

LABORATORIES OF AUTOMOTIVE MECHATRONICS

Description of main activities:

The Institute of Automotive Mechatronics (UAMT) at the Faculty of Electrical Engineering and Information Technology of the Slovak University of Technology in Bratislava provides research and development and education in applied and automotive mechatronics, electromobility and control of mechatronic systems. Complex mechatronic systems are being formed based on the synergy of mechanical, electronic, information, communication and control technologies and their integration. UAMT consists of four departments: Department of Applied Mechanics and Mechatronics, Department of Information, Communication and Control Systems, Department of Electronics, Microcomputers and PLC Systems, Department of E-mobility, Automation and Drive Systems.

Research, education and cooperation with industries are carried out in the following laboratories and teaching rooms of the Institute:

- Joint laboratories and teaching rooms of automotive mechatronics and electromobility (supported by Volkswagen Slovakia, a. s., Schneider Electric, s. r. o., PSA Peugeot Citroen Slovakia)

- Laboratories of computer modeling, simulation and experimental mechatronics
- Laboratory of mechatronic systems modeling and control
- Laboratory of autonomous mechatronic systems
- Interactive online lab

Equipment available:

- Demonstration modules for teaching automotive mechatronics and electromobility,
- Computer systems, CAD-CAE supporting software systems: ANSYS, MSC ADAMS, CATIA, Solid Edge, AutoCAD, Matlab Simulink, Labview, MATHEMATICA,
- Electric propulsion systems; traction - driving systems and power electric energy systems,
- Electronic teaching models for automotive mechatronics; fuel cell systems and their management and diagnostic systems,
- Diagnostic modules for automotive mechatronics and electromobility; hybrid car electronic module; ABS electronic module;

combustion engine electronic module; electronic module for communication in cars,

- Biomechatronic modular electronic and software system for measuring acupuncture points,
- Devices for measuring material properties, deformation and mechanical stresses, and dynamic properties of mechatronic components and systems,
- Cars and electromobiles (Peugeot 206, Kia, VW e-Up).

CONTACT

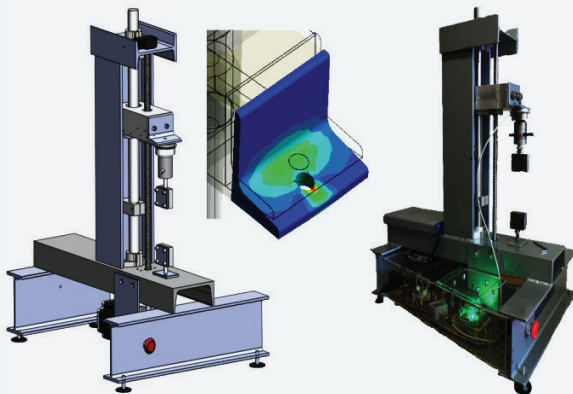
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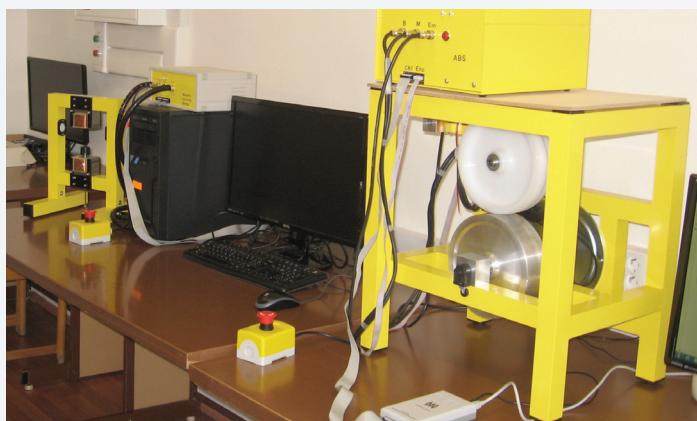
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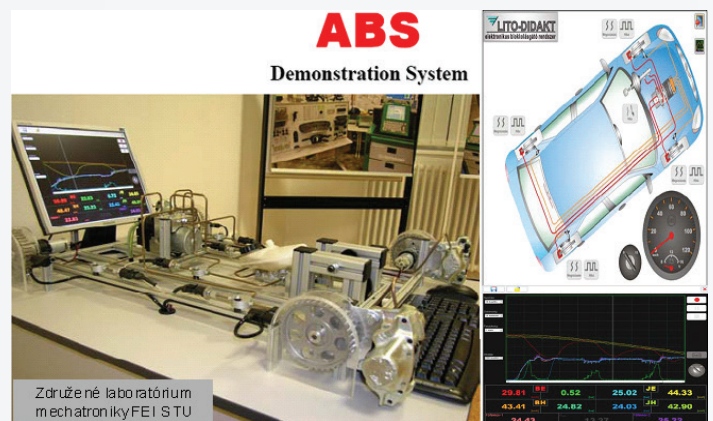
Teaching modul for measuring material properties



Teaching demonstration modul for hybrid vehicle



Teaching modul for automatic control



Teaching demonstration modul of ABS system

LABORATORY OF SAFE OPTIMAL PROCESS CONTROL

Description of main activities:

The research area is aimed to the design, synthesis, and implementation of optimal control systems for process control applications which require rigorous guarantees that the control system will exhibit desired safety and economical properties. The parameters of safety and economical behaviour are divided into theoretical properties (closed-loop stability, satisfaction of process constraints, economically optimal process operation), and practical properties (guaranteed execution of the optimization algorithm on platforms with restricted computational resources, correct behaviour of the control system even under failures of the communication channels). Nowadays, these

properties are verified by extensive testing which is time consuming and expensive. Therefore, the main goal of the research is to develop a unified methodology which allows designing optimal control systems in which safety properties can be imposed and verified already at the design stage.

Equipment available:

- Laboratory of Process Control (distillation column, chemical reactor, heat exchangers, liquid tanks, membrane separation plant)
- Laboratory of Industrial Control (Simatic, Honeywell, BR Automation, Foxboro)

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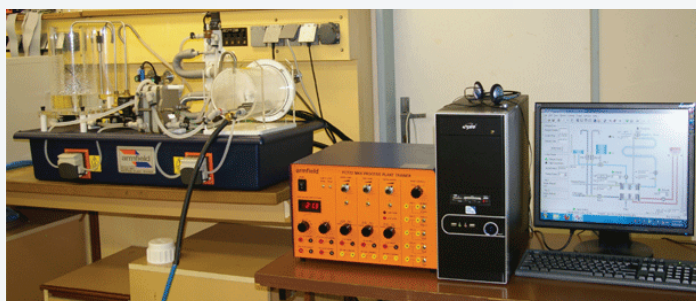
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Distillation column – Armfield UOP3CC



Multifunction station Armfield PCT40

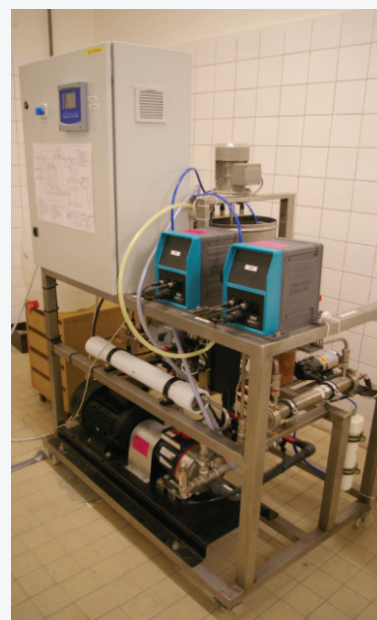


Training station Armfield PCT23



LEGO
Mindstorms

Membrane
separation
plant



RESEARCH CENTRE OF USER EXPERIENCE AND INTERACTION

Description of main activities:

The main activities of the Centre include:

- Research in monitoring the behaviour of the information systems' users and groups based on monitoring the eye-view, face, emotions and interactions with the keyboard and mouse at different levels of detail and selected physiological parameters (skin conductance, temperature, pressure, EEG, ECG, respiration),
- Evaluation of user behaviour using qualitative and quantitative studies based on the research in machine learning and data mining,
- Design of interaction methods based on a user behaviour analysis and analysis of stimuli (textual in particular, using NLP methods) - adaptation, personalization, recommendation,
- Design of new applications, including mobile applications, based on the data obtained in the studies of computer user behaviour.

The Centre is divided into two laboratories:

EEngelbarts's Laboratory of User Experience Research (UX Lab). The Laboratory is used for research and verification of the study results involving web applications, PCs, tablets, smartphones or other multimedia interactions. Laboratory is ideal for qualitative user studies. It is equipped with instruments for detailed user monitoring: face emotion tracking, eye tracking,

physiological sensors (EEG, temperature, skin conductance, respiration, etc.), mouse movements, keylogging and face recognition. The Laboratory consists of multiple rooms connected with semi-transparent glass, which enables observation of the experiment participant's behaviour without disturbances.

Simon's Laboratory of Personalized Learning (UX Group). The classroom-style laboratory is designed for simultaneous monitoring of behaviour of groups of users. The specific domain of the Laboratory is student's learning. In particular, the Laboratory enables larger-scaled quantitative user studies. It comprises twenty workstations, each equipped with an eye-tracker. All workstations are connected to a single information system which is capable of real-time transfer of all necessary data to central storage, from where they can be further analysed.

Equipment available:

UX LAB:

- 5x performance workstation, 1x monitor Tobii TX300 22", 6x monitor 24", 3x monitor 30",
- 1x eye-tracker Tobii TX300 – detailed monitoring; 1x eye-tracker Tobii X2-60 + mobile stand (USB Camera + NUC) - monitoring of mobile devices; Tobii Studio - analysis and visualization software of eye tracking, 2x recording license, 3x evaluation license; 1x UHD Philips 58" TV; 2x Emotiv EEG headset; 1x TEA sensor set,

1x capture license; 1x license software for recording and analysing the signals from TEA sensors including eye-tracker,

- Captive - 1x license software for recording and analysing the signals from TEA sensors including eye-tracker,
- Observer XT FaceReader – 1x software license for realization of user studies and recording of facial expressions,
- Luxand - software for faces analysis.

