CXI TUL

CXI TUL

- The Institute for Nanomaterials, Advanced Technologies and Innovations (CXI) is a research center of the Technical University of Liberec (TUL). Our goal is to contribute to the development of a region traditionally oriented towards technical industries.

- A total of 11 departments focus on solving questions not only in the macro world but also in a world a million times smaller than a millimetre, in which different physical rules apply. The one called the nanoworld.

- Every year, around 80 research projects employ more than 170 scientific, technical and administrative staff. Students also cooperate on research projects here.

RESEARCH DIRECTIONS

Nanomaterials in natural sciences focuse on the R&D, synthesis, behavioral description, and particularly application of advanced materials and nanomaterials, mostly in the field of water treatment, environmental protection and life sciences. This research direction ensures that the innovations contribute to a sustainable and healthier world.

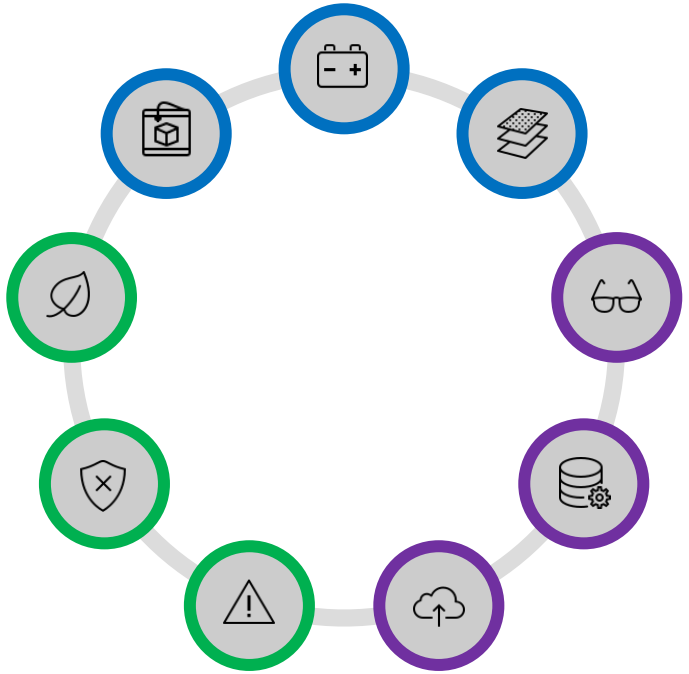
Competitive engineering focuses on the research, development, and application of cutting-edge engineering technologies and structures. We specialize in mechatronic systems, power units, and other machine and vehicle components in view of new approaches. We also excel in progressive methods for processing new materials, including additive technologies. Our innovative solutions are designed to drive progress and efficiency across various industries.

System integration deals with the development of state-of-the-art SW solutions, data processing and integration between systems, cybersecurity and architecture, communication protocols such as 5G, providing communication interfaces for industrial applications. Our expertise covers sensors and electronics, PLCs, robotics, including the use of collaborative robots, cloud application development, big data analytics, machine learning and AI, LLMs, industrial computer vision and others.

RESEARCH DIRECTIONS - COMPETENCES

Autonomous systems
autonomous and cooperative systems
autonomous utility electrovehicle

Additive manufacturing
3D printing including metallic prints and reinforcing by advanced materials



Advanced materials and machines design
the new light-weight and sustainable components, innovative design and systematic planning of technical systems innovations

Augmented reality
collaboration & remote assistance, mixed reality wearables

Green technologies, up-scaling
environmental friendly products, piloting of technologies

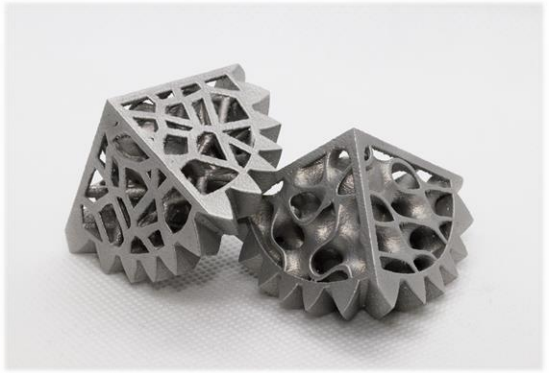
Environmental protection
(waste) water and groundwater treatment, waste disposal, air filtration

