

CXI TUL





Structure of research at CXI

- three progressive research directions
- differences in scientific focus and expertise; however, mutual cooperation
- each research direction lead by guarantor



Structure of research at CXI



NANOMATERIALS IN NATURAL SCIENCES



COMPETITIVE ENGINEERING



SYSTEM INTEGRATION



RESEARCH DIRECTIONS



CXI DIRECTOR
Miroslav Cernik

RESEARCH DIRECTOR
Michal Petru



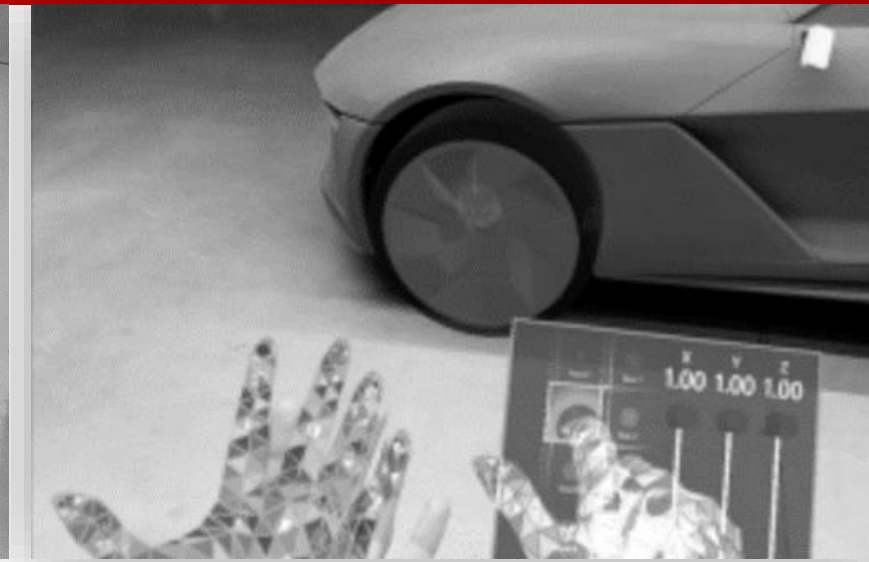
**NANOMATERIALS
IN NATURAL
SCIENCES (RD1)**

Lukas Dvorak



**COMPETITIVE
ENGINEERING
(RD2)**

Jiri Safka



**SYSTEM
INTEGRATION
(RD3)**

Jan Koci



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 research, technology and construction of pilot and professional biomass carriers, purification and analysis of environmental contaminants and testing of nanomaterials.



