



FIZINIŲ IR
TECHNOLOGIJOS MOKSLŲ
CENTRAS

FTMC Cooperation Opportunities

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Vilnius | 2018 October 12 d.

About the CENTER

CENTER FOR PHYSICAL SCIENCES AND TECHNOLOGY (FTMC) is the largest scientific research institution carrying out a unique fundamental research and technological development works in scientific fields of laser technologies, optoelectronics, nuclear physics, organic chemistry, bio and nanotechnologies, electrochemical material science, functional materials, electronics, etc. in Lithuania. In the Center not only the innovative science but also high technologies expedient for business and society needs are developed.

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Implemented ISO 9001 quality standards.

What we can offer?

Services:

Analytical

Foundry Services

**Research and
Development**

**Precise Equipment
Manufacturing**



What we can offer?

Analytical:

Structural Analysis

Accredited Corrosion
Research Laboratory

Optical measurements
and investigations

High-Power Microwave
(HPM) research

Tribology Laboratory

Organic Chemistry
Analysis

Foundry Services:

Processing and Laser
Technologies

Semiconductor
Formation & Integration

Custom Organic
Synthesis

Specialized textile
Manufacturing

Precise Equipment Manufacturing:

Magnetic and Bioelectromagnetic
Investigations

Research & Development:

Technology development
from TRL 1 to 7

Solution to Business
Cases

Spin-Off incubation
environment

Analytical: Structural Analysis

Structural and elemental analysis services:

- Chemical composition determination by SEM EDX & WDX
- TEM studies
- HR XRD analysis and RSM
- XRD studies of polycrystalline materials
- Determination of chemical composition by X-ray fluorescence spectroscopy by wave dispersion method
- Auger and XPS spectroscopy

More detailed services description:

<http://litexbeam.ftmc.lt/services.php>

Price list:

http://litexbeam.ftmc.lt/images/Price_list_23.pdf

Analytical: Structural Analysis

Examples of equipment:



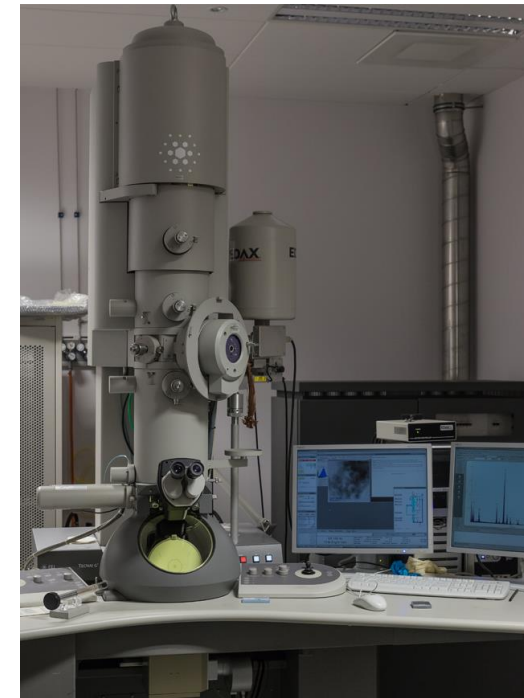
X-RAY DIFFRACTOMETER SMARTLAB:

- **X-ray source:** 9 kW x-ray source tube with rotating Cu anode.
- **Optics for polycrystalline samples:** parallel beam/Bragg-Brentano, polycapillary.
- **High resolution optics:** Ge monochromators: Ge (220)X2, Ge (220)X4, Ge (400)X2; analysers: Ge (220)X2, Ge (400)X2.
- **Detectors:** scintillation SC-70, 1D (linear) D/teX Ultra.
- **High temperature stage** Anton Paar DHS 1100 (temperatures up to **+1100 °C** in vacuum or He gas atmosphere).



SCANNING ELECTRON MICROSCOPE HELIOS NANOLAB 650:

- **Electron source** - Schottky type field emission electron source.
- **Galium ion source** – FIB.
- **X-ray spectrometer (EDX)** - INCAEnergy (Oxford Instruments) with X-Max detector.
- **Resolution:** 0.8 nm (30-2 kV); 0.9 nm (1 kV); 1.5 nm (200 V).



TRANSMISSION ELECTRON MICROSCOPE TECNAI G2 F20 X-TWIN:

- **Electron source** - Schottky type field emission electron source.
- **Energy dispersive x-ray spectrometer** - EDAX with r-TEM detector.
- **Resolution** (point, line) - (0.25-0.102 nm).

Full available equipment list:

<http://litexbeam.ftmc.lt/index.php> -> Equipment

Analytical: Accredited Corrosion Research Laboratory



Accredited Corrosion Research Laboratory services:

- Expert evaluation of corrosion damages of various products (metals, alloys, steels, paints, lacquers, etc.) in natural and artificial atmosphere and solutions.
- Evaluation of corrosion impact on industrial objects.
- Consultation on corrosion protection.
- Accredited according to **ISO/IEC 17025:2005** and **EN ISO 9227:2017** standards.
- The Scope of Accreditation (Flexible) also covers an evaluation of coatings corrosion damages according to the **EN ISO 10289, EN ISO 4628** clauses 2, 3, 4, 5, 6 and 7.

Pricing:

The price to be agreed upon.

Analytical: Accredited Corrosion Research Laboratory



Additional services and testing:

1. Evaluation of coatings adhesion by Cross Cut Test, **EN ISO 2409**.
2. Determination of resistance to liquids. Immersion in liquids other than water, **EN ISO 2812-1**.
3. Determination of resistance to liquids. Water immersion method, **EN ISO 2812-2**.
4. Determination of resistance to humidity. Condensation (single-sided exposure), **EN ISO 6270-1**.
5. Determination of resistance to humidity (condensation-water atmospheres), **EN ISO 6270-2**.
6. Copper-accelerated acetic acid salt spray (CASS) corrosion test, **EN ISO 9227:2017**.
7. Total immersion corrosion test for Aircraft Maintenance Chemicals, **ASTM F 483-08**.
8. Corrosion of low-embrittling cadmium plate by Aircraft maintenance chemicals, **ASTM F 1111**.
9. Sandwich corrosion test, **ASTM F 1110-02**.
10. Cyclic immersion corrosion of cadmium plate, **SAE AIR6130**.
11. MEK Resistance test, **ASTM D 4752 – 98**.

Analytical: Optical measurements and investigations

Optical measurements and investigations services:

- Transmittance measurements.
- Diffusion and mirror reflection spectra measurements.
- Low-temperature (3-300 K) modulation spectroscopy (photo-, electro-reflectance, lambda-modulation) and photoluminescence measurements.
- Determination of electron energy band gap.
- Determination of Varshni, Arrhenius parameters.
- Evaluation of the optical yield/quality (emission intensity versus reference sample emission)
- finding of the characteristic spectral lines of the sample, which can be exploited for a particular application within UV-NIR spectral range.