UX GROUP:

- 20x computer, 20x monitor 24", 20x eye-tracker Tobii X2-60 (USB camera + NUC), 20x Creative Senz3D camera,
- Tobii studio – analysis and visualization software of eye tracking, 20x recording license,
- Server, disk array and software infrastructure for parallel user study.

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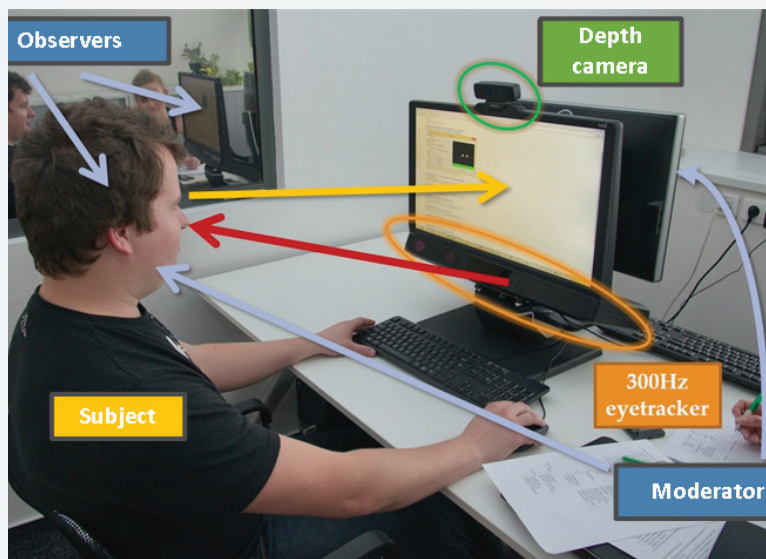
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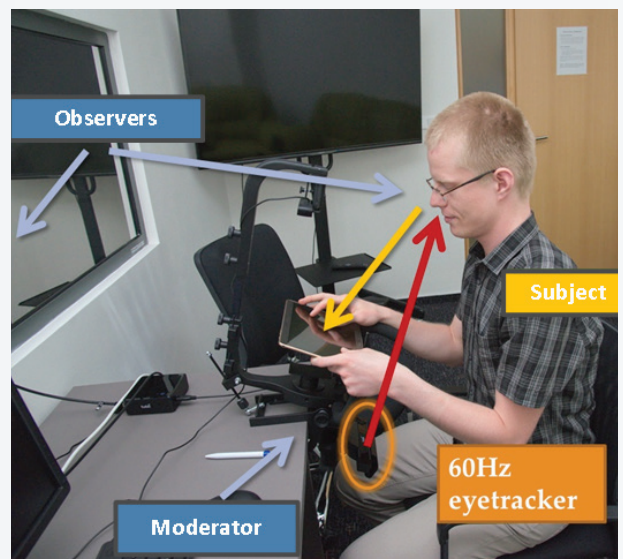
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Ongoing experiment in the laboratory for detailed research of user experience



Ongoing experiment in the laboratory for user experience research of mobile applications, TV and multimedia

COMPUTER VISION AND COMPUTER GRAPHICS LABORATORY

Description of main activities:

Laboratory of Computer Vision and Graphics Working Group of VGG (Vision & Graphics Group – vgg.fiit.stuba.sk) serves primarily for research activities and as an opportunity for students to work on their team projects, bachelor or diploma projects.

Professional activities cover areas:

Computer Vision

- Processing of medical radiological data, organ segmentation, detection of anatomical anomalies (in cooperation with Siemens Healthcare)
- Visual detection and object recognition
- Modelling the human visual attention, saliency maps

Computer Graphics

- Modelling of highly detailed 3D surfaces, light field

Information Visualization

- Data visualization in virtual reality (VR), augmented reality (AR)

- Visualization of information as a 3D graph in AR, VR and research of new methods of user interaction

Equipment available:

- Optical see-through AR glasses (Vuzix STAR 1200XLD)
- Head-mounted display headset (Oculus Rift)
- Interactive transparent projection foil (UGO)
- 3D monitor 27" NVIDIA 3D Vision
- Projectors (3D Vision) 144Hz (BenQ XL2720Z)
- Nvidia 3D Vision Glasses
- Nikon D810 full-frame DSLR camera with 36.3 MP (2x) including the lens: Nikon 14-24mm, Nikon 24-70mm, Nikon AF-S 70-200mm
- High-speed camera 340 fps 2 MP resolution Basler acA2000-340kc
- Light field camera LYTRO ILLUM

- Accurate spectrophotometer Konica Minolta CM-2500d
- Sensor KinectV2 (4x)
- Eye tracker: Eye Tracking Glasses SMI ETG 2 Wireless
- Sensor Leap Motion
- SpaceNavigator 3D mouse, Smartpen Wifi™ SmartPen 8GB Propack

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Oculus Rift + Leap Motion sensor



RGB-D data acquisition using Kinect (on helmet). Eye tracker SMI (glasses).



LABORATORIES OF ELECTRONICS AND PHOTONICS

INSTITUTE OF ELECTRONICS AND PHOTONICS

Description of main activities:

Research and development of micro-/ nano-electronic structures and „SMART“ electronic, sensoric and photonic systems and their utilization for better quality of life (health, wellness, environment).

Design, preparation, testing and characterization of electronic, optoelectronic and photonic structures, devices and systems in very clean, in the Slovak Republic unique laboratories with an area of 200 m². Development and optimization of organic light-emitting diodes (OLED) and field effect transistors (OFET), thin-film sensoric structures and systems based on metal oxides, carbon nanostructures, graphene layers etc. Research and applications of such structures in the field of flexible organic electronics and sensorics, medical technology and optoelectronics.

Design, implementation and testing of low power consumption integrated or hybrid circuits and systems on a chip and their utilization in SMART applications, for example in microprocessors for on-chip signal pre-processing, in mobile biomedical sys-

tems (biomonitoring systems, ECG, EMG), in monitoring of electrical parameters (energy consumption) etc.

The workplace consists of more specialized and uniquely equipped laboratories and is intensely involved into the solution of national and international research projects.

Equipment available:

- Agilent 4155C parametric programmable analyzer,
- BIORAD DL8000 Deep Level Transient Spectrometer (DLTS),
- MonoVista 750 CRS micro-Raman spectrometer UV VIS ,
- PhE-102 spectral ellipsometer, wavelength from 250 to 1100 nm,
- Atomic force microscope (AFM) - Park systems XE-100,
- Clean rooms, 200 m² in cleanliness class ISO 5 (cleanliness class 100),
- Süss MA6 modular lithographic equipment for submicron lithography,
- Raman spectrometer (ISA-JobinYvon -Dilor-Horiba, 633 nm),

- SEM cold cathode microscope JEOL JSM 7500,
- Vapour deposition system for organic materials and metals.

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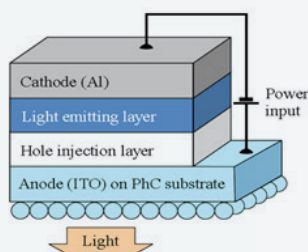
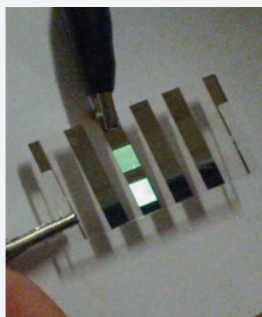
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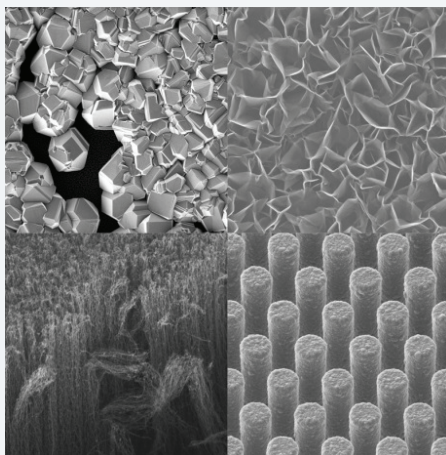
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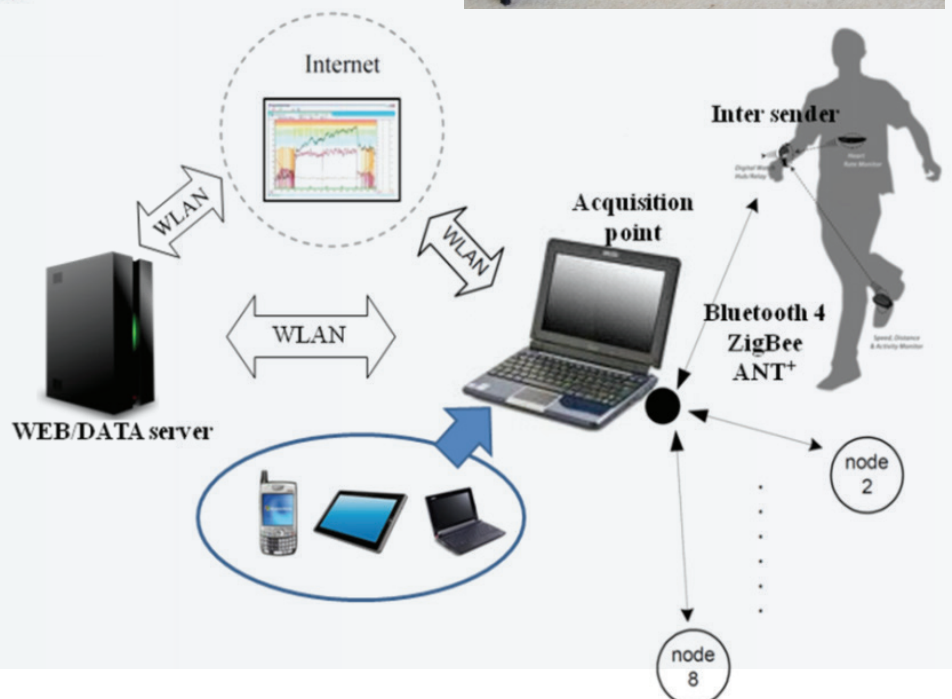


Organic LEDs

„SMART“ electronic
system for human stress
measurement (Health
and Wellness)



Diamond layer, graphene, carbon nanotubes



LABORATORY OF METAL MATERIALS

Description of main activities:

The aim of research activities is surface treatment of the metal materials used in automotive industry and testing of the coating quality, aluminium winning, surface treatment of aluminium and its alloys, functional coatings on metal substrates (alloys, composites) for power engineering and their behaviour at extreme conditions (high temperature, corrosive atmosphere).