COMPETITIVE ENGINEERING



DEPARTMENT OF
3D TECHNOLOGIES



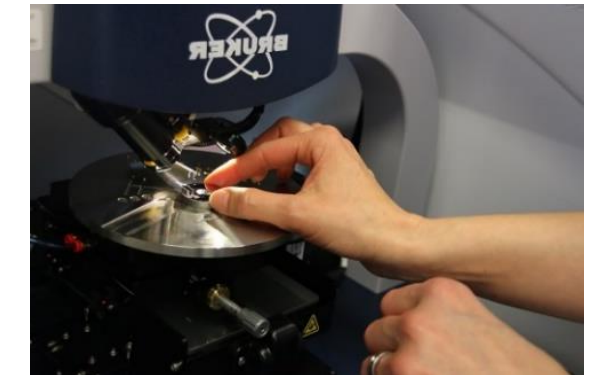
DEPARTMENT OF
VEHICLES



DEPARTMENT OF
MACHINES DESIGN



DEPARTMENT OF
ADVANCED
TECHNOLOGIES

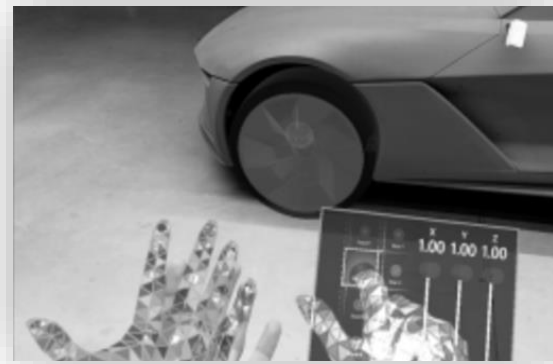


DEPARTMENT OF
ADVANCED
MATERIALS

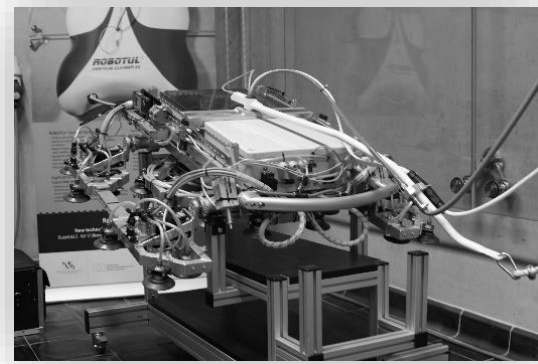
The research direction of competitive engineering combines research and development in the areas of manufacturing and the automotive industry with great application potential. The workplaces support the industrial activities of companies not just in the close-by regions and focus on the application of new technologies and technological procedures to ensure a higher degree of innovation in industrial production.



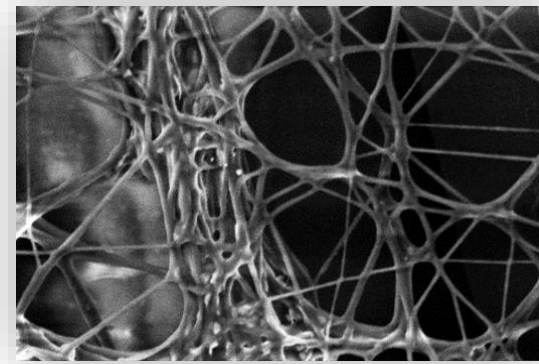
SYSTEM INTEGRATION



DEPARTMENT OF
SW ARCHITECTURE
AND DEVELOPMENT



DEPARTMENT OF
MECHATRONIC SYSTEMS
AND ROBOTICS



DEPARTMENT OF
PROCESS MODELING & AI



DEPARTMENT OF
PHYSICAL
MEASUREMENTS

Focus on research and development of modern software solutions, system solutions for data processing and integration between systems, and the provision of communication interfaces. An integral part is the field of robotics, including the use of collaborative or sensitive robots. The emphasis is being put on the introduction of state-of-the-art elements of visualization and projection of measured data, including the use of MR/AR.



CXI competence fields



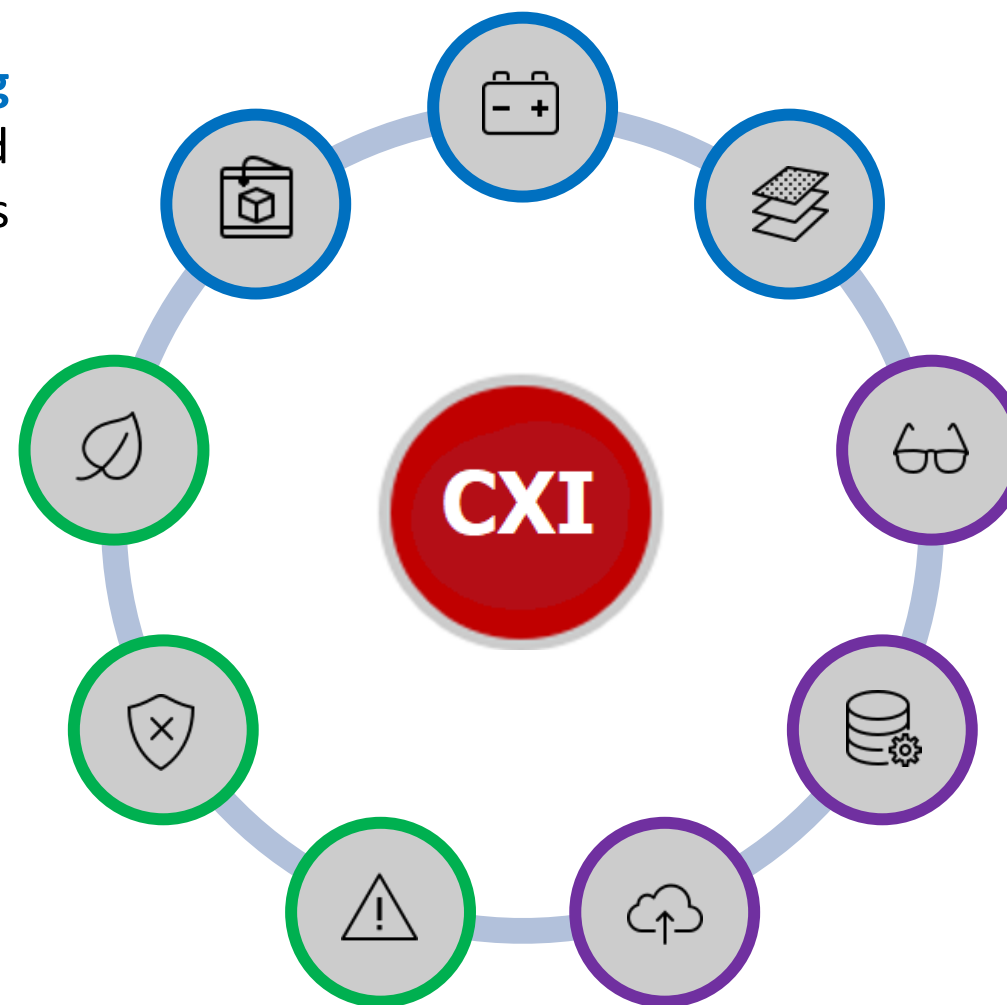
Autonomous systems
autonomous and cooperative systems
autonomous utility electrovehicle