Pricing:

The price to be agreed upon.

Analytical: Optical measurements and investigations

Additional Optical measurements and investigations services:

- **Research & Development:**

- FT-IR spectroscopy in vacuum
- Determination of the absolute configuration of molecules (VCD)

- **Polymers and Chemistry:**

- Identification of inorganic fillers in polymer composites in the far infrared region
- Identification of inorganic minerals and pigments

- **Surface Analysis:**

- Detection and characterization of thin and monolayers
- Surface analysis combined with polarization modulation (PM-IRRAS)

- **Material Science:**

- Characterization of optical and highly reflective materials (windows, mirrors)

- **Semiconductors:**

- Determination of oxygen and carbon contents in silicon wafers for quality control

Analytical: Optical measurements and investigations

Optical measurement equipment:

- **Shimadzu UV-VIS-NIR Spectrophotometer UV-3600:**

- Transmittance and reflectance
- Wavelength range of 185 to 3,300 nm
- Wavelength accuracy : Visible/ Ultraviolet region ± 0.2 nm, Near-infrared region ± 0.32 nm
- Absorbance range -6Abs to +6Abs, Accuracy within ± 0.003 Abs (1.0Abs)/ ± 0.002 Abs (0.5 Abs), Drift 0.0002 Abs/h.
- Kinetics
- Accessories: MPC-3100 Multi-Purpose Large-Sample Compartment (built-in integrating sphere, Wide wavelength range : 240 ~ 2600 nm, Maximum sample size : Transmission 305 mm dia. ~50 mm thick or 204 mm dia. ~300 mm long. Reflection 305 mm dia. ~50 mm thick)

- **Low-temperature (3-300 K) modulation spectroscopy setup:**

- photoluminescence and photoluminescence excitation
- Spectroscopic range 200 nm (UV) - 2500 nm (NIR)
- Resolution: <1 nm
- Sensitivity for the modulation spectroscopy: $\Delta R/R \sim 10E-4 - 10E-5$.
- Various CW and pulsed excitation/modulation sources available (266, 355, 473, 532, 633, 657 nm) to excite for luminescence and probe different depth of a sample.

Analytical: Optical measurements and investigations

Optical measurement equipment:

- **Variable angle spectroscopic ellipsometer RC2:**

- Wavelength Range: 210-1690 nm;
- Angles of Incidence: 20° - 90° ($\pm 0.02^{\circ}$) (Vertical automated angle base);

Measurement capabilities:

- Spectroscopic Ellipsometry (SE), Psi ($\pm 0.03^{\circ}$)* and Delta ($\pm 0.06^{\circ}$)* over their full range;
- Generalized SE, complete 2x2 Jones matrix for anisotropic samples;
- Mueller Matrix SE, all 16 elements (± 0.005)* of the 4x4 Mueller matrix;
- Depolarization, measure ($\pm 0.5\%$)* and model the non-ideal nature of your sample;
- Intensity, both reflectance and transmittance, including anisotropic terms such as like-and cross-polarized intensities. (* acquisition time 10 seconds)

Accessories:

- Camera with display to view spot location on sample.
- Focussing to 200 μm beam diameter.
- Focussing to 400 μm beam diameter.

- **Fourier-transform infrared spectrometer (FT-IR) Vertex 70v (Bruker) with PMA 50 Polarization modulation accessory:**

- Wavelength range: 12000 – 30 cm^{-1} (resolution 0.2 cm^{-1});
- RAM II module equipped with 0.5 W power Nd:YAG (1064 nm) laser.

Accessories:

- 11° Combined transmission and specular reflection accessory;
- Variable angle reflection accessory;
- Automatic rotational holder for polarizers (Polyethylen and KRS-5);
- Standard transmission sampling kit;
- Horizontal ATR (ZnSe);
- Diffuse reflectance accessory;
- 30 degree specular reflectance accessory.

Analytical: High-Power Microwave (HPM) Research

Structural Analysis High-Power Microwave (HPM)
Research services:

Shielding against HPM weapons investigations:

Shielding effectiveness measurements of:

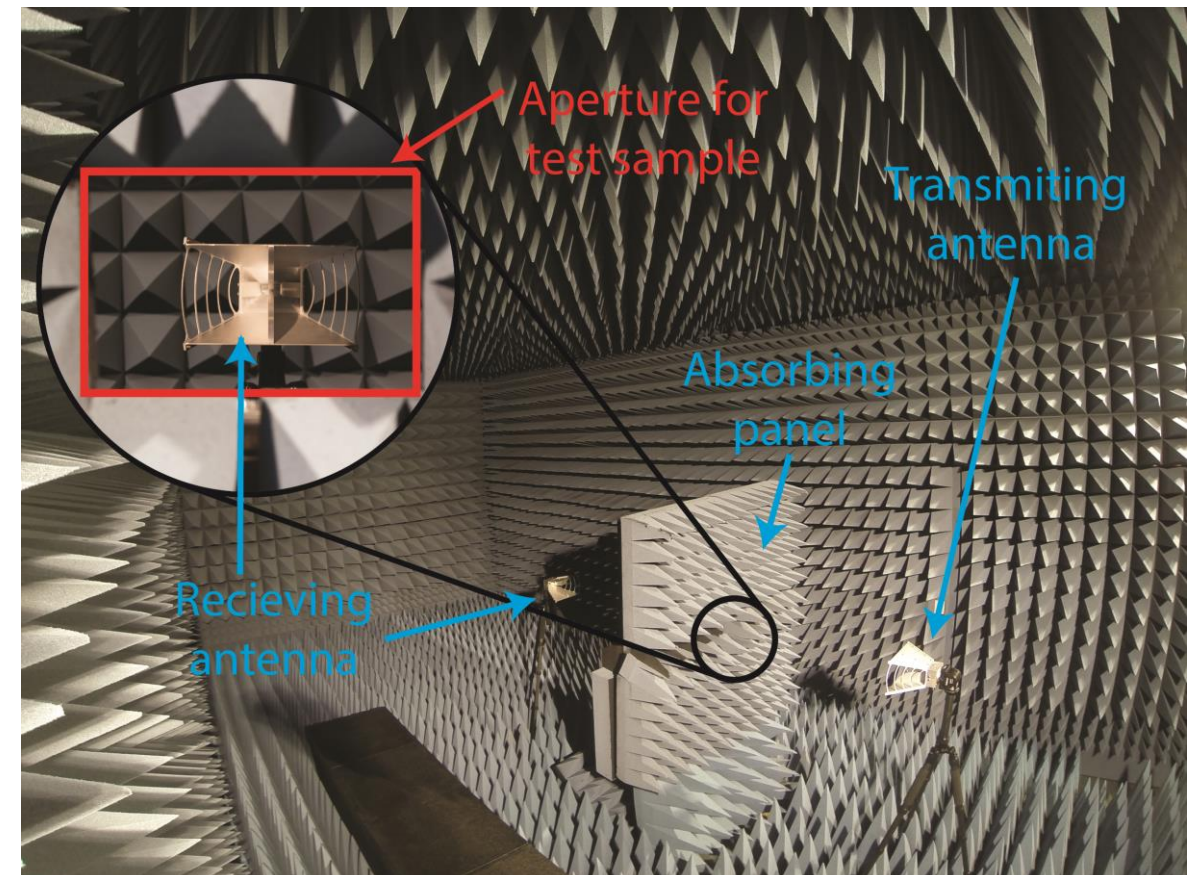
- Textiles
- Building materials
- Windows

Useful for:

- Hardening electronics against HPM radiation

Pricing:

The price to be agreed upon.