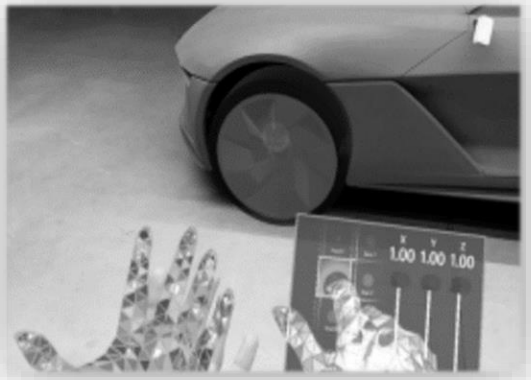
BIG DATA, artificial intelligence
big data storage and analysis, machine learning & AI, image and pattern recognition

Risk of nanomaterials, high-tech analysis
environmental risk of nanomaterials, advanced analytical techniques

Industrial IoT
advanced sensors, displays, edge and cloud computing, 5G and SigFox networks

CXI RESEARCH DIRECTIONS





Nanomaterials in natural sciences

Competitive engineering

System integration

RESEARCH DIRECTION NO. 1

Ing. Mgr. Lukáš Dvořák, Ph.D.
Head of RD1

Nanomaterials in natural sciences

- Study and application of advanced materials, especially nanomaterials, especially in the fields of environmental protection and safety, biotechnology and life sciences, including hi-tech analytical techniques
- The research direction combines basic research with applied research and development of advanced technologies and structures not only based on nanomaterials but also includes pilot projects in the field of technologies at real workplaces in close cooperation with industries

NANOMATERIALS IN NATURAL SCIENCES

DEPARTMENT
OF NANOCHEMISTRY

DEPARTMENT OF
ENVIRONMENTAL TECHNOLOGY

DEPARTMENT
OF APPLIED BIOLOGY

DEPARTMENT OF
ENVIRONMENTAL CHEMISTRY

The research direction of nanomaterials in natural sciences combines basic and applied research, advanced technologies including hi-tech analysis, not only environmental contaminants. Great emphasis is also put on synthesis and testing of different nanomaterials and their verification in practical application, mainly in water treatment processes.

DEPARTMENT OF ENVIRONMENTAL TECHNOLOGY

Ing. Mgr. Lukáš Dvořák, Ph.D.
Head of OTŽP

MAIN RESEARCH ACTIVITIES

- Advanced (waste)water treatment technologies
- Membrane bioreactors and systems with biomass carriers
- Effective groundwater remediation by nano- and microiron
- Application of nanomaterials in various treatment processes and technologies
- Development and testing of nano-based filters

COOPERATION

- Project and contracted R&D in cooperation with industrial partners and stakeholders
- Taylor-made research and development
- Examination and intensification of current treatment processes
- Independent expert evaluation

DEPARTMENT OF ENVIRONMENTAL TECHNOLOGY

Environmental Nanorobotics Laboratory (LEN)

M. Pumera

- Development and study of microrobots and nanomaterials for applications in environmental protection
- Use advanced techniques for synthesising autonomously moving colloidal nanoparticles, nanorobots and microrobots that can be programmed for specific tasks, etc.