Equipment available:

- DTA/TG analyser,
- Potentiostat/Galvanostat Solartron ECHI 1287,
- SEM,
- AFM,
- LABIMEX corrosion chamber,
- Pulse sources,
- Solartron 1260 frequency analyser,
- AUTOLAB electrochemical system,
- High temperature furnaces,
- Carl Zeiss optical microscope,
- UV-VIS spectrophotometer,
- Ion chromatograph.

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Corrosion chamber



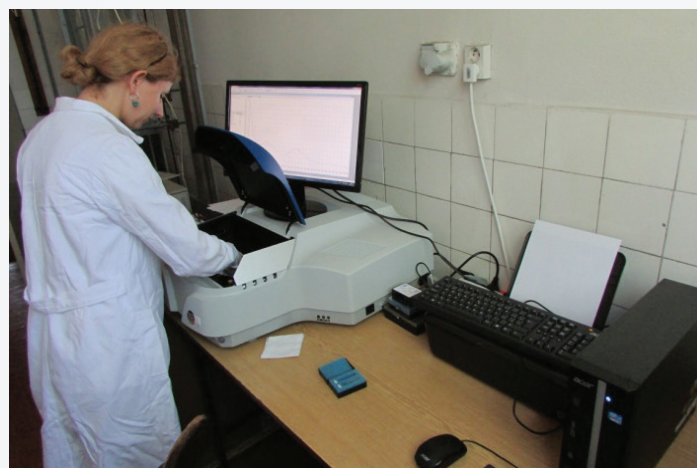
Surface analysis accessory instruments



DTA/TG analyser



Solartron electrochemical instruments



UV-VIS spectrophotometer

LABORATORY OF POLYMER MATERIALS

Description of main activities:

Materials of biopolymers and polymers from renewable raw materials – biomaterials for medical applications, dermatological agents, drug carriers, packaging materials, fibres and textile materials of biopolymers and polymers from renewable raw materials. Development of new materials based on poly (ε-caprolactone), starch, chitin and chitosan, cellulose, polyhydroxybutyrate and polylactic acid.

Equipment available:

- Fluid mixer,
- A twin-screw co-rotational segmental extruder with granulation,
- Chill-roll line for cast monofilms,
- Chill-roll unit for cast three-layer A-B-A films production,
- Line for the three-layer blown A-B-A film production,

- Line for the production of extruded profiles of the L and JOKL types and hoses,
- BOY 60E injection press,
- Melt fibre spinning line,
- Blow moulding of hollow products - extrusion blow moulding technology,
- Vacuum forming,
- Hydraulic press,
- Line for plasma-surface for finishing of printed products,
- DSC calorimeter,
- DMA analyser,
- Climate chamber,
- Measuring the permeability of gases and vapours,
- Measuring the impact strength by Sharpy method,
- Measuring of melt flow index,

- Fully equipped capillary rheometer Göttfert 75,
- JEOL 7500F Scanning Electron Microscope.

CONTACT

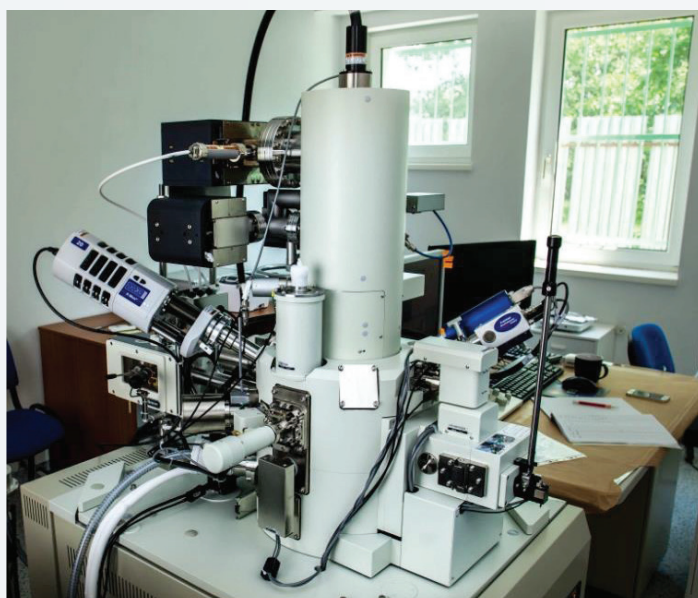
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JEOL 7500F Scanning Electron Microscope



SLOVAKION - SLOVAK CENTRE OF EXCELLENCE IN ION BEAM AND PLASMA TECHNOLOGIES FOR MATERIALS ENGINEERING AND NANOTECHNOLOGY

Description of main activities:

research and development of advanced materials and nanomaterials based on ion beam and plasma technology, environmentally friendly materials for bonding at low temperatures in composite materials, light metal materials and in non-metallic materials. Laboratories in the Scientific Centre of Materials Engineering are focused on ion beam technology, plasma deposition and modification, ion beam analysis and computer modelling.

Equipment available:

- 6 MV Tandem accelerator system with high-current beam for ion beam analysis (IBA) and ion implantation,
- Multi-purpose 500 kV air insulated accelerator system for ion implantation,
- DC pulsed sputtering system for different target materials: reactive metal oxides and metals,
- RF magnetron sputtering system with dual MS separation,
- system for plasma immersion ion implantation (PIII),
- Langmuir probe,
- Ellipsometer.

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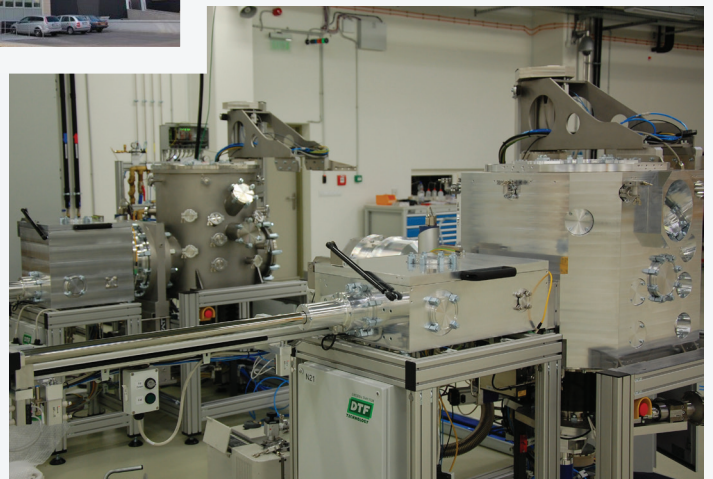
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Ion acceleration systems



Plasma technologies



LABORATORY OF SPECTROSCOPY AND THERMAL ANALYSIS

Description of main activities:

Diagnostic and analytical methods for material research, optical spectroscopic methods, resonance spectroscopies – EPR, NMR, X-ray analysis, thermal analysis. Research is focused on the behavior of the redox active metals in biological systems, particularly on the metal induced oxidation stress leading to biomolecular damage. Additionally, synthesis, structure and physicochemical properties of coordination compounds with biologically active ligands will be studied using spectroscopic methods (EPR, NMR, UV-VIS, IR, Raman), X-ray analysis and theoretical ab initio calculations.

Equipment available:

- EPR spectrometers EMX (X-band) and EMX-Plus (X- and Q-band) from Bruker,

- Raman spectrometer MultiRAM with microscope RamScope III (Bruker),
- Diffractometer STOE STADIVARI with 4-ring goniometer,
- Diffractometer Gemini R (Oxford Diffraction),
- Potentiostats/galvanostats HEKA PG284 and PG390 (HEKA Elektronik),
- UV-Vis-NIR spectrophotometer AvaSpec-2048x14-USB2 (Avantes),
- NMR spectrometer VNMRs 600 MHz (Varian),
- UV-Vis-NIR spectrophotometer UV3600 (Shimadzu),
- DSC calorimeters DSC 8500 and DSC 7 (PerkinElmer), DSC 60 (Shimadzu),
- DTA/TG calorimeter Exstar Seiko 6300,
- FT-IR spectrometer NICOLET NEXUS 470 (Thermo-Nicolet).

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EPR spectrometer EMX-Plus, X- and Q-band



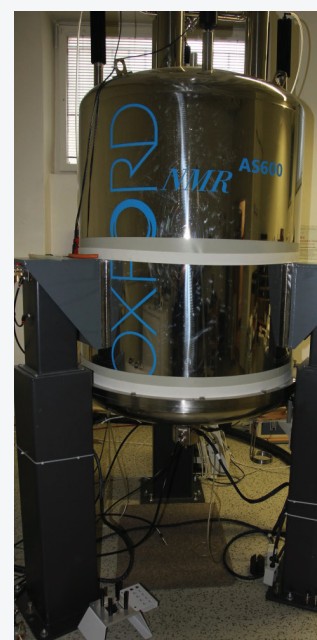
Raman spectrometer MultiRAM with microscope RamScope III



Diffractometer STOE STADIVARI with 4-ring goniometer



DSC calorimeter
DSC 8500



NMR spectrometer
VNMRs 600 MHz

LABORATORY OF BUILDING MATERIALS AND PHYSICS

Description of main activities:

The laboratory consists of three cooperating working sites – Laboratory of plasters and concrete, Laboratories for testing of the physical and chemical properties of building materials and Laboratory for x-ray diffraction analysis, scanning electron microscopy and thermal analysis. Laboratories are focused on research, development and exams of plasters, cement basis building materials, lime, gypsum and also ceramics, brick components and other materials.