Analytical: High-Power Microwave (HPM) Research

Structural Analysis High-Power Microwave (HPM) development services:

High Power Microwaves (HPM) attack detection systems development:

Prototype parameters:

- 384 steps for full rotation ($0.93^\circ/\text{step}$)
- Scanning 16 s for 360°
- Nonreflecting tower, max load 10 kg
- Frequency range 1-18 GHz (covered by sensors set)

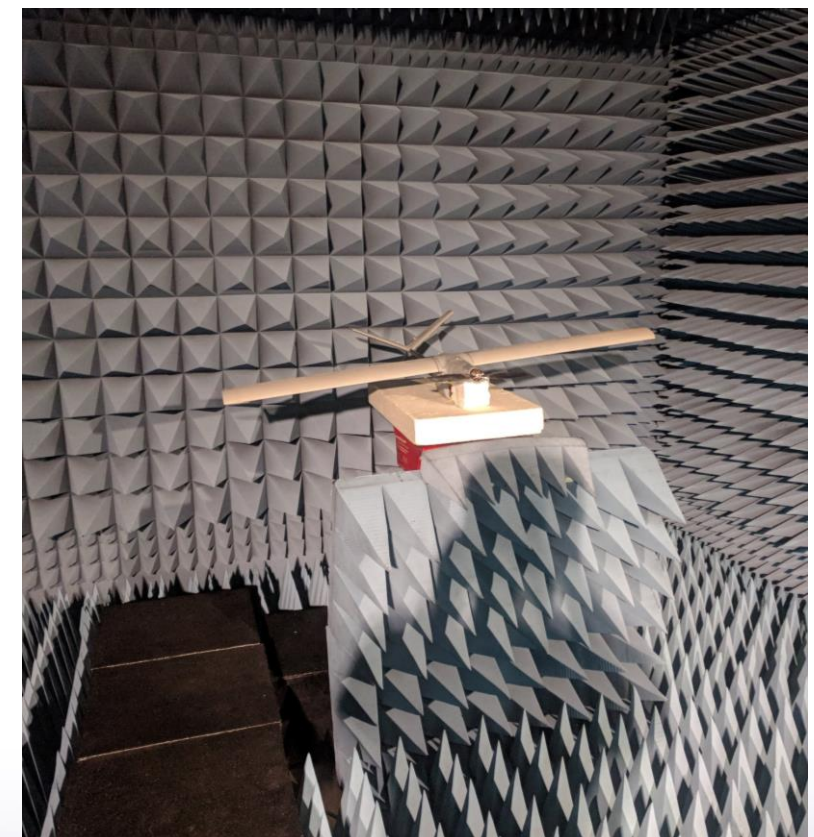
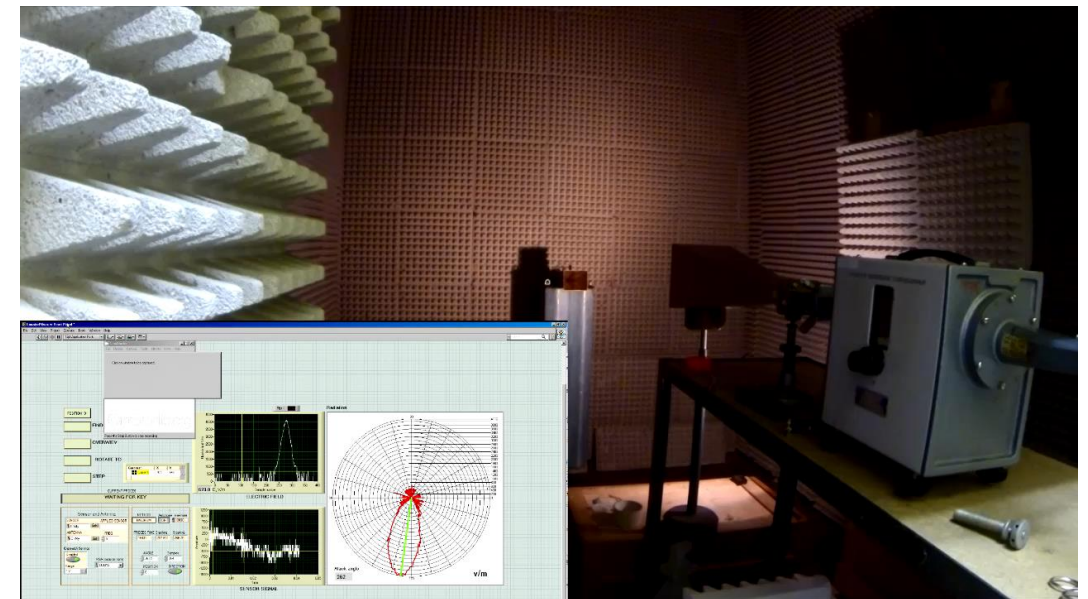
HPM for UAV's (drones) upset systems development:

HPM can damage:

- Navigation systems
- Control systems
- Stabilization systems
- Communication systems
- Motor electronics

Pricing:

The price to be agreed upon.



Analytical: Tribology Laboratory

Tribology Laboratory services:

- Research of lubrication, wear, friction and other interactions between moving surfaces.
- Studies of degradation and electrochemical processes.
- Training of tribology researchers.
- Lubrication technology, including coatings, biobased oils and additives.
- Degradation of oils, biofuels, rubber, plastics and similar functional materials.
- New wear resistant coating development together with synthesis chemists
- Electrochemical and corrosion processes in oil films.
- Tribology of anodized alumina, electrochemically treated surfaces and other coatings.

Pricing:

The price to be agreed upon.

Analytical: Organic Chemistry Analysis



- **Laboratory of Materials Analysis** is researching functional organic compounds, performing chemical analysis and evaluating their biological properties.
- The scientific group has a strong background in development and optimization of chromatography (both liquid and gas) and mass-spectrometry based analytical techniques and their applications in environmental, (bio) pharmaceutical and industrial objects; participates in R&D projects.
- The main tasks are separation, identification and analysis of natural substances (mainly secondary metabolites, such as essential oils, flavonoids, polyphenols, coumarins, alkaloids etc.) with many different biological properties; bio-assays (toxicity, antimicrobial, antioxidant activity etc.) of the extracts, determination of the eco-toxic substances in different industrial matrices.