Nanofibre Preparation Laboratory (LPN)

M. Komárek

- Preparation of flat nanofibrous layers by electrostatic wetting of polymer solutions
- Optimization of the preparation process by setting and on-line control of parameters (especially electrical voltage, currents, speed, temperature and humidity) in the softening room
- Modification of material parameters of nanofibre layers
- Preparation of composite fibres with nanofibre cladding

DEPARTMENT OF ENVIRONMENTAL CHEMISTRY

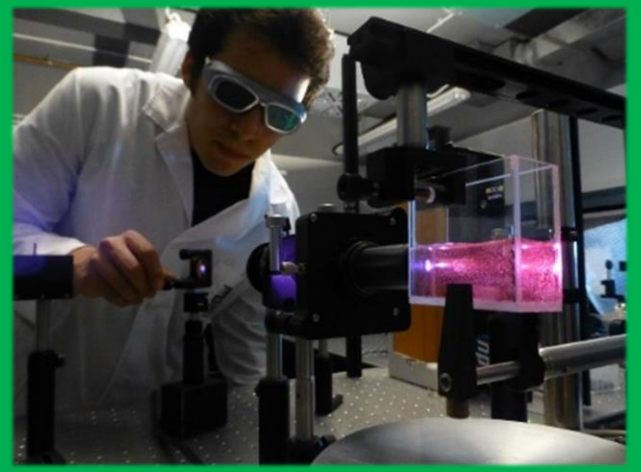
doc. Ing. Stanislaw Witold Waclawek, Ph.D.
Head of OECH

MAIN RESEARCH ACTIVITIES

- Toxic substances in the environment - advanced methods of their monitoring and catalytic elimination
- Nanostructured sorbents for analytical preconcentration of pollutants
- Phytoindications of groundwater pollution (phytoaccumulation, phytoremediation)
- Advanced methods of chemical instrumental analysis

COOPERATION

- Analytical background for internal research groups, external scientists and industrial customers
- Solving common environmental problems with a focus on pollutants



DEPARTMENT OF ENVIRONMENTAL CHEMISTRY

Signatář EA MLA
Český institut pro akreditaci, o.p.s.
Olšanská 54/3, 130 00 Praha 3

vydává

OSVĚDČENÍ O AKREDITACI

č. 252/2024

Technická univerzita v Liberci
se sídlem Studentská 1402/2, 461 17 Liberec 1, IČO 46747885

pro zkušební laboratoř č. 1611
Analytická laboratoř CXI TUL

Rozsah udělené akreditace:

Chemické analýzy vod, výluhů, zemin, kalů, aerosolů, mikrobiologické a biologické analýzy vod, kontrola účinnosti sterilizátorů, odběry vzorků vod vymezené přílohou tohoto osvědčení.

Toto osvědčení je dokladem o udělení akreditace na základě posouzení splnění akreditačních požadavků podle

ČSN EN ISO/IEC 17025:2018

Udělení akreditace je platné do 27. 5. 2029

V Praze dne 3. 6. 2024

Ing. Jan Velíšek
ředitel odboru zkušebních
a kalibračních laboratoří
Český institut pro akreditaci, o.p.s.

Analytical Laboratory of
CXI TUL

L. Lacinová

accredited by CIA under number 1611

It offers for companies, institutions and, citizens, project and industrial partners:

- A sampling of drinking, warm and bathing waters
- Chemical and microbiological water analyses
- Chemical analysis of leachates, soils and sludges
- Checking the efficiency of sterilizers and autoclaves

DEPARTMENT OF NANOCHEMISTRY

doc. RNDr. Michal Řezanka, Ph.D.
Head of ONCH

MAIN RESEARCH ACTIVITIES

- Synthesis of chemical compounds
- Use of sol-gel method for preparation of nanomaterials
- Preparation of cyclodextrin-functionalized nanomaterials
- Use of nanomaterials in tissue engineering and catalysis

COOPERATION

- Physico-chemical analyses of (nano)materials
- Synthesis of organic or inorganic compounds
- Preparation of nanoparticles
- (Nano)material functionalization
- Organic and inorganic chemistry consulting

DEPARTMENT OF APPLIED BIOLOGY

RNDr. Alena Ševců, Ph.D.
Head of OABI

MAIN RESEARCH ACTIVITIES

- Development of nanomaterials and porous structures for regenerative medicine, drug delivery and cosmetics
- Study of microbial activity in relation to the safety of radioactive waste repositories
- Influence of nanomaterials and microplastics on natural microbial communities

COOPERATION

- Verification of antimicrobial efficacy of photocatalytic surfaces
- Bioremediation, the impact of remediation interventions on microbial communities
- Electrospinning, development of nanofiber matrices and nanomaterials
- Risks of nanomaterials
- Evaluation of interactions of nanomaterials with tissue cells

PROJECT SOLUTIONS (E.G.)