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

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

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

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

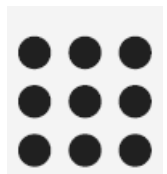


Advanced materials and machines design
the new light-weight and sustainable components, innovative design and systematic planning of technical systems innovations

Augmented reality
collaboration & remote assistance, mixed reality wearables

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

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

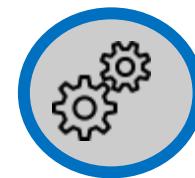


RESEARCH DIRECTIONS



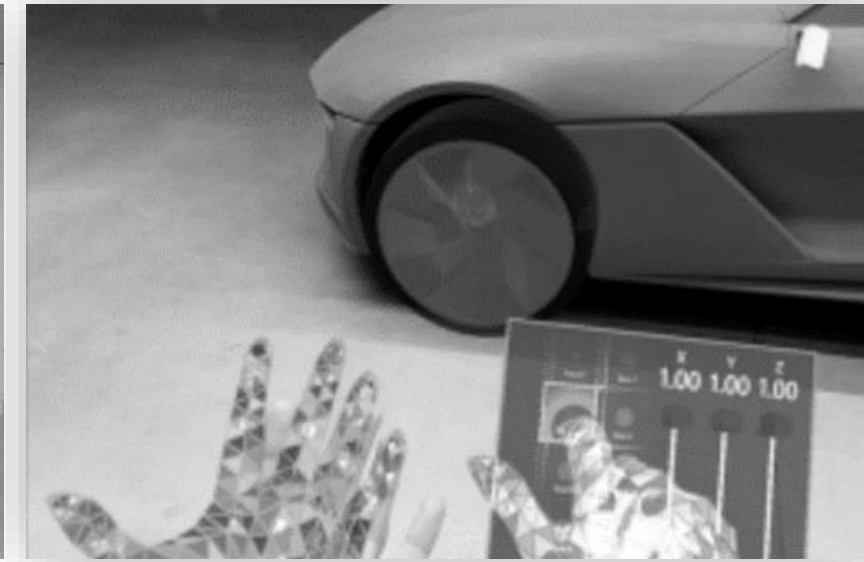
**NANOMATERIALS
IN NATURAL
SCIENCES (RD1)**

Lukas Dvorak



**COMPETITIVE
ENGINEERING
(RD2)**

Jiri Safka



**SYSTEM
INTEGRATION
(RD3)**

Jan Koci



FOCUS OF RD1

**STUDY AND APPLICATION OF
ADVANCED MATERIALS, ESPECIALLY
NANOMATERIALS, MOSTLY IN THE FIELD
OF ENVIRONMENTAL PROTECTION,
BIOTECHNOLOGY AND LIFE SCIENCES,
INCLUDING HI-TECH ANALYTIC
TECHNIQUES**



FOCUS OF RD1

**RESEARCH DIRECTION COMBINES
BASIC RESEARCH WITH APPLIED
RESEARCH AND DEVELOPMENT OF
ADVANCED, NOT ONLY, NANO-BASED
TECHNOLOGY AND CONSTRUCTION**

**THIS INCLUDES ALSO PILLOTING OF
TECHNOLOGIES AT REAL SITES
COUPLED WITH DETAILED ANALYSIS**



Departments of RD1

DEPARTMENT OF ENVIRONMENTAL TECHNOLOGY
lead by Lukas Dvorak, Ph.D.