Pricing:

Upon Request + 10% discount for fifth sample and more.

Organic Chemistry Analysis sample preparation techniques:

- a. preparation of powder samples by a grinding-mill
- b. extraction with organic solvents, solid-phase extraction, ultra-sonic agitation
- c. distillation, hydro-distillation by a Clevenger type apparatus

e. chemical derivatization

f. pre-concentration procedure

Organic Chemistry Analysis services:

No	Service	Specific description of service
1.	Sample preparation for analysis	Simple mechanical sample preparation without chemicals (shredding, milling, etc.)
2.	Sample preparation for analysis	Sample preparation by several stages or using chemicals
3.	Determination of chemical composition by HPLC–DAD–TOF	Qualitative and quantitative analysis
4.	Total content of phenols	Analysis of total content of phenols will be performed spectrophotometrically by the Folin-Ciocalteu method (using gallic acid as a reference).
5.	Anti-oxidant activity test	The test will be applied by DPPH and ABTS methods
6.	Anti-oxidant activity test	The test will be applied by electrochemical methods (cyclic voltammetry and square wave voltammetry techniques)
7.	Toxic activity test	The brine shrimp (<i>Artemia</i> sp. (larvae)) lethality test
8.	Spectrophotometric analyses	Different standard methods

Equipment and techniques available in the laboratory:

1. High performance liquid chromatography system (Agilent HPLC 1260 Infinity) with diode array (1260 DAD UV/Vis) and time of flight mass spectrometric detectors (6224 TOF LC/MS, Agilent)
2. BAS-Epsilon system (West Lafayette, USA) for cyclic voltammetry and square wave voltammetry.
3. Lambda 25 UV/VIS spectrometer (Perkin Elmer)

Foundry Services: Processing and Laser Technologies

Processing and Laser Technologies department services:

Laser processing:

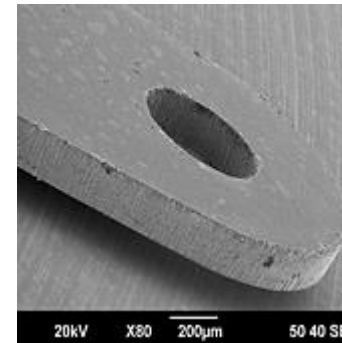
- In-Glass marking.
- Laser Beam Interference Ablation.
- Laser Direct Writing.
- Ultrashort Pulse Laser Ablation.

Molecular:

- Dip Pen Nanolithography.
- Microcontact printing.
- Piezoelectric InkJet Printing.
- Colloidal Nanolithography.

Analytical:

- bio AFM.
- Electrochemical sensors.
- Imaging Surface Plasmon Ellipsometry.
- SEM with EDS/WDS elemental analysis.



Detailed services:

<http://www.lts-ftmc.lt/en/>

Pricing:

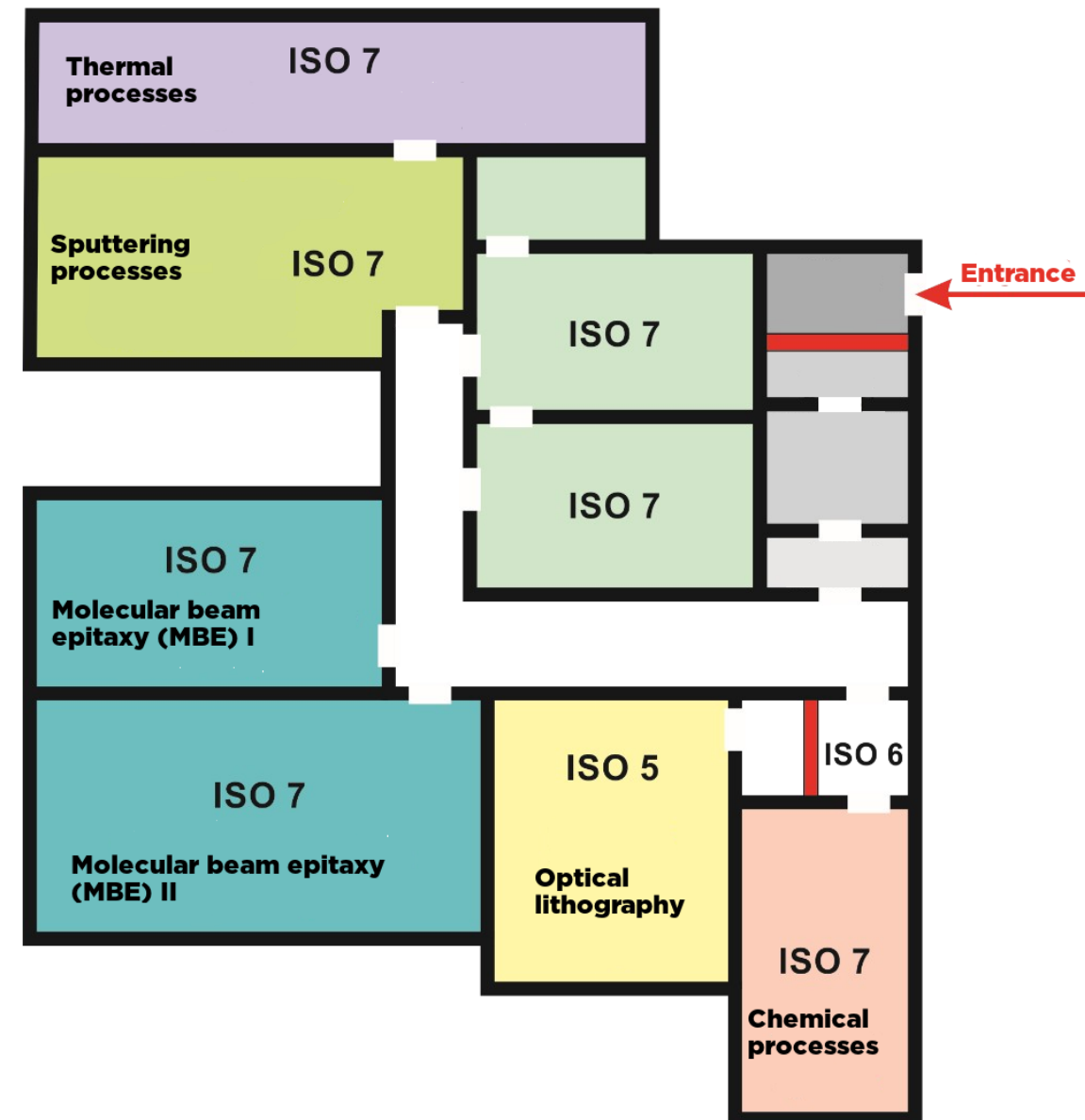
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Foundry Services: Semiconductor Formation & Integration

Semiconductor Formation & Integration foundry services:

- ISO5 (50 m²) and ISO7 (352 m²) cleanroom facilities.
- Two molecular beam epitaxy reactors for III-V compounds on up to 3" wafers;
- Full prototyping/production line for small amounts of optoelectronic devices and semiconductor lasers;
- Fabrication of mid-IR (3-5 μm) Quantum Cascade Lasers for gas sensing applications
- Molecular Beam Epitaxy services;
- Fabrication of laser structure wafers with custom wavelengths (3-5 μm);

Very short lead time (2-6 weeks).