Research and expertise activity was recently focused on:

- Modification of cement composites properties by chemical additives and mineral additions;
- Exploitation of waste and recycled materials in building materials;
- Influencing of brick crock porous structure by additives;

- Measuring the thermal performance of construction materials under various temperature and moisture conditions;
- Mortar development for historic buildings restoration;
- Studying the hydration and carbonation course of the processes in lime-pozzuolana binders with metacoline, zeolite and ash additive;
- Corrosion of cement composites in aggressive acid and ammonia salts solutions;
- Assessment of the causes and extent of damage to concrete, mortar and plaster in the aggressive action of the external environment.

Equipment available:

- Automatic high pressure mercury porosimeter with accessories;
- Scanning electron microscope with EDX detector;

- Apparatus for simultaneous thermal analysis;
- Laser analyzer of particle size;
- Climatic chamber;
- Automatic device for frost proof exams;
- Helium gas pycnometer.

CONTACT

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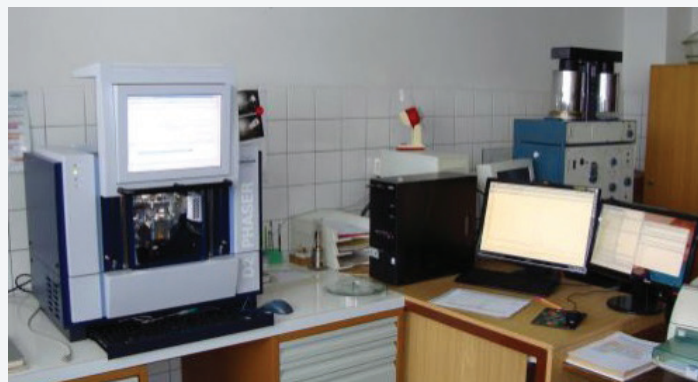
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Electron microscope with EDX detector



Working site of x-ray diffraction phase analysis



Automatic high pressure mercury porosimeter with accessories



Laboratories for testing of the physical and chemical properties of building materials

LABORATORY OF PARTICULATE MATERIALS

Description of main activities:

Specialized activities for engineering and manufacturing companies for the chemical, food, pharmaceutical and consumer goods industries (mechanics of particulate materials, flow and processing of compressible liquid mixtures, separation and dewatering of the mixture by filtration and pressing, intensification heat and mass transfer in equipment, hydromechanics of airlift bioreactors).

Laboratory of Particulate Materials is primarily used for:

- Research of basic mechanical and physical properties of particulate materials (organic and inorganic) and three-phase system with the particulate solid phase,
- Research and verification of the compressibility and heat effects of powder materials under extreme compression,
- Research, design and validation of agglomeration and granulation technologies aimed primarily at transforming the different shape of dry and wet materials with fine-grained solid phase.

The Laboratory is a part of the Leading research centres and laboratories of the University Science Park at the STU. It has rich international scientific cooperation

and is implementing research projects for practice.

Equipment available:

- KISTLER 60 kN Electromechanical press,
- Freeman Rheometer FT4 Powder rheometer,
- Malvern Mastersizer 3000 Laser diffraction particle size analyzer,
- Microtrac PartAn 3D, 3D particle size and shape analyzer,
- Quantachrome Fully automated, high-performance mercury porosimeter Poremaster 60GT,
- Quantachrome Aquadyne DVS Water sorption analyzer,
- Malvern Morphologi 3G Advanced particle characterization,
- RHEWUM A2 Vibratory Sieve Shaker,
- JEOL JSM IT300LV Scanning Electron Microscopes,
- JEOL JCM-6000 Scanning Electron Microscopes,
- Auto Fine Coaters JEOL JFC-1300,
- DANTEC 60X with Ar-Ion 300 mW Laser Doppler Anemometry system,
- Polytec BBC with He-Ne 50 mW Laser Doppler Anemometry systems,

- Pilot-scale experimental twin-cylinder compactor,
- Intensive mixer with prismatic and cylindrical chamber,
- Axial and radial extruders,
- Ball, pin, jaw and blade mills,
- Experimental station for hydromechanical separation,
- ESEDRA bioreactor with sterilizer,
- Experimental drying chamber.

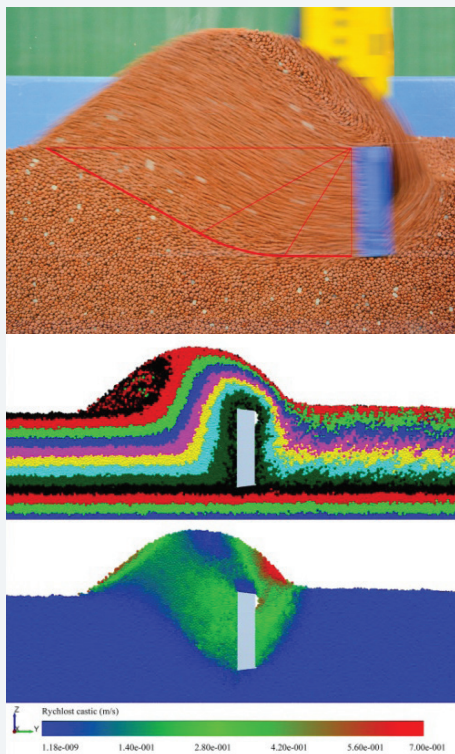
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The movement of the homogenizer's blade



Electromechanical
press KISTLER 60kN

Rheometer FT4
Powder
rheometer

LABORATORIES OF STU CENTRE FOR NANODIAGNOSTICS

Description of main activities:

Analysis of micro/nanostructures and systems for micro/nanoelectronic applications, sensorics, photonics, electronics, medicine, geology, material engineering and environment. Analysis of interfaces is possible at subangstrom level. Devices provide a possibility to examine:

- chemical composition,
- crystallography, defects, and crystallographic orientation,
- manifestations of properties of electron structure,
- surface contamination,
- 3D morphology of objects in nanoscale,
- microscopy of magnetic materials,
- optimisation of technological processes.

At present, the Centre deals with research of interaction of volume and 2D carbon materials, as they are promising and prospective materials for electronic applications.

Equipment of the Transmission Electron Microscopy Laboratory

Analytical transmission electron microscope JEM ARM 200cF with the resolution of 0.78 Å equipped with field auto emission electron source and with

two correctors of spherical aberration enables a complex characterization of nanostructured objects on the subatomic level by means of the following methods: imaging with high angle annular dark field detector (HAADF), imaging with low angle annular dark field detector (LAADF), imaging with annular bright field detector (ABF) in scanning regime (STEM), in TEM/HRTEM regimes, and imaging in back-scattered electron (BEI) and secondary electron regimes (SEI). Electron diffraction methods (selected area diffraction, nanobeam diffraction, convergent and precession diffraction) are available to acquire the information related to crystallographic structure. Further possibilities include orientation and phase mapping, qualitative and quantitative energy dispersive analysis (EDS), electron energy loss spectroscopy (EELS) and mapping of atom distribution in the sample. Microscope has incorporated Lorentz mode for characterization of magnetic samples and biprism for electron holography. 3D morphology of nanoscaled objects can be obtained by employing electron tomography. Other adjacent laboratories serve for preparation of TEM samples where various physical and chemical methods are exploited.

Equipment of the Auger Spectrometry Laboratory

The Auger microprobe JEOL JAMP 9510-F serves for elemental analysis of various structures and it combines the advantages of scanning electron microscopy and Auger electron spectroscopy. Except of standard Auger electron spectra and concentration depth profiles, recording of Auger maps and line profiles is possible. In secondary electron mode, the best resolution is 3 nm and the smallest spot of the electron beam in the Auger analysis mode is 8 nm. Auger spectroscopy is an appropriate complement of methods incorporated in TEM, because Auger signal is released from the topmost surface of a structure under study, usually from 0.5 – 3 nm depths. In the mode with energy resolution $\Delta E/E = 0.05\%$ exists a possibility to examine also plasmonic excitations. Owing to these parameters, the device is dedicated to analysis of nanostructures.

