**High Resolution Transmission Electron Microscope (HRTEM)**

**Equipment:** High Resolution Transmission Electron Microscope (HRTEM)

**No. of Equipment: UFCH 21**

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**Equipment Description**

Technical parameters of High Resolution Transmission Electron Microscope (HRTEM) were specified on the basis of analysis of series of samples relevant for development of nanostructured materials for environmental applications in cooperation with leading manufacturers of electron microscopes.

* electron source: La-B6 filament/ W cathode
* high tension programmable in steps
* accelerating voltage: 80–100-200 kV
* computer controlled goniometer stage
* resolution in TEM mode: point image 0.23-0.38 nm, Lattice image 0.14-0.2 nm
* Magnification range x 400 – x 1 500 000
* microscope will be equipped with automatic airlock and gun lift
* microscope will be equipped by CB difraction
* specimen tilt angle +-25°
* sample holders: standard single tilt holder
* sample size 3mm grid
* specimen exchange using airlock with automatic pumping system
* fully automatic evacuation system
* digital imaging and image recording by CCD camera
* step down transformer

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

The high resolution transmission electron microscope will serve to analyses in many research fields:

In the field of synthesis and design of new multifunctional nanomaterials for environment protection, there are conceptually new nanostructured materials with the potential for application in innovative technologies and also low dimensional materials and their composites such as carbon dots, nanotubes and graphene derivatives, nanofibers, metal oxide nanoparticles and redox active nanomaterials.

In the field of heterogenous 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, or new “clean” catalytic processes for chemical production. Also novel nanomaterials and technologies for sustainable energy and chemical production will be studied such as materials for catalytic processes for transformation of natural gas to liquids, Nanomaterials for utilization of renewables or magnetically separable green catalysts.

In the field of photocatalytic technologies the mastering nanomaterials for photocatalysis will be studied, materials for effective photocatalytic processes, functional surfaces for environmental protection and hybrid materials combining photocatalysts and heterogeneous catalysts.

In the nanotechnology for trapping and chemical degradation of pollutants, there will be studied materials for sorption and natural based nanomaterials produced by “green” technology, modified nanofiber filters and Advanced antimicrobial filters/membranes.

**Detailed description of expertise**

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

The characterization of nanomaterials with specialization on i) microporous and micromesoporous H-zeolites and metal/metal-oxo zeolites of various structural topologies, ii) metal/metal-oxo nanomaterials (Spinels, Perovskites, Oxides, Supported catalysts M/M-oxo on ZrO2/Al2O3/SiO2), iii) carbon nanomaterial (low-dimensional carbon materials and derivatives, nanotubes, 3D graphene structures), and vi) nanofibers (WOx/ZrO2, CeO2/ZrO2, TiO2).

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

The characterization of the nanomaterials in the field of nanostructured sorbents, nanofiber filters, photocatalysis and functionalization of surfaces.

**Keywords describing research area:**

High resolution transmission electron microscope (HRTEM); Catalysis; Catalysts; Nanomaterials; Nanoparticles; Metal/metal-oxo nanomaterials; Nanocarbon materials; Graphene materials; Nanofibers

**Competence**

**Relevance for applied and industrial research:**

High resolution measurement of powder materials in the atomic scale for development of synthesis of advanced compounds and materials in the field of heterogeneous catalysis and nanotechnologies. Microscopic characterization of nanomaterial for analysis of structure/synthesis/functionality relationships for novel synthesis and large scale production of nanomaterials and catalysts.

**Relevance for fundamental studies:**

Use of HRTEM will be centered mainly on fundamental studies in the area of nanostructured catalysts and low-dimensional carbon materials. Configuration and accessories of the microscope will be specialized on the analysis of the morphology, phase analysis and analysis of crystal orientation of inorganic nanomaterials and carbon-based nanostructures. The microscope will enable analysis of materials sensitive to electron beam characteristics.

**Comments**