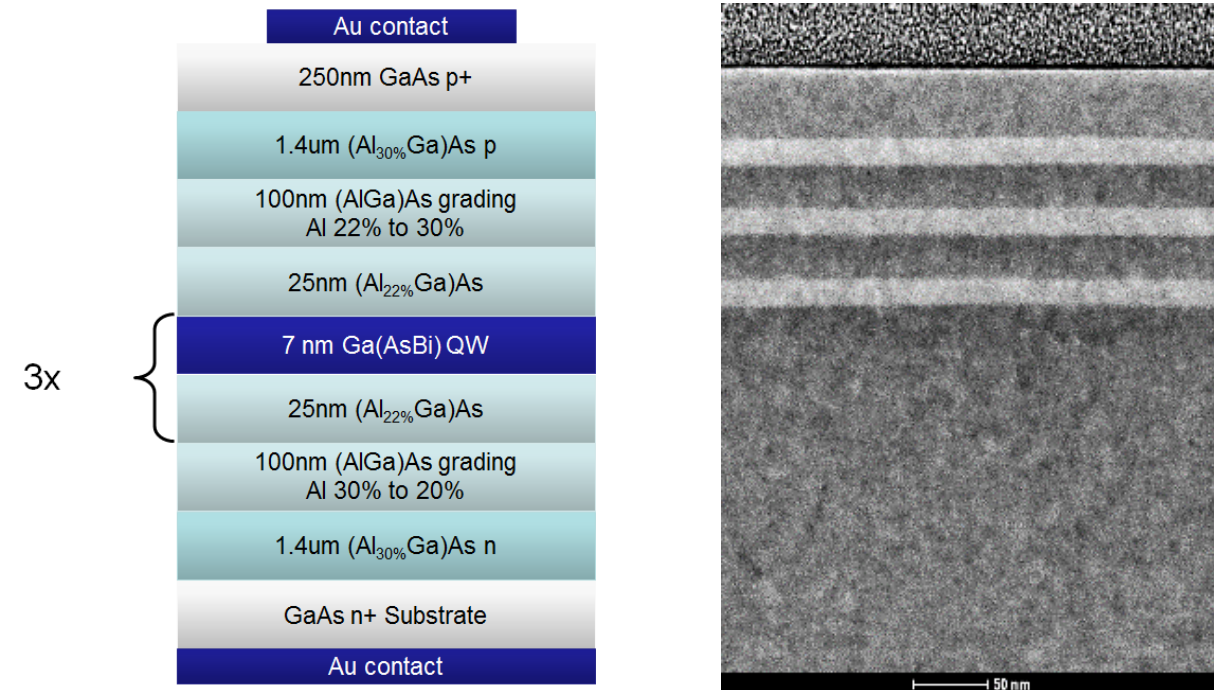


Foundry Services: Semiconductor Formation & Integration

Semiconductor Formation & Integration foundry services:

Growth of QC structures for mid-IR (3-5 μm)

- InGaAs/AlAsSb on InP (strain balanced)
- InGaAs/AlInAs on InP (lattice matched and strain balanced)
- InGaAs/InGaAs on InP (strain balanced)
- InAs/AlSb on InAs (nearly lattice matched)
- InAs/Al(As)Sb on InAs (lattice matched)

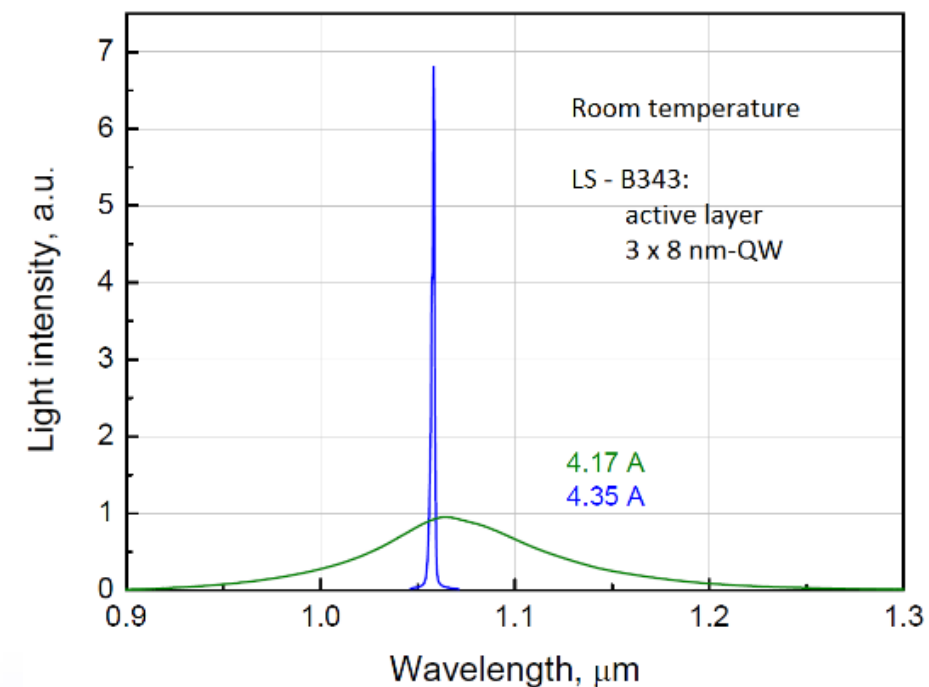


Interband devices

- InGaAsBi on InP
- GaAs/GaAsBi on GaAs
- GaAs/AlGaAs on GaAs etc.

Pricing:

The price to be agreed upon.