CONTACT

Slovak University of Technology in Bratislava

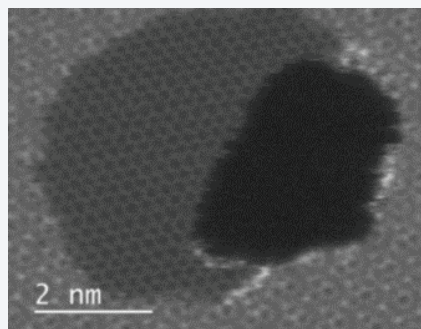
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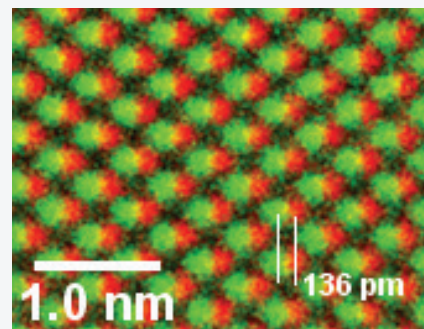
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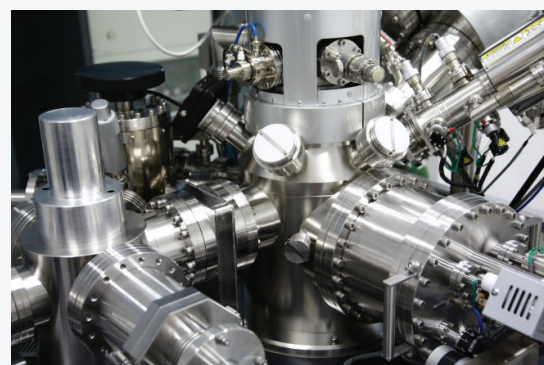


STEM image of graphene monolayer and multilayer and EDS map of Ga atoms (green) and As (red) in GaAs



A part of transmission electron microscope Jeol JEM ARM 200cF

Analytical chamber of Auger microprobe Jeol JAMP 9510-F



LABORATORIES OF APPLIED BIOCATALYSIS

Description of main activities:

The preparation of whole cell biocatalysts and enzymes, the preparation of recombinant biocatalysts, combined chemo-biocatalysis, the use of biocatalysts in special chemicals production, immobilisation of biocatalysts, pharmaceutical biotechnology and redox biocatalysis. The results and experiences gleamed in this field cover a broad range of applications. Biocatalysts and selective producers are employed in the production of precursors for chemical and pharmaceutical industries as well as in the production of antigens and substances with a high added value, usable in pharmacy, medicine and food science.

Equipment available:

- Fermenters New Brunswick BioFlo 115 – 7 fermenters, culture vessels with working volumes from 0.5 up to 12 litres with automatic control and sampling,
- Bioreactor DasGip – 4 fermenters, culture vessels with working volumes from 50 up to 250 ml with automatic control and sampling,
- Gas chromatograph Agilent FID and MS detector, qualitative and quantitative

analysis of fermentation broth metabolites and trace analysis,

- Ultrafiltration and microfiltration unit Acta Flux S, laboratory instrument for the concentration of biomass and proteins produced by fermentation,
- UV/VIS Spectrometer VarioScan fluorescence-plate reader UV, measurement at different wavelengths and fluorescence detection,
- HPLC Agilent with UV/VIS and RI detector, analysis of microbial products and metabolites,
- Freeze Dryers Leybold-Heraeus concentration of biochemicals and drying of microbial cultures,
- Bactron Anaerobic Chamber, manipulation with anaerobes,
- Isotachophoresis Labeco, the analysis of organic acids and ions in a culture medium,
- UV/VIS spectrophotometer Agilent, the measurement of spectra and enzyme kinetics,
- Microscope Kvant, traditional optical microscopy and fluorescence microscopy,

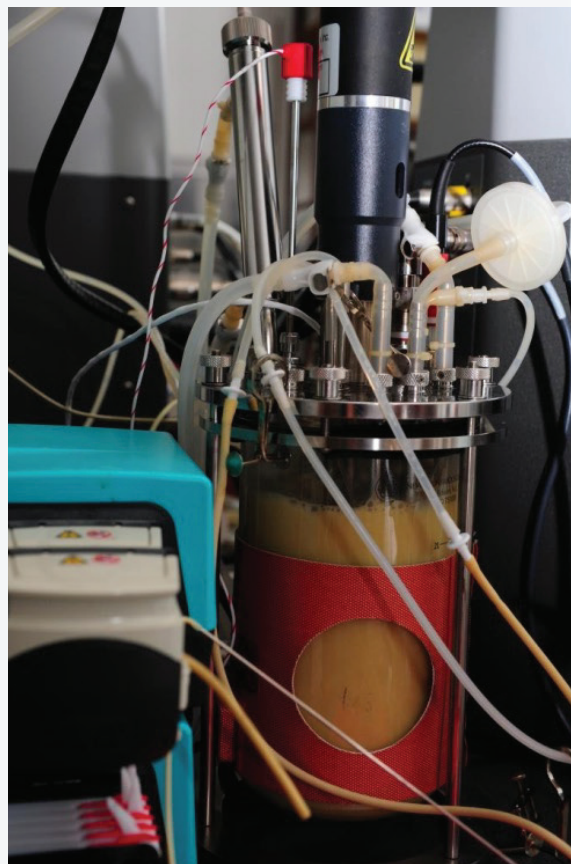
- Laminar flow cabinet Ekokrok, sterile work with microorganisms,
- Eppendorf Mastercycler (PCR), DNA electrophoresis Consort, DNA amplification and analysis,
- -80 °C ultra-low temperature freezer Thermo Scientific, long-term storage of microorganisms and enzymes,
- Hitachi ultracentrifuge, protein isolation,
- Continuous Cell Disruptor, cell disruption is provided in continuous mode,
- ÄKTA Purifier chromatography system, low pressure chromatography, protein purification system,
- Nano, Ultra, Micro Filtration Unit, purification and desalination of samples.

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LABORATORY OF FERMENTATION TECHNOLOGY

Description of main activities:

The application of fermentation process in microbial production of primary and secondary metabolites, the employment of immobilized biocatalysts, the scale-up of fermentation processes, down-stream processing of special chemicals, optimization and demonstration of fermentation and isolation processes. The Laboratory has unique equipment for up-stream processes (more than 20 bioreactors with working volumes from 0.1 up to 800 litres) and down-stream operations (micro-, ultra-, nanofiltration, filtration with back-flush, electrodialysis, ion exchange separation, vacuum evaporation, crystallisation). The Laboratory equipment allows for the targeted research and demonstration in food, medical and industrial biotechnology.

Equipment available:

- New Brunswick BioFlo 510 a 660 Fermenters – in situ autoclavable fermenters for scale up processes - 20 and 100 l,
- Novaferm Fermenters for cultivations in 5, 12, 150 and 400 l,

- Gas chromatograph Agilent FID and MS detector, qualitative and quantitative analysis of fermentation broth metabolites and trace analysis,
- Ultrafiltration and microfiltration unit Chezar for high capacity biomass and protein separation,
- Micro-Oxymax Metabolic gases analyzer (Columbus Instruments USA): O_2 , CO_2 , CO, methane, H_2 , H_2S measurements,
- Vacuum distillation (Simax), high capacity vacuum distilling for chemicals concentration,
- Ion exchange chromatography for medium/product desalting,
- HPLC Agilent with UV/VIS and RI detector, analysis of microbial products and metabolites,
- Freeze Dryers Leybold-Heraeus concentration of biochemicals and drying of microbial cultures,
- Bactron Anaerobic Chamber, manipulation with anaerobes,
- Ekokrok Laminar flow cabinet, sterile work with microorganisms,

- -80 °C ultra-low temperature freezer Thermo Scientific, long-term storage of microorganisms and enzymes,
- Hitachi ultracentrifuge, protein isolation,
- Continuous Cell Disruptor, cell disruption is provided in continuous mode,
- AKTA pilot – semi industrial low pressure chromatography, protein purification,
- Electrodialysis – high capacity purification and sample desalting.

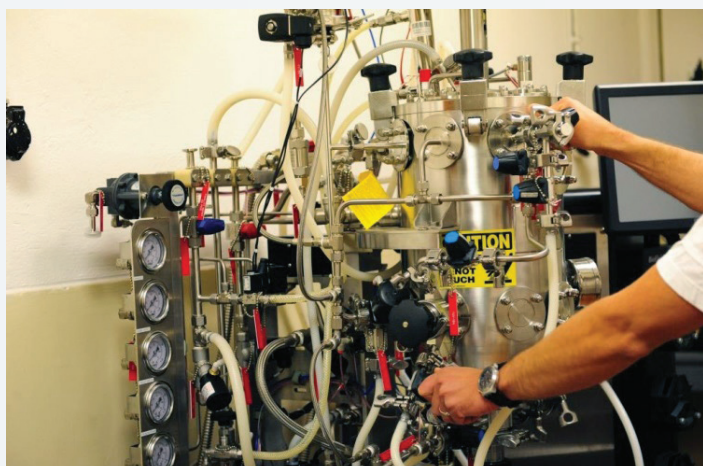
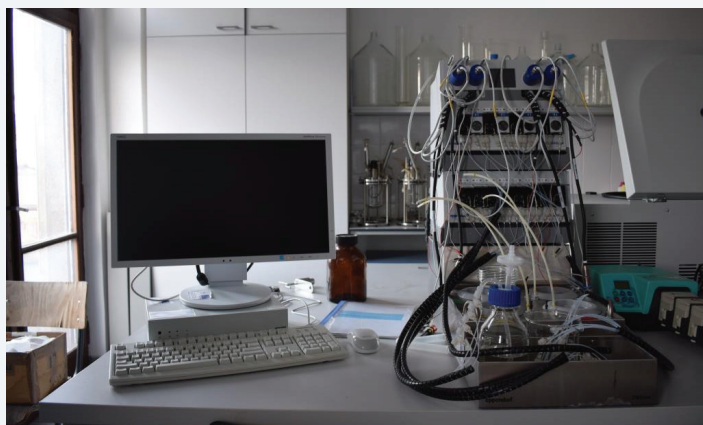
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LABORATORY OF BIOTECHNOLOGICAL PREPARATION OF BIOPRODUCTS ENRICHED WITH BIOLOGICALLY ACTIVE COMPOUNDS AND ENZYMES

Description of main activities:

The research is focused on study and regulation of microbial production of biologically active lipophilic compounds (polyunsaturated fatty acids, carotenoid pigments, squalene, mycosterols, coenzyme Q10, fungal fibers, glycoproteins, etc.) as well as enzymes (amylases, lipases, xylanases etc.) by solid state and submerged fermentations and applications of these bioproducts in biomedicine, pharmaceutical and food/feed fields. Bio-engineering parameters of fungal solid state fermentations for bioproducts preparation are optimized and regulated using semi-scale fermentation tank (it is unique in the Europe) with the aim to scale-up results from laboratory to industrial scale and to provide know-how for such biotechnological processes. An important part of the work also deals with gene engineering, characterization of the key gene coding biosynthesis of biologically active compounds and their functional expression in microorganisms and plants. The work links classical biotechnology and agrobiotechnology as well as microbial and plant genomic and metabolomic with the aim to improve nutritional properties of

agro-sources into high-valued bioproducts. The whole laboratory outputs create a unique part of the research aimed on biotechnological production of biologically active metabolites, where highly producing microorganisms are not only excellent study models and "cell factories", but also as useful donors of genes for production of "tailor-made" microorganisms and plants with new properties. The team of Assoc. Prof. Čertík is internationally respected and actively collaborates with several national and world-known universities, institutions and industrial partners.