LIFEPOPWAT

prof. Dr. Ing. Miroslav Černík, CSc.

e-mail: miroslav.cernik@tul.cz
tel.: +420 485 353 178

EU LIFE program

Wetland+®

LIFEPOPWAT (Innovative technology based on constructed wetlands for treatment of pesticide contaminated waters) is a European project that combines chemical and microbiological water treatment technologies. The essence of the demonstration system is the Wetland+ wetland cascade, which removes halogenated pollutants from flowing waters with low operating costs.

The aim of the project is to show the functionality of the technology on a full-scale prototype with a flow rate of over 100,000 m3 per year and to verify the procedures for its optimization aiming at smaller and larger water flows with different chemical composition.

TECHNICAL UNIVERSITY OF LIBEREC · PHOTON WATER · Jaworzno · AARHUS UNIVERSITY · GIG Research Institute 95 · SERPOL · DIAMO · Ministerstvo životního prostředí · NFOŠiGW

Life · LIFE POP WAT

SURRI

prof. Dr. Ing. Miroslav Černík, CSc.

e-mail: miroslav.cernik@tul.cz
tel.: +420 485 353 178

EU HORIZON TWINNING

The project SURRI aims to establish a multinational shared research agenda and project pipeline for addressing the challenges radionuclides pose to land remediation and materials recovery, with a particular focus on rare earth elements (REE) and other critical elements, in order to facilitate more efficient cycling and management of water, soil and material resources.

The research concept is based on the integration of electrochemical and microbiological interventions, which can be applied, in-situ or ex-situ, to provide new tools to unlock the remediation of radionuclide affected sites.

TECHNICAL UNIVERSITY OF LIBEREC
SAPIENZA UNIVERSITÀ DI ROMA
University of Southampton
UNIVERSIDAD DE GRANADA
SURRI

LIFE4ZOO

Ing. Tomáš Lederer, Ph.D.