Foundry Services: Semiconductor Formation & Integration

Semiconductor Formation & Integration foundry available equipment:

Thin film deposition:

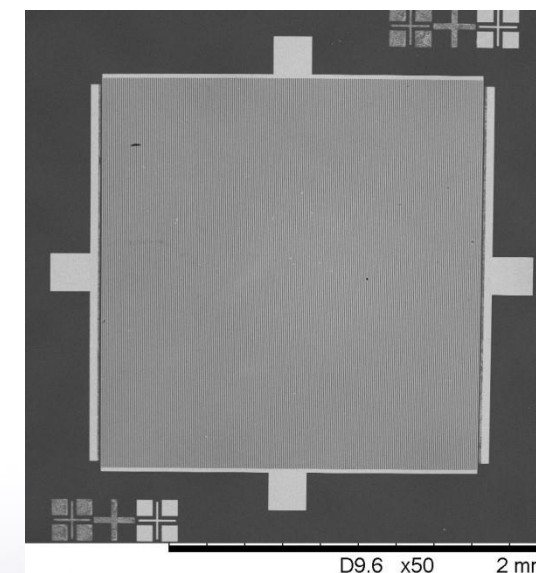
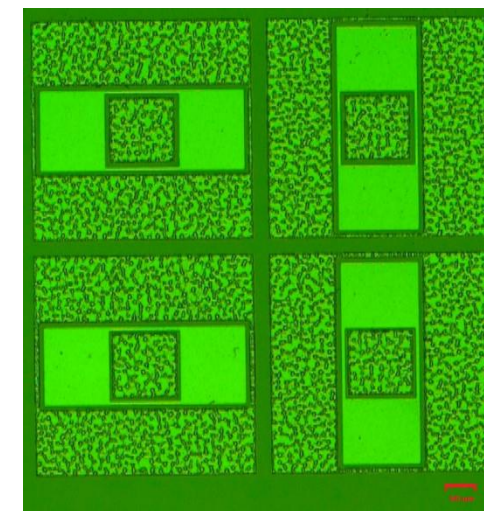
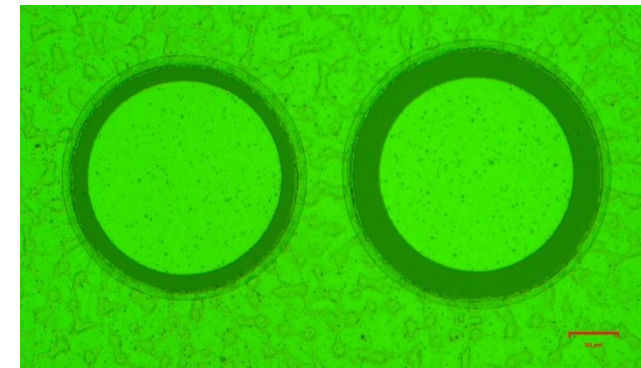
- Magnetron sputtering system
- E-beam sputtering system
- Double tube PECVD for SiNx, SiO₂, Al₂O₃, SiC, graphene.

Lithography:

- Laser Lithography system Heidelberg instruments DWL 66+ with 600nm resolution
- Karl Suss MJB3 mask aligner 1.5um resolution.

Arriving in 6 months:

Chlorine chemistry ICP RIE system;
Fluorine chemistry ICP RIE system;
PECVD reactor for SiNx, SiO₂ coatings;
New mask aligner (up to 5'', 1μm resolution)

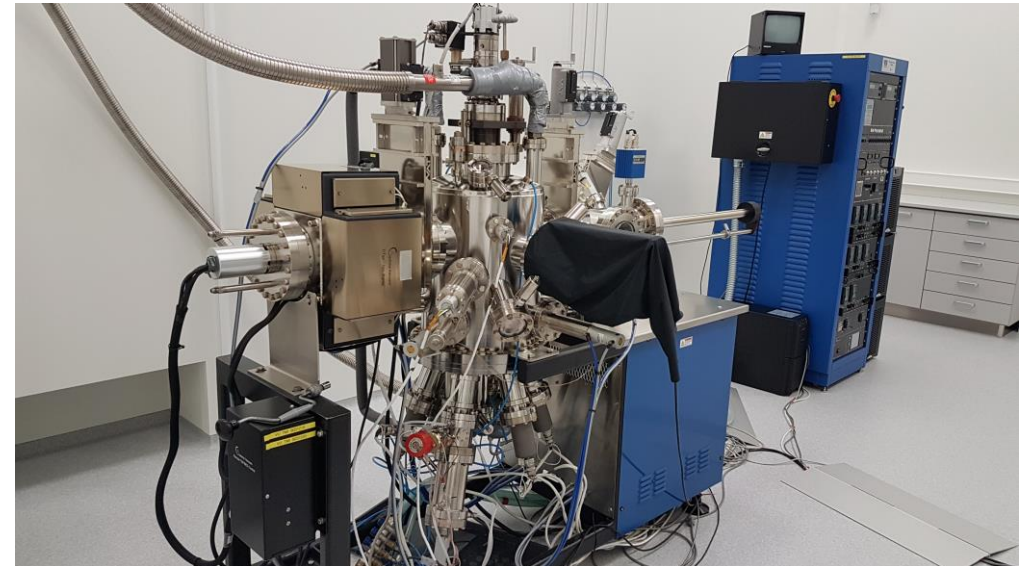


Foundry Services: Semiconductor Formation & Integration

Semiconductor Formation & Integration foundry available equipment:

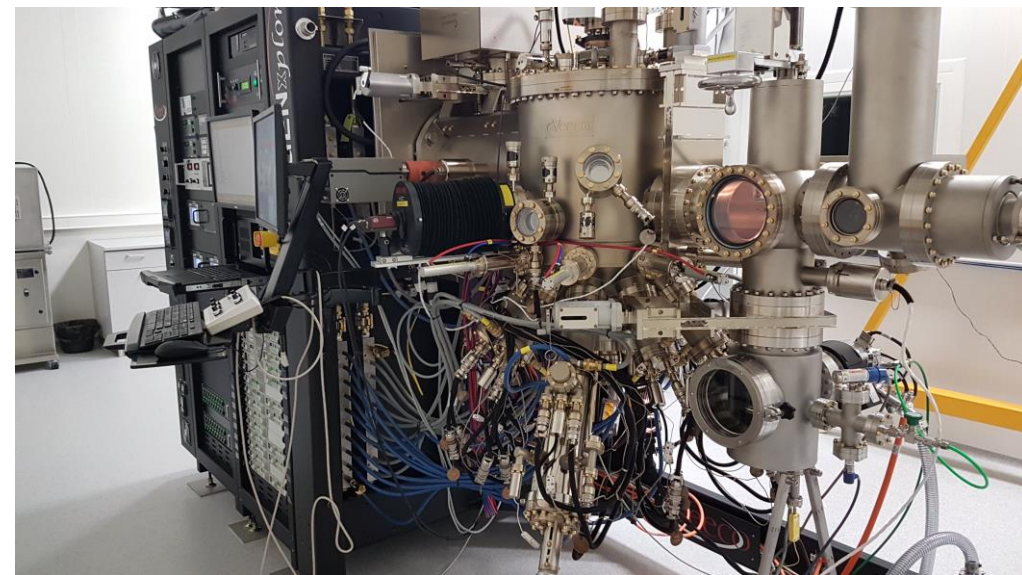
SVT Asccociates MBE reactor:

- 2'' wafers;
- Clean Antimony-free reactor;
- Group III: In, Ga, Al;
Group V: As cracker, Bi;
Dopants: Si, Be, Te (GaTe)
- III-As;
III-AsBi;
LT-GaAs;



VEECO GENXplor R&D MBE system:

- 3'' wafers;
- Extremely high composition and thickness accuracy (error <1.5%);
- Group III: In, 2xGa, Al;
Group V: As cracker, Sb cracker, Bi;
Dopants: Si, Be, Te (GaTe)



Foundry Services: Custom Organic Synthesis

Custom organic synthesis and R&D services:

Examples of products and services:

- Total synthesis of 5-OH-Omeprazole;
- Total synthesis of Orellanine;
- Hybride reactor for Suzuki coupling (prototype for 2-3kg scale synthesis available);
- Copper-free synthesis of 3-bromopyrazole from 3-aminopyrazole;
- Synthesis of 2,5-dioxopyrrolidin-1-yl 3-(2,5-dioxo-2,5-dihydro-1H-pyrrol-1-yl) propanoate in 3 kg scale;
- Synthesis of Biotin NHS ester in 3 kg scale;
- Synthesis of Cy2, Cy3 and Cy5 dyes and NHS esters in 1-10 g scale

New product R&D lead time – from 2 days up to 1 year approx.

Pricing:

The price to be agreed upon.

Foundry Services: Specialized textile Manufacturing

Specialized textile Manufacturing services:

- Manufacturing of textile materials.
- Design and construction of clothing systems.
- Development of prototypes of textile materials and products.
- Manufacturing of pilot batches.
- Performance of their final trial.
- Manufacturing of military protection clothing.

Pricing:

The price to be agreed upon.

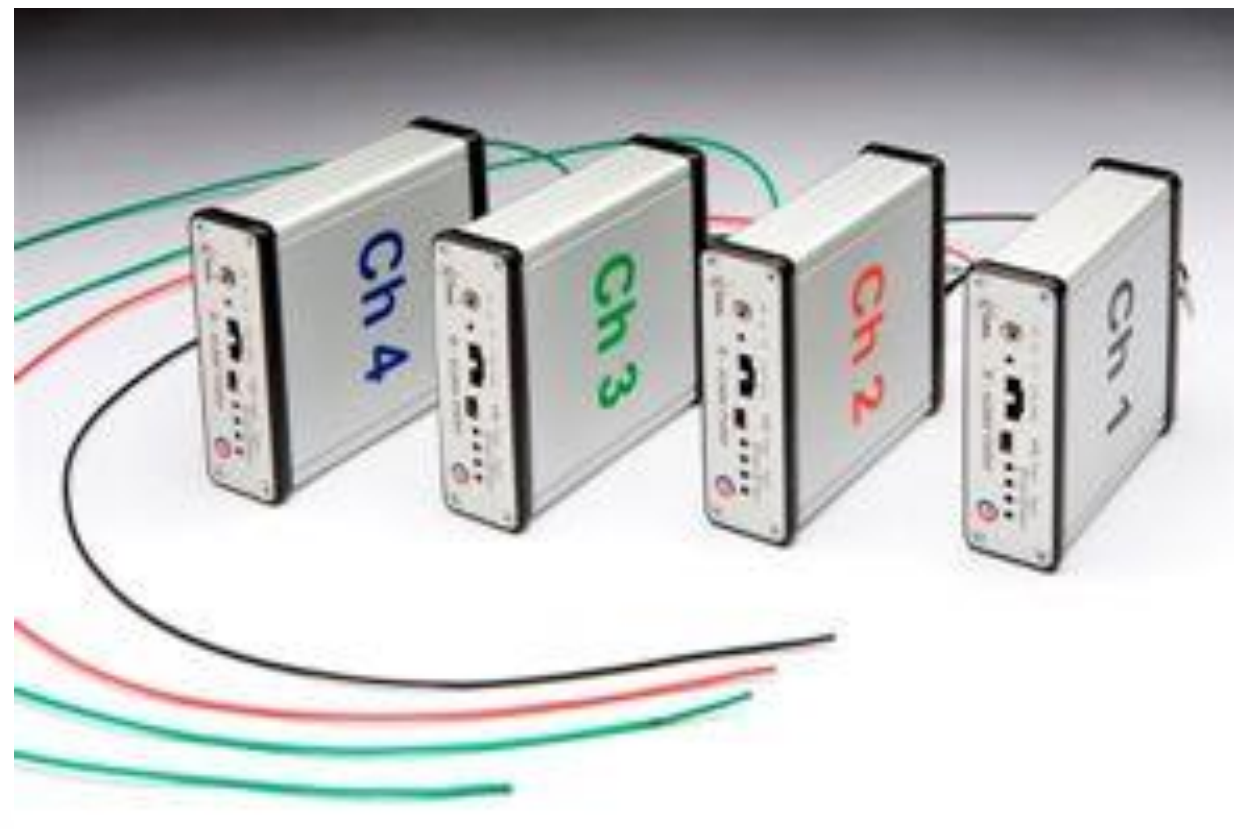


Precise Equipment Manufacturing: Magnetic and Bioelectromagnetic Investigations

Precise Equipment manufactured at FTMC:

• CMR-B-scalar sensors module for high pulse magnetic field measurement:

- CMR-B-scalar sensor based on polycrystalline (La-Sr-Mn-O) films and colossal magnetoresistance (CMR) effect;
- It is able to measure a magnetic induction of up to 40 T independently on its direction;
- The sensor active volume is $400\ \mu\text{m} \times 50\ \mu\text{m} \times 0.4\ \mu\text{m}$;
- Sampling rate 0.73 MSa/s;
- Remotely controlled from PC;
- Optical data transfer line;
- 2 D and 3D sensors array possibilities.



Precise Equipment Manufacturing: Magnetic and Bioelectromagnetic Investigations

Precise Equipment manufactured at FTMC:

- **Commercial CMR-B-scalar magnetic field meter - Pulse magnetic field measurement in to electric power systems and high efficiency electromotors:**
- It is able to measure a magnetic induction in the (0,2 - 5) T range independently on its direction.
- Frequency range up to 10 kHz;
- Sampling rate 2 MSa/s;
- Data storage possibility in to SD card



Precise Equipment Manufacturing: Magnetic and Bioelectromagnetic Investigations

Precise Equipment manufactured at FTMC:

- Frequency converter – speed and torque control of AC induction motors:
 - Motor power – up to 4kW.
 - Supply – three-phase 50/60Hz, 400V.
 - Output voltage frequency – adjustable, (0–100) Hz.
 - Adjusting of speed (output voltage frequency) – by hand, using keyboard; automatic in feedback control system.