Equipment available:

Biotechnological laboratories are equipped with a semi-scale fermentation tank BL-BIO-30SS as the only one in the Europe and with standard techniques used for submerged fermentations (shakers, fermenters) as well. Separation and purification methods of product/s after fermentations are determined by properties of isolated microbial metabolite/s (filtration and extraction instruments, centrifuges, rotation vacuum evaporator, freeze-dryer). The research group is equipped with modern instruments

for structural analysis of natural compounds based on chromatographic methods such as GC with FID and MS detectors and autosampler (Agilent Technologies), HPLC with DAD and RI detectors and autosampler (Agilent Technologies), TLC with autosampler (Camag automatic TLC sampler 4), and different elution chambers with following visualization and quantification using densitometry detector (CAMAG TLC Scanner 4, with range of 190 – 900 nm). UV/Vis measurements is carried out using NanoPhotometer™ IMPLÉN. Experimental laboratories for gene engineering are certified for GMO and are equipped with laminar and incubation boxes, PCR with temperature gradient, centrifuges and deep freezer.

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Prefermented bioproducts enriched with polyunsaturated fatty acids and pigments prepared by fungal solid state fermentation and their application for preparation of functional cereal-based products



Highly oleaginous and pigment forming microbial strains prepared by gene engineering



Transgene cereals containing polyunsaturated fatty acids prepared by functional expression of fungal fatty acid desaturase genes (collaboration with Plant Production Research Centre in Piešťany)



Microbiological and cultivation laboratory

LABORATORIES OF NUCLEAR TECHNOLOGY

Description of main activities:

Research of structural materials for nuclear installations, development of new radiation-stable materials for the fission and fusion technology. Computer modelling and simulation for nuclear power industry. Analysis of microstructures and selected physical parameters of materials.

Equipment available:

- Low-background alpha/beta gauge with POB 302 proportional flow gas detector and TEMA mk310 kit,
- Alpha/beta scintillation detector with TEMA DA310 spatial activity analyser,
- Alpha scintillation chambers to measure the volumetric activity of air,
- Scintillation gamma spectrometer with 3" NaI(Tl) detector in a low-background lead shield low-chamber with the ASA100 or Osprey analyser,
- Mobile gamma-spectrometry measurement system with 2" NaI(Tl) detector and Unispec analyser,
- High definition gamma-spectrometry system with detector placed in a low-background steel chamber with the Lynx low-analyser,
- Dimension Edgetm atomic force microscope by VEECO Co.,
- Transmission Mössbauer Spectrometry (TMS), Conversion Electron Mössbauer Spectrometry (CEMS) and Conversion X-ray Mössbauer Spectrometry (CXMS),
- Automated measurement device to detect electro-physical parameters of detectors by measuring their current-voltage characteristics within the voltage ranging from 0.1 V up to 1000 V and currents from 1 fA to 20 mA,
- Spectrometric route for detecting spectroscopic properties of examined detectors,
- Programs for quantitative and qualitative analysis of X-ray fluorescence spectra,
- Microscope with image digitisation for photo-documentation of samples of detectors,
- Positron Annihilation Lifetime Spectroscopy (PALS),
- Coincidence Doppler Broadening Spectroscopy (CDBS).

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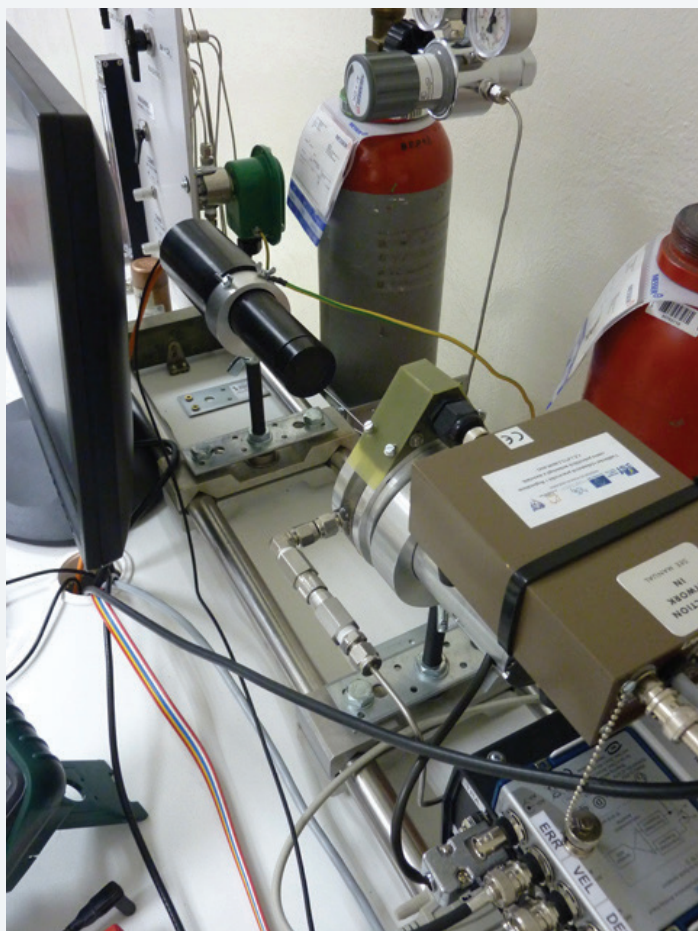
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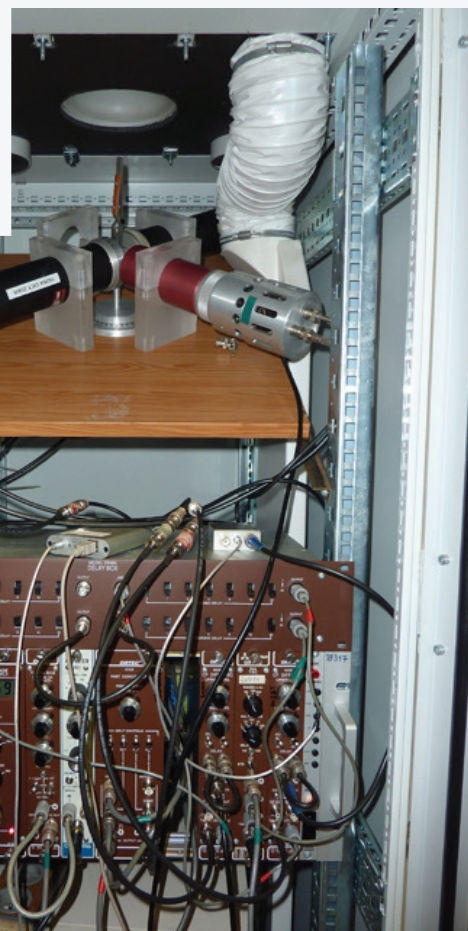
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Mössbauer spectrometer



Positron Annihilation Lifetime Spectroscopy (PALS)

NATIONAL CENTER OF ROBOTICS

Description of main activities:

- Targeted research in the field of robotics, especially in the field of mobile and service robotics, industrial robotics and medical robotics,
- Support for students in development of robotic applications,
- Creation of own robotic systems capable of deployment in various sectors of the economy and human activity,
- Promotion of robotics and also the science and technology in general for the professional public,
- Organization of events (conferences, competitions, etc.) focused on robotics,
- Building and development of robotic center within the area of Faculty of Electrical Engineering and Information Technology, Slovak University of Technology in Bratislava,
- Assisting students and professional community in developing their skills and knowledge in the field of robotics through the support of educational activities,
- Establishing cooperation with companies, organizations and personalities working in robotics,
- Participation in projects funded by the European Union, Slovakian ministries or other bodies focused on educational development and support,

- Raising the level of education by the implementation of training courses and other educational activities,
- Acquisition of theoretical knowledge and practical skills in robotics,
- Formation of robotic personality with positive moral qualities and will power.

Equipment available:

- IRB 4600 and IRB 120 Robotic manipulators (set contains also Cognex force control and visual system),
- SCHUNK PEH-40-XX-12 Electronic gripper,
- OJ-10 industrial robot, KUKA KR-16 industrial robot,
- MRVK mobile robot constructed by ZŤS VVÚ Košice,
- Robotic arm KV-01 embedded into robot MRVK,
- Black Metal mobile robot, 9 pieces of iRobot Create,
- Robot Androver, industrial robot Mistubishi RV-20FM-D,
- HEX-70-CE-2000N Force-torque sensor optoforce,
- Kinect Sensor, version 1 and 2,
- Laser scanners (Hokuyo URG-04LX, Hokuyo UTM-30LX, RPLIDAR 360°, SICK TIM 561),
- Visual systems (HDR camera uEye UI-5120SE-M-HQ, thermo vision TIM 160),

- DJI FF440 quadcopter, DJI F550 hexcopter,
- DJI F450 quadcopter, geodetic GPS Leica 1200+,
- Nikon D3100 and Samsung NX-2000 Cameras with high resolution,
- Lightweight robotic manipulator SCHUNK LWA 4P 6KG 6DOF,
- 3D printers: Prusa i3 Plus, Rebel 2, reprappro Ormerod 2,
- NAO and Bioloid GP Humanoid robots,
- Walking hexapod robots,
- Innovative mechatronic concepts of robots – Gul'ko and Segway-Dicycle robots,
- Mobile manipulator with omni wheels Kuka YouBot.

