs** – http://www.eurolcds.com
- **Light Space Technologies** – https://www.lightspace3d.com/
- **Evoled** – http://evoled.eu
- **ISP Optics** - https://ispoptics.com/
- **Schaeffler** – https://www.schaeffler.com

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 **/ 110** in Photonics / **90 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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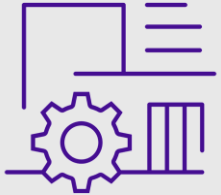
CAMART² — EC recognized Consortium

- H2020 Teaming call – to make **the best emerging ones – strong and advanced**
- ISSP In Consortium with leading Swedish partners – KTH and RISE
- The 5th best (out of 170) and **the only one in Northern Europe**
- **31M EUR** investment over 7 years
- With emphasis on **innovation** and **technology transfer**

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

Welcome to collaborate

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materize

More on our expertise
and case studies
materize.com