**Equipment:** Apparatus for determining the pore structure and specific surface area

**No. of Equipment: UFCH 19**

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**Equipment Description**

**Description of equipment:**

A device for determining the surface area, pore size distribution and pore volume by the physical gas sorption of 3 samples simultaneously. The device is completed autonomous unit for the preparation of 6 samples with a separate pump.

**Specifications and technical features:**

- Supply voltage of the apparatus is 230 VAC, 50/60 Hz.

- The device is equipped with a high-quality vacuum system with turbomolecular and 4-speed vacuum pumps for measuring adsorption and desorption isotherms. Realistically achievable relative pressure is better than 1x10-9.

- Dewar allows up to 80-hour analysis without the need to refill the cooling medium (e.g. liquid nitrogen or argon)

- The device allows long-term measurements, adsorption and desorption of three samples simultaneously. The temperature of the cooling bath is continuously determined from the measured vapor pressure of sorbate (simultaneously with the measurement of 3 samples)

- At least two measuring stations are used for analyzes in the range of a pore size of 0.35 nm to 100 nm, equipped with three pressure sensors with ranges of 1,000, 10 and 0.1 torr for each. These stations allow analysis of micropores in extremely low relative pressure range and the determination extremely small surface areas

- Accuracy of pressure transducers is better than 0.15% of measured value

- Stability of the temperature measuring system (a pressure sensor) is better than ± 0.05 ° C.

- Leak rate of the system is better than 0.1 μmHg / min. The measuring system is made of stainless steel and is equipped with a combined measurement transducer "cold cathode micro-Pirani" for controlling the vacuum.

- All the measurement stations allow measurement of adsorption of gaseous N2, Ar, CO2, CO, H2, NO, O2, alkanes, alkenes

- Servo valve for filling sorbate ensures accurate dosing even very small amounts of gas.

- An autonomous unit for outgassing the probes allows the treatment of up to 6 samples. The temperature is adjustable up to 450 ° C in steps of 1 ° C, both evacuation or flushing with helium being possible. The unit is equipped with a rotary oil pump and transducers for measuring the vacuum level

- A system for eliminating the effect of changes in the level of liquid nitrogen is provided

- Software includes all the standard methods for the analysis of texture including advanced DFT / NLDFT methods.

- The device is equipped with an interactive program for controlling the measurement system, processing isotherms, user creation of measurement reports and modify the parameters of data processing

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

*Please, tick relevant research topic(s).*

|  |  |
| --- | --- |
| **WP3 SYNTHESIS AND DESIGN OF NEW MULTIFUNCTIONAL NANOMATERIALS FOR ENVIRONMENT PROTECTION** | |
| Conceptually new nanostructured materials with the potential for application in innovative technologies | x |
| Computer aided nanomaterials design |  |
| Low dimensional materials and their composites (carbon dots, nanotubes, graphene derivatives) | x |
| Nanofibers | x |
| Magnetic hybrids | x |
| Metal and metal oxide NPs | x |
| Redox active nanomaterials | x |
| Nanomaterials for biomedical applications | x |
|  | |
| **WP4 HETEROGENEOUS CATALYSIS FOR ENVIRONMENTAL PROTECTION** | |
| Nanomaterials for catalytic degradation of pollutants in water, soil and air | x |
| Nanostructured heterogeneous catalysts for abatement of pollutants from industrial processes and automotive transport | x |
| New “clean” catalytic processes for chemical production | x |
|  | |
| **WP5 NOVEL NANOMATERIALS AND TECHNOLOGIES FOR SUSTAINABLE PRODUCTION** | |
| Processes and technology for sustainable energy and chemical production | x |
| Catalytic processes for transformation of natural gas to liquids | x |
| Nanomaterials for utilization of renewables; Magnetically separable green catalysts | x |
|  | |
| **WP6 EFFECTIVE PHOTOCATALYTIC TECHNOLOGIES** | |
| Mastering nanomaterials for photocatalysis | x |
| Effective photocatalytic processes | x |
| Photovoltaic paints | x |
| Functional surfaces for environmental protection | x |
| Hybrid materials combining photocatalysts and heterogeneous catalysts | x |
| Thin photocatalytic films for direct solar splitting of water | x |
|  | |
| **WP7 NANOTECHNOLOGY FOR TRAPPING AND CHEMICAL DEGRADATION OF POLLUTANTS** | |
| Nanomaterials for sorption | x |
| Natural based nanomaterials produced by “green” technology | x |
| Reactive sorbents for degradation of pesticides and highly toxic agents | x |
| Degradation of chemical warfare agents | x |
| Analysis of filtering capabilities of nanomaterials | x |
| Elimination of radionuclides contamination |  |
| Modified nanofiber filters; Advanced antimicrobial filters/membranes | x |
| Nanoiron for groundwater and waste water treatment | x |
| Nano-trapping of heavy metals | x |
|  | |
| **WP8 SENSING AND MONITORING OF POLLUTANTS** | |
| Efficient sensing of pollutants | x |
| Biosensing by new devises |  |
| Application of new sensors in monitoring of pollutants |  |
| Magnetic sensors; Magnetically assisted SERS sensors |  |
| Advanced electrochemical sensors |  |
| Graphene based nanosensors | x |
|  | |
| **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**:

All the topics dealing with solid materials where the knowledge of their texture, surface area, pore size distribution is essential, including a majority of WPs of the infrastructure

All the topics where interaction of gaseous molecules with the solid surface is essential (especially catalysis, photocatalysis, sorption, trapping of pollutants etc.)

**Keywords describing research area:**

Texture, surface area, pore size distribution, adsorption

**Competence**

**Relevance for applied and industrial research:**

Essential for a number of technologies, such as catalysis, photocatalysis, sorption etc.

**Relevance for fundamental studies:**

Essential for all the studies on solid materials