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CENTRE OF EXCELLENCE OF 5-AXIS MACHINING

Description of main activities:

The main objective of the Centre of excellence is to support the research and development in the field of production and control of complexly shaped parts by 5-axis machining and 3D contact and non-contact measurement. Workplace enables to carry out research in:

- Several ways and strategies of 5-axis machining,
- HSC CNC milling and turning of complexly surfaced shapes,
- Dynamic conditions of HSC turning and milling,
- CNC grinding and control of axis cutting tools,
- CNC rotary ultrasonic machining and laser machining of difficult-to-machine materials,
- Usage of CA technologies in CAD/CAM/ CNC/CAQ,
- 3D contact and non-contact measurement of complexly shaped parts,
- Principles of Reverse Engineering,
- Evaluation of coolant quality, including the usage of ozone to eliminate their bacterial contamination.

Centre consists of the following departments:

- Workplace of CNC HSC high-tech technologies of 5-axis machining,
- Workplace of CAD/CAM high-tech technologies of 5-axis machining,
- Workplace of 3D contact and non-contact measurement of complexly shaped parts.

Equipment available:

- DMG HSC 105 Linear 5-axis milling centre,
- DMG Ultrasonic 20 5-axis machine tool with ultrasonic assistance,
- DMG DMU monoBLOCK 85 5-axis milling centre,
- SAUER Lasertec 80 Shape 5-axis laser machine tool,
- Reinecker WZS 60 5-axis grinding machine,
- DMG CTX ALPHA 500 turning centre,
- ZOLLER GENIUS 3S universal measuring device for axis cutting tools measurement,
- HAIMEER Tool Dynamic balancing machine for balancing tool holders,

- Thermal axis clamping devices for cutting tools,
- KISTLER rotating dynamometer, KISTLER stationary dynamometer,
- TOC analyser, device utilizing ozone in order to eliminate bacterial contamination,
- PowerSHAPE CAD software, PowerMILL CAM software,
- ArtCAM and FeatureCAM CAD/CAM software, CopyCAD CAD/CAQ software,
- ZEISS METROTOM computer tomograph,
- ZEISS CenterMax 3D coordinate measuring machine,
- ATOS SO 4M 3D scanner.

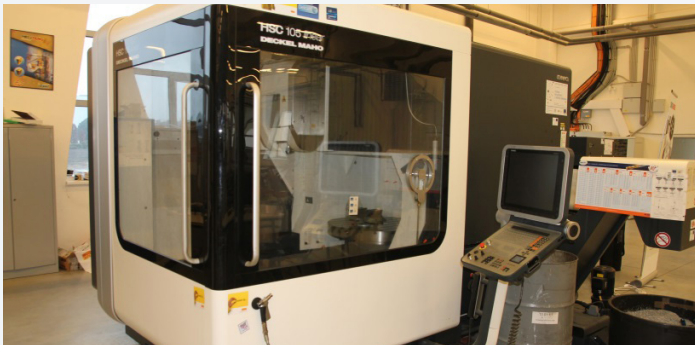
CONTACT

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DMG HSC 105 Linear 5-axis milling centre



DMG Ultrasonic 20 5-axis machine tool with ultrasonic assistance



DMG DMU monoBLOCK 85 5-axis milling centre



ZEISS CenterMax 3D coordinate measuring machine



SAUER Lasertec 80 Shape 5-axis laser machine tool

LABORATORY OF PHYSICAL PROPERTIES OF BUILDING CONSTRUCTIONS

Description of main activities:

The Department of Building Constructions (KKPS) is one of the leading Slovak institutions focused on research and development of civil engineering. It greatly contributes to the research at the Faculty of Civil Engineering, education of students, development of civil engineering, normative activity and other activities related to building industry and practice.

The mission of KKPS is to identify, develop and implement sustainable and energy effective building technologies and construction systems by creating partnerships between university sources and industry in order to provide high-quality analyses and experiments, and ensure the technological development and its market coverage.

The scientific and research activity of the Department is focused on the issue of indoor thermal comfort, heat and humidity transfer through walls and roofs of buildings and their junctions, sound spread in buildings, room and outdoor acoustics, theory of day lighting of buildings, solar energy, air infiltration and effects of driven rain, total energy efficiency of buildings, durability of building materials, diagnostics and renewal of buildings.

Equipment available:

- Big climatic chamber for synergic research of heat transfer, diffusion of water vapour and air infiltration under the stationary and non-stationary boundary conditions,
- Acoustic chamber for experimental research of sound spread in the air and the influence of sound insulation - it enables laboratory measurements of airborne sound insulation of vertical and horizontal constructions, and also the measurement of impact sound insulation,
- Blower door test is a device used for the measurement of airtightness of low-energy buildings and for the measurement of infiltration (exfiltration) through elements of envelope and dividing constructions of buildings,
- Big pressure chamber for research of air infiltration through details or elements of envelope constructions systems of buildings loaded by total pressure difference Δp ,
- Big rain chamber for research of water penetration through details, components and envelope construction of buildings,
- TWIN-BOXes – solar research for studying the energy balance of windows and external materials,

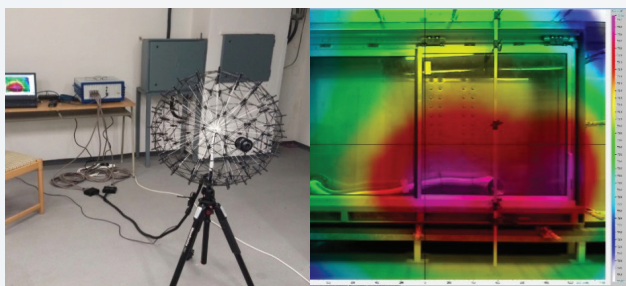
- The wind tunnel allows the experiments determining the static and dynamic effects of wind on the building construction and structural engineering. The models are located in a rotational flow which is simulated as a natural wind over various categories of terrain roughness. The length of the tunnel is 26.3 m,
- The laboratory of research of roofs enables an experimental determination of lifetime of roofs and their functional layers in conditions of accelerated aging by using the following equipment: chamber for carrying out accelerated weather testing, climatic chamber, laboratory dryers with forced air circulation, tensile tester, ultrasonic thickness gauge and drying scales.

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Pohľad na zostavu akustickej kamery pri meraní v laboratóriu katedry KPS / The view of acoustic camera set in the process of measuring in the laboratory of the Department of Building Constructions



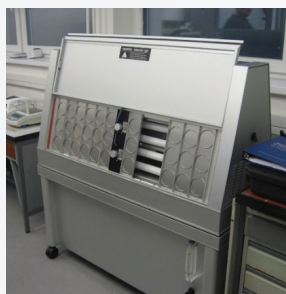
Meteorologická stanica AMS / AMS Meteorological station



Pohľad na ventilátor s centrálnou jednotkou a diferenciálnym tlakomerom - súčasť zariadenia pre blower door test / The view of the fan with central unit and differential pressure gauge - a part of the device for the blower door test



Pohľad na veľkú tlakovú komoru pre výskum filtrácie vzduchu detailmi alebo prvkami (okná, zasklené steny) obalových konštrukcií / The view of the big pressure chamber for research of air filtration through details or elements (windows, glass walls) of envelope constructions of buildings



Pohľad na prístroj QUV/spray / The view of the QUV/spray device



Pohľad na komoru pre výskum spoľahlivosti striech / The view of the chamber for research of reliability of roofs

LABORATORY OF BIOMASS PROCESSING

Description of main activities:

The Laboratory is a part of the Institute of Production Systems, Environmental Technology and Quality Management.

Pedagogical and scientific focus of the Institute covers two main aspects of a mechanical engineering company:

- Technical - in the area of Production Engineering with emphasis on environmental aspects throughout the life cycle of the products,
- Managerial - with emphasis on the quality, innovation and economic efficiency of production.

Laboratory of biomass processing is used primarily for:

- Development of production nodes and new machines, and equipment for tech-

nologies of mechanical recovery (crushing, drying, sorting, briquetting, pelleting),

- Research of technical and economic parameters of technologies of mechanical recovery of various biomass and waste,
- Research of composite materials based on biomass and other solid waste, and their parameters.

The laboratory is a part of the "National centre for research and application of renewable sources of energy" located at STU in Bratislava, which was built by the Structural Funds under the call for "Centres of Excellence".

Equipment available:

pelleting and briquetting lines with computer control feature (crusher, separation machine, pellet press, briquetting press,

screw press, belt dryers, tanks, pellet cooler), calorimeter, hygrometer, strainers, thermometer, thermal imager, muffle furnace, equipment for measuring the mechanical properties of the pellets (hardness, abrasion), extruder with granulator and cooler features.

CONTACT

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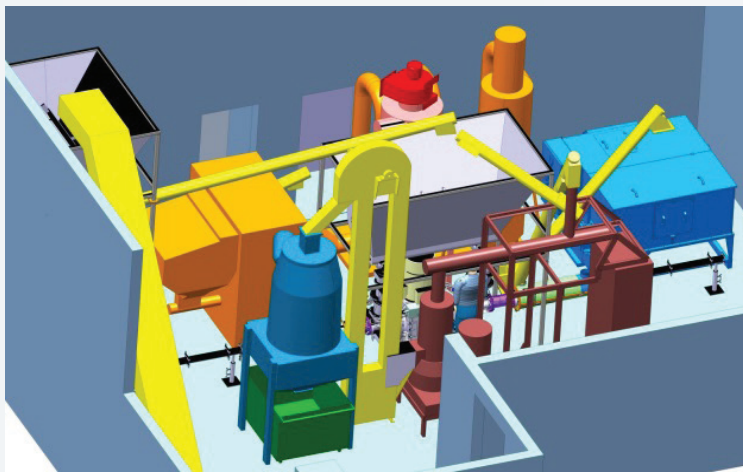
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A 3D model of a pelleting and briquetting line



Extruder with granulator and cooler features



Pelleting press with a cooler and a mote-separator

PRODUCT DEVELOPMENT RESEARCH CENTRE

Description of main activities:

- Consulting services for the development and multimedia presentations of industrially manufactured products.
- Production of models and prototyping of mass-produced products.
- Design training, creation of design models of industrially produced products and clay models for automotive industry.
- Multimedia presentations and photography documentation of product development.

