**Empyrean, series 3, multipurpose X-ray powder diffractometer, Co tube**

**Equipment:** Empyrean, series 3, multipurpose X-ray powder diffractometer, Co tube

**No. of Equipment:** UACH17

**Responsible coordinator:** Dr. Petr Bezdička

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**Equipment Description**

**Description of equipment:**

Empyrean, series 3, multipurpose X-ray powder diffractometer, Co tube

**More detailed specifications and features**:

* Co radiation
* iCore – dCore multipurpose primary and secondary optics
* programmable sample changer up to 45 samples
* Bragg – Brentano reflection geometry
* transmission geometry alternatively with the focusing mirror
* micro-diffraction (poly-capillary exit diameter of 50 microns, spot size of about 60 microns on the surface of sample)

**Specification of expertise relevant to NanoEnviCz workpackages:**

|  |  |
| --- | --- |
| **WP3 SYNTHESIS AND DESIGN OF NEW MULTIFUNCTIONAL NANOMATERIALS FOR ENVIRONMENT PROTECTION** | |
| Conceptually new nanostructured materials with the potential for application in innovative technologies | ✓ |
| Computer aided nanomaterials design |  |
| Low dimensional materials and their composites (carbon dots, nanotubes, graphene derivatives) | ✓ |
| Nanofibers | ✓ |
| Magnetic hybrids | ✓ |
| Metal and metal oxide NPs | ✓ |
| Redox active nanomaterials | ✓ |
| Nanomaterials for biomedical applications | ✓ |
|  | |
| **WP4 HETEROGENEOUS CATALYSIS FOR ENVIRONMENTAL PROTECTION** | |
| Nanomaterials for catalytic degradation of pollutants in water, soil and air | ✓ |
| Nanostructured heterogeneous catalysts for abatement of pollutants from industrial processes and automotive transport | ✓ |
| New “clean” catalytic processes for chemical production |  |
|  | |
| **WP5 NOVEL NANOMATERIALS AND TECHNOLOGIES FOR SUSTAINABLE PRODUCTION** | |
| Processes and technology for sustainable energy and chemical production |  |
| Catalytic processes for transformation of natural gas to liquids |  |
| Nanomaterials for utilization of renewables; Magnetically separable green catalysts | ✓ |
|  | |
| **WP6 EFFECTIVE PHOTOCATALYTIC TECHNOLOGIES** | |
| Mastering nanomaterials for photocatalysis | ✓ |
| Effective photocatalytic processes |  |
| Photovoltaic paints | ✓ |
| Functional surfaces for environmental protection | ✓ |
| Hybrid materials combining photocatalysts and heterogeneous catalysts | ✓ |
| Thin photocatalytic films for direct solar splitting of water | ✓ |
|  | |
| **WP7 NANOTECHNOLOGY FOR TRAPPING AND CHEMICAL DEGRADATION OF POLLUTANTS** | |
| Nanomaterials for sorption | ✓ |
| Natural based nanomaterials produced by “green” technology | ✓ |
| Reactive sorbents for degradation of pesticides and highly toxic agents | ✓ |
| Degradation of chemical warfare agents |  |
| Analysis of filtering capabilities of nanomaterials |  |
| Elimination of radionuclides contamination |  |
| Modified nanofiber filters; Advanced antimicrobial filters/membranes |  |
| Nanoiron for groundwater and waste water treatment | ✓ |
| Nano-trapping of heavy metals |  |

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| --- | --- |
| **WP8 SENSING AND MONITORING OF POLLUTANTS** | |
| Efficient sensing of pollutants |  |
| Biosensing by new devises |  |
| Application of new sensors in monitoring of pollutants |  |
| Magnetic sensors; Magnetically assisted SERS sensors |  |
| Advanced electrochemical sensors |  |
| Graphene based nanosensors |  |
|  | |
| **WP9 TOXICITY AND RISKS OF NANOMATERIALS** | |
| Health risks |  |
| Environmental risks |  |
| „In vitro“ and „in vivo“ toxicity tests – cytotoxicity, genotoxicity, interactions with membrane |  |
| RNA gene expression changes and protein expression changes |  |
| Complete eco/aquatoxicity ecotoxicity evaluation |  |
| Toxicity against bacteria and fungi |  |

**Detailed description of expertise**

**Please, specify the main research topics connected with equipment**:

Qualitative and quantitative phase analysis of crystalline phases

Ex-situ structural transformations at elevated temperature

Micro-diffraction of small heterogeneous solid samples with complicated stratigraphy

**Please, specify the secondary research topics connected with equipment**:

Analysis and quantification of clay-based materials, of various clinker or concrete materials.

**Keywords describing research area:**

**X-ray powder diffraction, X-ray powder micro-diffraction, quantitative phase analysis, qualitative phase analysis**

**Competence**

**Relevance for applied and industrial research:**

Non-destructive analysis, qualitative and quantitative phase analysis of crystalline solids, determination of amorphous content by indirect method using an internal standard addition.

Studies of changes in materials connected with their applications, usage, functionality.

Studies of changes in materials caused by ageing, fatigue at operation conditions.

**Relevance for fundamental studies:**

Studies of phase transformations at elevated temperatures that could lead to elucidation of their mechanisms. Direct comparison with methods of thermal analysis (could be complementary each other)

Studies of changes of physical and structural properties of materials connected to doping, reaction pathways etc..

**Comments**

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