Precise Equipment Manufacturing: Magnetic and Bioelectromagnetic Investigations

Precise Equipment manufactured at FTMC:

• Nanoelectroporator:

Biotechnologies:

Microbial transformation;

Mammalian cell transfection;

Protein transfection;

Enhance extraction of cell proteins;

Microbial decontamination.

Medicine:

Enhance drug delivery to cancer and pathological cells or organism;

Induction of local intracellular signal;

Induction of cell migration.

Specifications:

Pulse rise time – 100 ns;

Pulse fall time– 300 ns;

Pulse duration – $3 \mu\text{s} \div 10 \text{ ms}$;

Pulse amplitude – $100 \div 4000 \text{ V}$;

Single and repetitive signals generation.



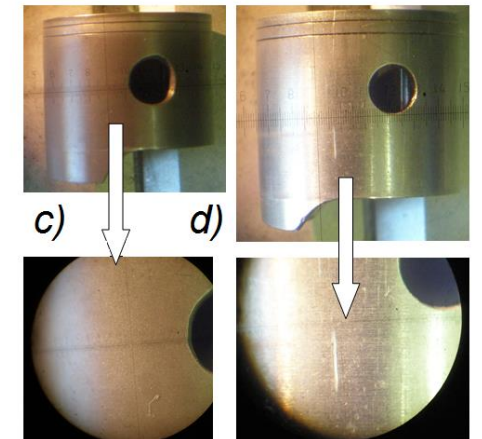
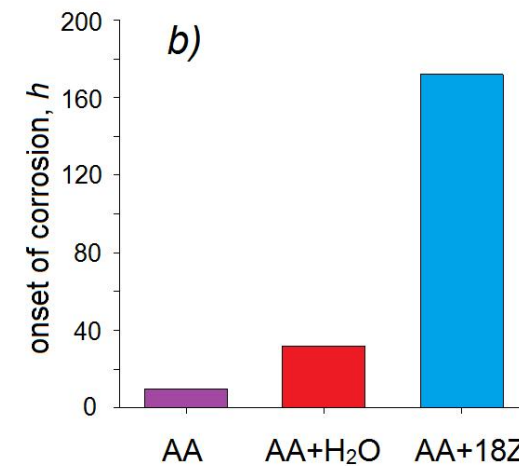
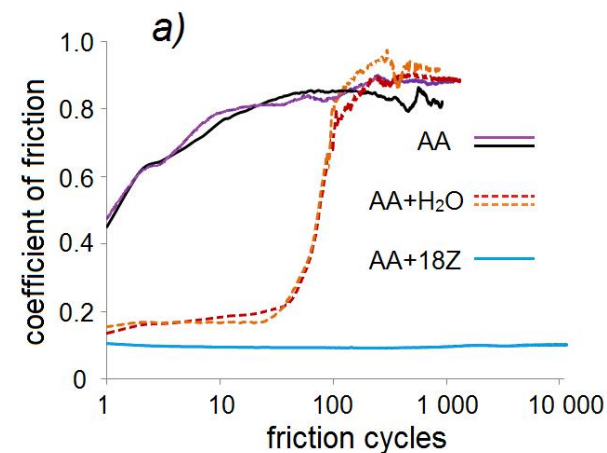
Price:

Upon request.

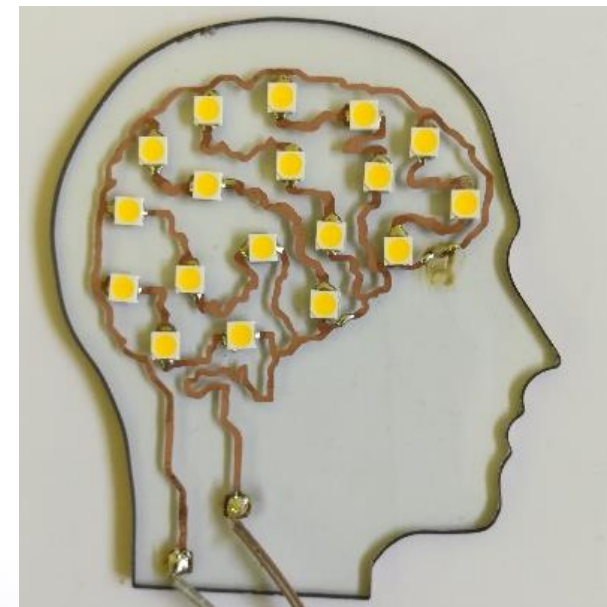
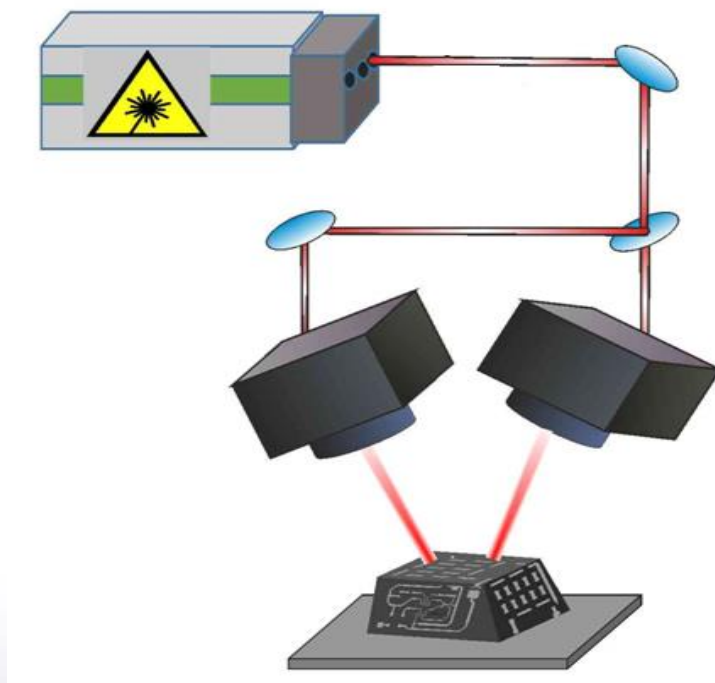
Research & Development: Technology development from TRL 1 to 7

Example of Technologies already developed at FTMC and ready for transfer or scale-up:

- Anodized aluminium coating with biobased filler to significantly improve resistance to wear.



- Selective Surface Activation Induced by a Laser (SSAIL).



Research & Development: Spin-Off incubation environment

FTMC has two science and technology parks:

- **Science and Technology Park of Institute of Physics” (FIMTP):**
 - Specialized in Photonics and engineering technologies
 - Provides assistance for enterprises growth and technological business incubation.
 - Increase of competitiveness of the country and induce the growth of knowledge-based economy.
 - Promotes export stimulation and clustering.
 - <http://www.fimtp.lt/en/>
- **“Science and Technology Park for New Materials”** – under development. Main focus for chemistry, biotechnology and semiconductor fields.





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FTMC – your R&D partner!

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Vilnius | 2018 October 12 d.



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