Equipment available:

The workplace comprises three sections:

Manufacturing studio

- Robotic arm of KUKA KR 15/2, KR C1 rev.1.3.3 (interchangeable tools),
- Set of manufacturing tables intended for vehicle/automobile clay models creation (scale 1:4),
- Joinery workshop (table rotary saw, combined woodworking machine, bench drill, face grinder and woodturning lathe),
- Centre lathe SPA-700 P.

Digital fabrication and visualization lab

- 3D printer Objet – PolyJet technology (workpad size 260×260×200 mm),
- 3D printer ZPrinter – gypsum based composite, multicolour printing (workpad size 236×185×127 mm),
- 3-axis CNC machine centre (workpad size 900×600×80 mm),
- 5-axis CNC machine centre (workpad size 300×400 mm),
- Laser – plastics, wood, organic glass, textile, paper, leather, rubber, anodized aluminium and ceramics (workpad size 1400×900 mm),
- 3D scanner – portable laser scanner,
- Programmable 3D hot wire polystyrene cutter,
- Vacuum press,
- Computer lab.

Product photography studio

- Nikon D800 camera,
- Lenses: Nikon 28-300mm f/3.5-5.6G ED VR AF-S NIKKOR, Nikon 24-120mm f/4G ED VR AF-S NIKKOR, Nikon 50mm F1.4 G AF-S Nikkor,

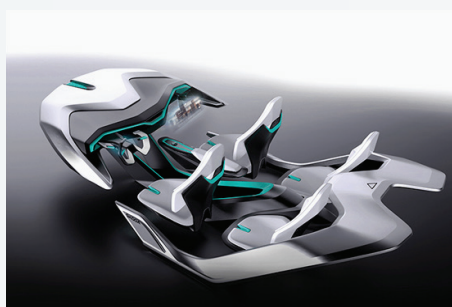
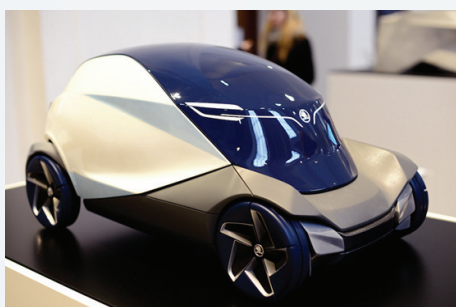
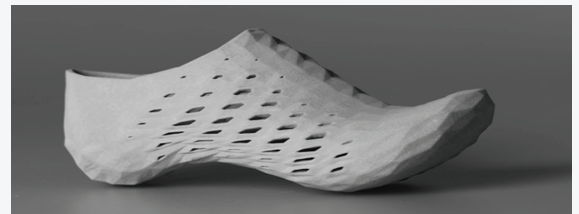
- RODE VideoMic Pro microphone,
- Stand: Manfrotto 055XPROB + 498RC2 SET,
- Flash lighting kit BOWENS GEMINI 3×500R with Pulsar Tx (kit includes 3 lights, lighting support stands, softboxes, umbrella, radio transmitter and receiver, and rolling case),
- Photography shooting table Walimex (120×100×80 cm).

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SPECTRA CENTRE OF EXCELLENCE EU

Characteristics of the main activities:

SPECTRA Centre of Excellence of the European Union at the Slovak University of Technology (STU) in Bratislava is the Central European scientific and education centre in the field of spatial planning that was established as a common workplace of the leading education and research institutions in the field of spatial development and planning – ARL Hannover, IUG Grenoble, University of Newcastle upon Tyne and STU Bratislava. SPECTRA Centre of Excellence is a registered trademark.

SPECTRA Centre of Excellence EU at STU is the international education, research, methodology and planning workplace in the field of spatial planning, urbanism, strategic socio-economic development planning, urban planning and environmental planning with operation across the Slovak Republic and Central European space. SPECTRA Centre obtained the title of centre of excellence first in 2000, then in 2009 as the Centre of research for settlement infrastructure of knowledge-based society, and finally the Slovak Academy of Sciences Centre of Excellence as part of the Centre for strategic analyses.

Major partner workplaces of SPECTRA Centre are the Faculty of Natural Sciences of Comenius University, the Institute of Forest Ecology of the Slovak Academy of Sciences, the Faculty of Education of Catholic University in Ružomberok and the Institute for Prognosis of the Slovak Academy of Sciences. SPECTRA Centre of Excellence comprises the following laboratories: Laboratory of GIS Methods and Laboratory of Experimental Social Sciences (VEEL).

Along with IOeR Dresden, SPECTRA Centre of Excellence is a coordinating workplace of SPACE.NET, the network of spatial planning workplaces of the Central and Eastern Europe with the regional cooperation workplaces equipped with the devices for monitoring spatial development in individual regions within the above-mentioned field, and for providing know-how to the practice of environmentally oriented social, cultural and economic development. It is also a coordinating workplace of the urban innovations network within the CEEPUS activities. It is a partner and a coordinator of national domestic and international projects of basic research (FP5, FP6, FP7, HORIZON 2020) as well as applied research and projects for practice (Interreg, Danube Strategy, Visegrad fund and others).

In cooperation with other workplaces, it provides expertise support to public administration, municipalities as well as other subjects of spatial development on the local, regional, national and international levels.

SPECTRA consists of four parts (sub-centres) pursuing specific issues. These are: Urban Safety Centre, Centre for Clean and Intelligent Technologies, Centre for Strategic Analyses and Centre for Smart Structural Development.

More information can be found at:
www.spectra-perseus.org.

Laboratory for GIS methods

High-tech GIS laboratory equipped with 20 high-performance computers with software for GIS applications and AutoCAD software, its own server and a large format scanner serve the requirements of scientific activities

of SPECTRA Centre of Excellence as well as the needs of specialized education. The Laboratory is equipped with specialized work desks with chairs and necessary data projectors for group presentations. The Laboratory also develops terrain modelling and 3D spatial analyses utilizing 3D models.

VEEL laboratory

At the end of 2010, the Laboratory of Experimental Social Sciences (VEEL) as a common workplace of the Institute for Prognosis of the Slovak Academy of Sciences and Institute of Management of the Slovak University of Technology in Bratislava was established within the SPECTRA workplace. Since 2013, it operates as a part of SPECTRA Centre of Excellence. VEEL is a partner of Ostrom laboratories within the network of Virtual Commons established in the Centre for Behaviour, Institutions and Environment (CBIE) at the Arizona State University.

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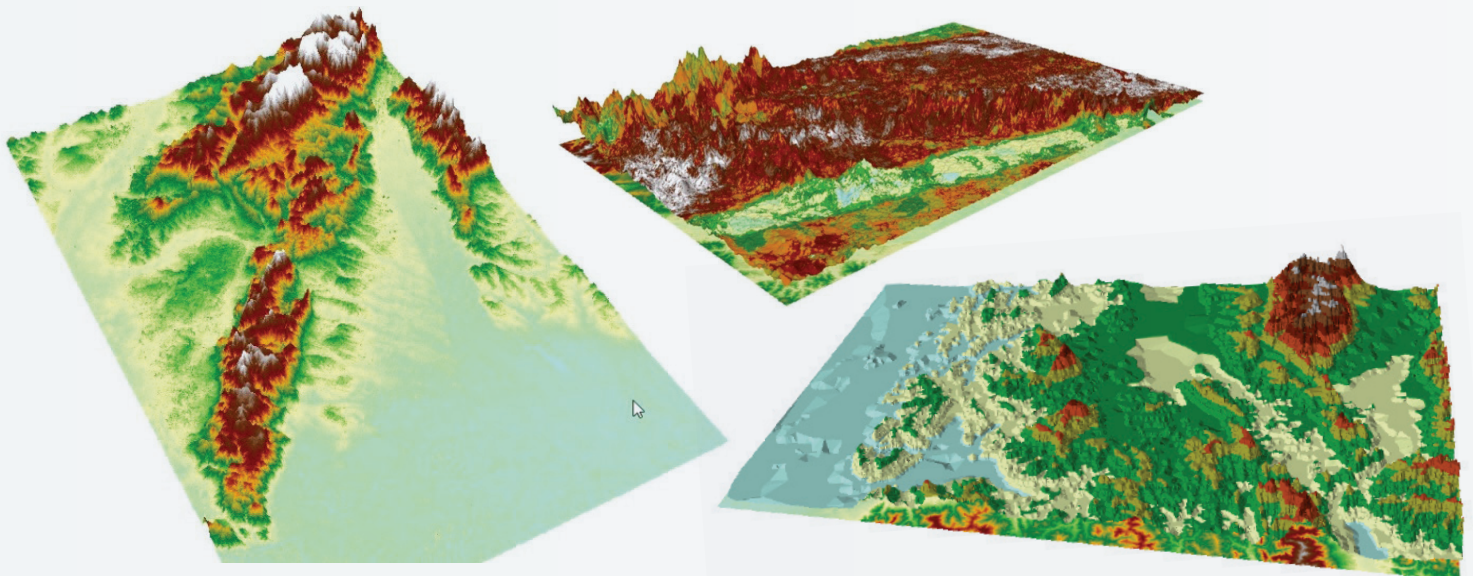
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Examples of using the GIS laboratory in student projects: rendered surface of model area as a base for 3D spatial analyses