e-mail: tomas.lederer@tul.cz
tel.: +420 485 353 260

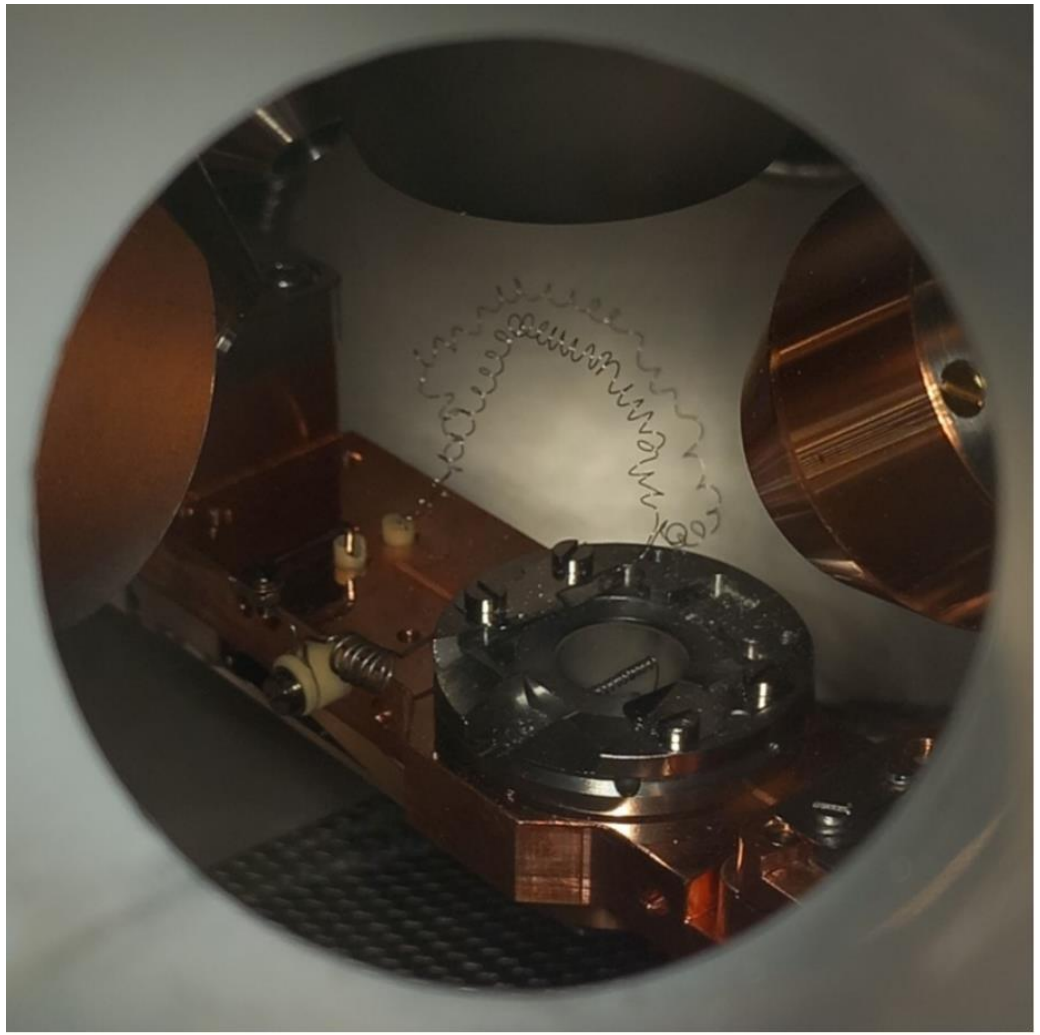
EU LIFE program

LIFE4ZOO

LIFE4ZOO (Water Resources Management in Visitor Attractions - FIT4USE Water Recirculation Technology) is a European project aiming to create a "circular economy" system for water use in visitor attractions such as Zoos.

The benefits of water recirculation are reduced demand on primary water resources, reduced cost-saving, reduced demand on sewerage systems and multiple synergies with better use of energy and water resources.

TECHNICAL UNIVERSITY OF LIBEREC
Universitat de Girona
Fundació Solidaritat UNIVERSITAT DE BARCELONA
ZOO LIBEREC
ZOO Barcelona
Life



PROJEKT

UPGRADE A MODERNIZACE VVI NANOMATERIÁLY A NANOTECHNOLOGIE PRO OCHRANU ŽIVOTNÍHO PROSTŘEDÍ A UDRŽITELNOU BUDOUCNOST

je spolufinancován **Evropskou unií**.

Cílem projektu Pro-NanoEnviCz III je modernizace přístrojové základny, která posílí výzkumný potenciál VVI NanoEnviCz a povede k úspěšnému splnění vědeckých cílů v oblasti nových nanomateriálů a nanotechnologií.

Spolufinancováno Evropskou unií

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

PRO-NANO ENVICZ III

Inovativní způsoby energetickoprovozní optimalizace membránových bioreaktorů - CZ.01.01.01/01/22_002/0000552

je spolufinancován **Evropskou unií.**

Významným přínosem pro další rozšíření technologie MBR a také cílem tohoto projektu je energetická optimalizace zajištění proudění aktivovaného kalu kolem membrán.

Spolufinancováno Evropskou unií

MINISTERSTVO PRŮMYSLU A OBCHODU

Foto: Zuzana Bajtová (Fotobanka TUL)

We look forward to you!

CXI TUL

INSTITUTE FOR NANOMATERIALS,
ADVANCED TECHNOLOGIES
AND INNOVATION TUL

RESEARCH ON THE TOP

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