**Photoelectron spectrometer with Kelvin probe**

*(completed by the contact personofequipment)*

**Equipment:** Photoelectronspectrometer with Kelvin probe ***(Pro-NanoEnviCz III)***

**No. of Equipment:** *UFCH36*

**Responsible coordinator:** prof. RNDr. Kavan Ladislav CSc., DSc.

**Name of Institution: J. Heyrovsky Institute of Physical Chemistry of the CAS, v.v.i.**

**Address of Institution:** Dolejškova 3, Praha 8, 182 00

**E-mail:** ladislav.kavan@jh-inst.cas.cz

**Telephone: +420 266 053 975**

**Homepage:** https://www.jh-inst.cas.cz/

**Contact person:** RNDr. Mansfeldová Věra Ph.D.

**E-mail:** vera.mansfeldova@jh-inst.cas.cz

**Telephone: +420 266 053 845**

**Equipment Description**

The ambient pressure photoelectron spectroscopy system (APS) offers energy level characterization of the absolute Work Function (Φ) for metals or Ionization Potential (IP) for semiconductors using a 3.3–7.0 eV tunable DUV optical source. The whole system uniquely offers the combination of (Φ, IP, Ef, Eg) measurements in one unit. The system includes a high-resolution Kelvin probe and darkened environment for determination of the sample Fermi-level (Ef) with respect to the gold alloy vibrating tip. The system allows characterisation of work function homogeneity of clean and coated surfaces on samples up to 50x50 mm2. For larger samples it offers scanning platform options up to 350x350 mm2. APS04 includes a variable intensity white light source for Surface Photovoltage (SPV) studies used to measure the intensity-dependent surface potential changes on semiconductors and VOC on planar solar cells. The APS04 configuration includes a second tunable Vis/IR source providing Surface Photovoltage Spectroscopy (SPS) over the energy range 1.2-3.1 eV (1000-400 nm) which can be used for both band-gap Eg and photo-excitation measurements.

**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 | X |
| 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 | X |
| Effective photocatalytic processes |  |
| Photovoltaic paints |  |
| 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 |  |
| 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 |  |
|  |
| **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**:

measures work function, Fermi level, and surface potential, analyzes photo-generated carrier dynamics, surface states, and band bending under illumination, interface engineering of new materials

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

band alignment and charge transfer analysis, work function mapping, defect control and surface passivation, optimization of light absorption and carrier transport, functionalization for enhanced photoelectrochemical activity

**Keywords describing research area:**

electrochemically active materials, metals and semiconductors, thin films, characterization materials for solar cells and batteries

**Competence**

**Relevance for applied and industrial research:**

develop functional materials and devices for batteries, solar cells and electronics; optimizing electrochemically active materials for battery performance, lifespan, and safety;
engineering semiconductors for efficient solar energy conversion, process control and device quality monitoring

**Relevance for fundamental studies:**

understand underlying principles and mechanisms that govern material behavior; exploring intrinsic properties of electrochemically active materials; understanding band structure, surface states, and quantum phenomena in metals and semiconductors, to study Fermi level alignment, band bending, and charge separation dynamics at a fundamental level; studying photoelectrochemical processes to uncover reaction kinetics, charge carrier recombination, and interfacial energetics

**Comments**