DEPARTMENT OF NANOCHEMISTRY
lead by assoc. prof. Michal Rezanka

DEPARTMENT OF APPLIED BIOLOGY
lead by Alena Sevcu, Ph.D.

DEPARTMENT OF ENVIRONMENTAL CHEMISTRY
lead by Pavel Hrabak, Ph.D.

- **CERTIFIED LABORATORY OF CHEMICAL REMEDIATION PROCESSES**
lead by Klara Liskova, MSc.



DEPARTMENT
OF NANOCHEMISTRY



DEPARTMENT OF
ENVIRONMENTAL TECHNOLOGY



DEPARTMENT
OF APPLIED BIOLOGY



DEPARTMENT OF
ENVIRONMENTAL CHEMISTRY

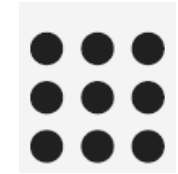
The research direction of **nanomaterials in natural sciences** combines basic and applied research, advanced technologies including hi-tech analysis, not only environmental contaminants. Great emphasis is also put on synthesis and testing of different nanomaterials and their verification in practical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



**Ing. Mgr.
Lukáš Dvořák, Ph.D.**

Guarantor of research
direction Nanomaterials
in Natural Sciences and
Department of
Environmental Technology

DEPARTMENT OF ENVIRONMENTAL TECHNOLOGY

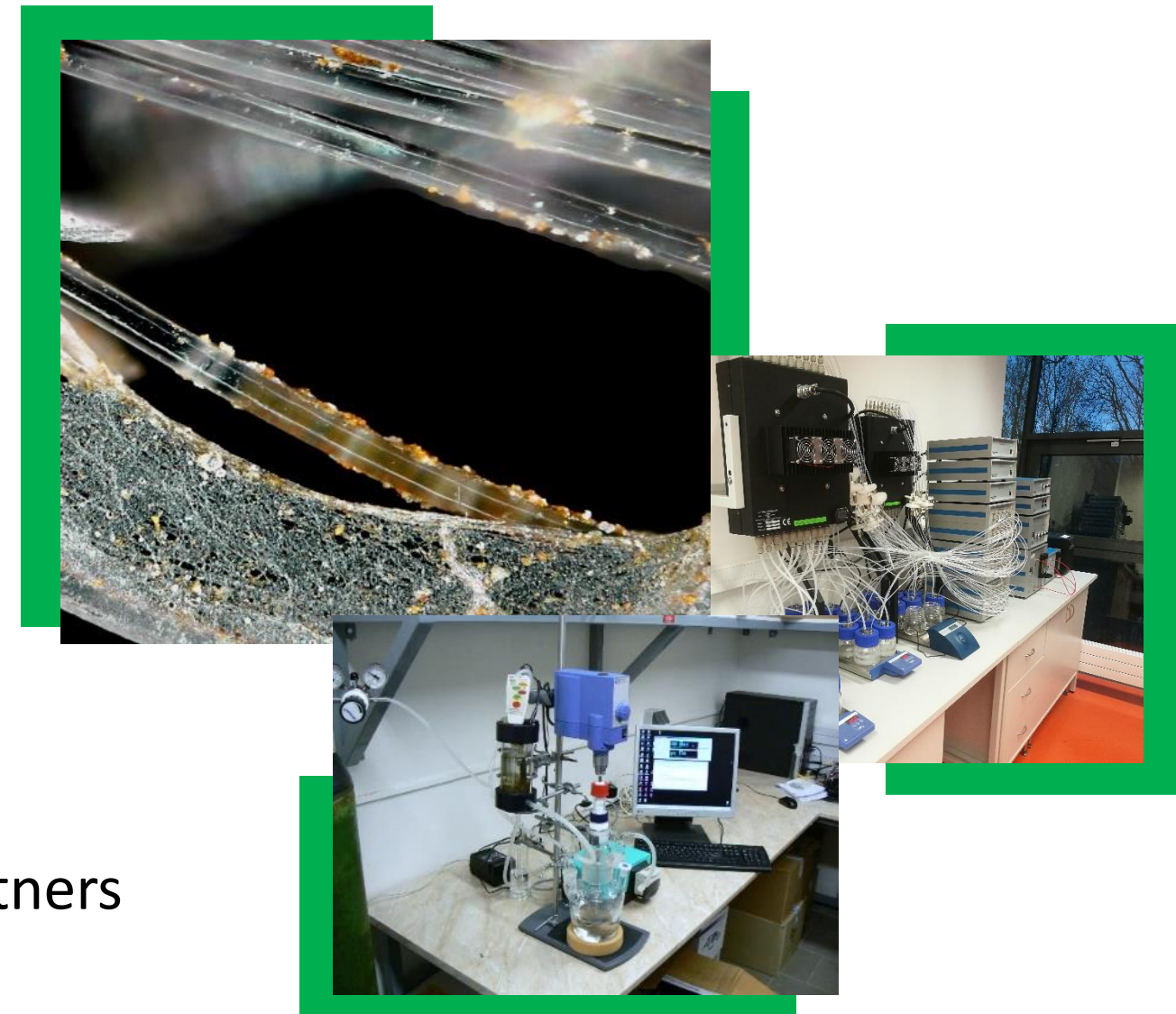


MAIN RESEARCH ACTIVITIES

- 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

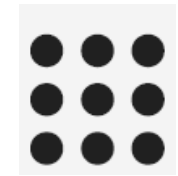




**doc. RNDr.
Michal Řezanka,
Ph.D.**

**Department of
Nanochemistry**

DEPARTMENT OF NANOCHEMISTRY

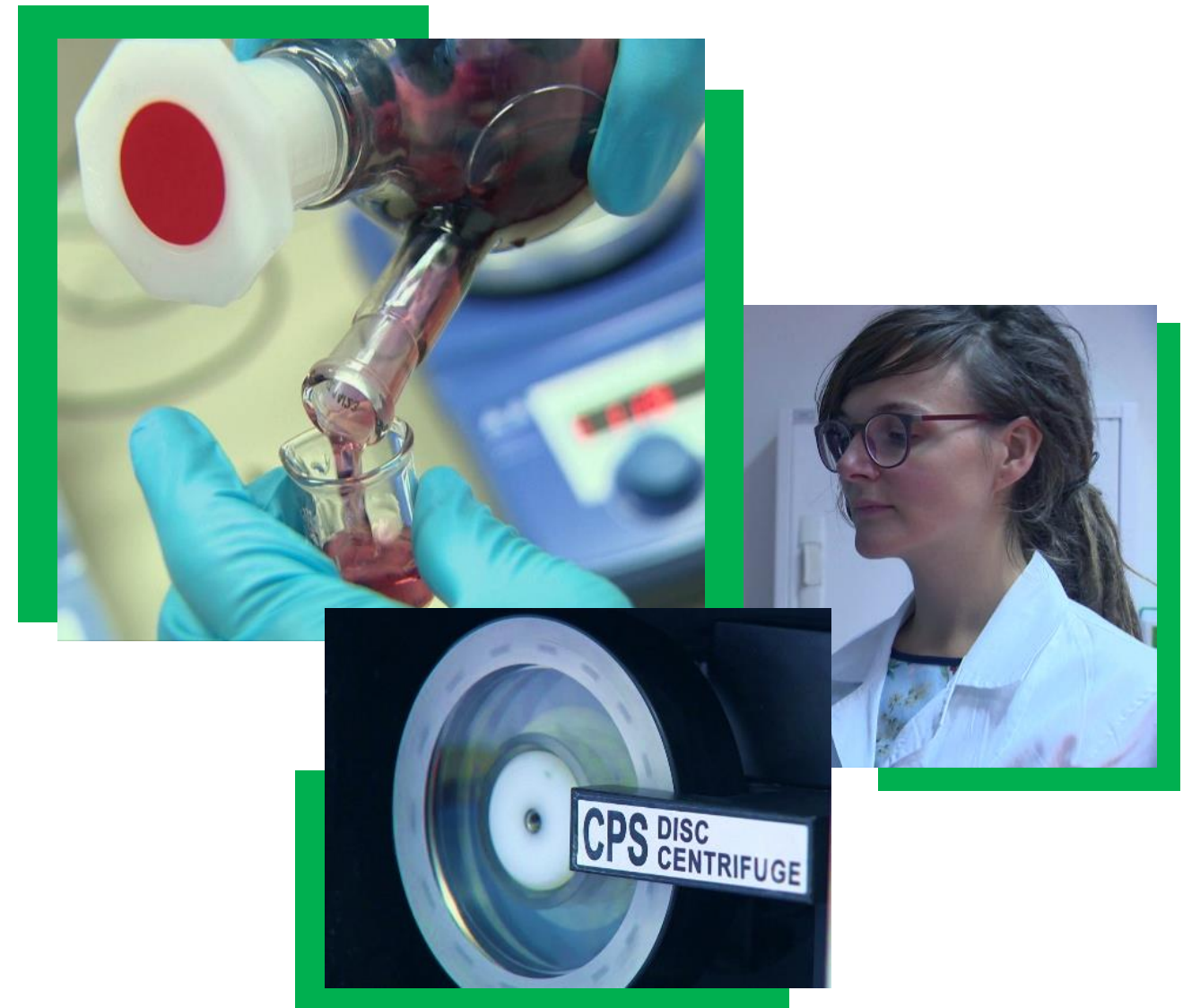


MAIN RESEARCH ACTIVITIES

- 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

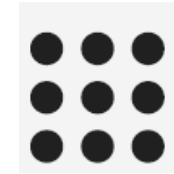
- Physico-chemical analyses of (nano)materials
- Synthesis of organic or inorganic compounds
- Preparation of nanoparticles
- (Nano)material functionalization
- Organic and inorganic chemistry consulting





**RNDr.
Alena Ševců, Ph.D.**

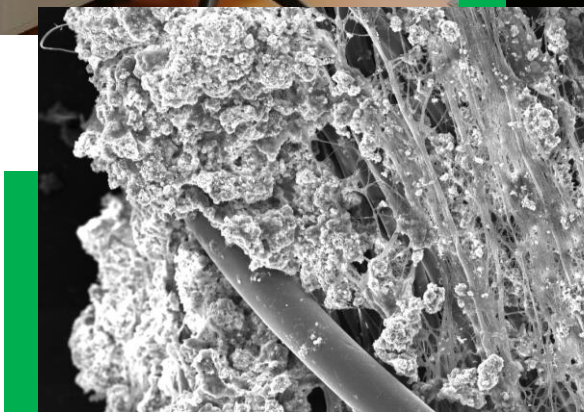
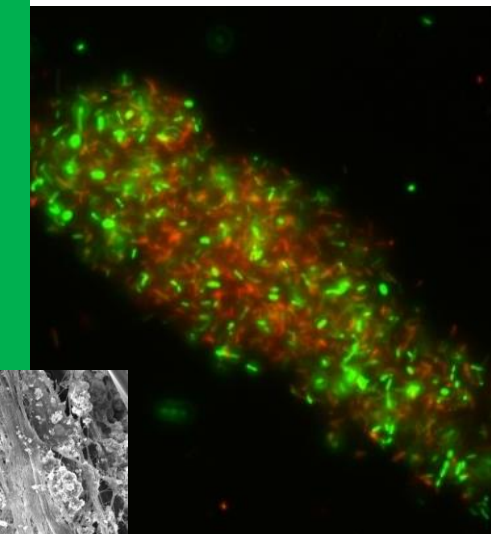
**Department of
Applied Biology**



DEPARTMENT OF APPLIED BIOLOGY

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

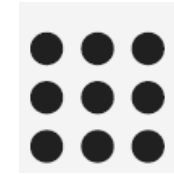
- Verification of antimicrobial efficacy of photocatalytic surfaces
- Bioremediation, the impact of remediation interventions on microbial communities
- Electrospinning, development of nanofiber matrices and nanomaterials
- Risks of nanomaterials
- Evaluation of interactions of nanomaterials with tissue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



**doc. Ing.
Stanislaw Waclawek, Ph.D.**

Department of
Environmental Chemistry

DEPARTMENT OF ENVIRONMENTAL CHEMISTRY



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





INSTITUTE FOR NANOMATERIALS,
ADVANCED TECHNOLOGIES
AND INNOVATION TUL

Studentská 1402/2 | 461 17 Liberec 1 | e-mail: cxi@tul.cz

cxi.tul.cz

Research on the Top