Air purity analyzers:

**Aparature for analysis in streaming air with different analyzers**

*(Air purity aparature equipped by analyzer of CO2 and volatile organic compounds)*

*(completed by the responsible coordinator of equipment)*

*Doplnění/rozšíření aparatury* **Aparature for analysis of nitrogen oxides and ozone in streaming air UFCH34 (modernization Pro-NanoEnviCzIII)**

*Analyzer of volatile organic compounds HORIBA APHA-370 VOC*

*Volatile organic compound analyzer HORIBA APHA-370 VOC*

*Carbon dioxide analyzer HORIBA APCA-370 CO2*

**Equipment: Aparature for analysis in streaming air with different analyzers** *(modernization Pro-NanoEnviCz III)*

**No. of Equipment:** *UFCH34*

**Responsible coordinator****: Ing. Jiří Rathouský CSc.**

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**Equipment Description**

It is an extension of the existing air purification apparatus (UFCH34). The complete experimental set-up consisted of analyzers Horiba APNA 370 NOx (NO+NO2), Horiba APOA 370 (O3), Horiba APHA 370 (VOC) and Horiba APCA 370 (CO2)

The APHA 370 is an analyzer for continuously measuring the concentration of total hydrocarbons (THC), CH4, and non-CH4 in ambient air, with additional applications in process and trace analysis. The flame ionization detector uses cross-flow modulation, alternating between measurement and reference gases. The reference gas is purified from THC, ensuring stable, low-maintenance operation with minimal interference. It features an internal gas pump and burner air is drawn directly from the ambiance to the detector. This device measures the total concentration of hydrocarbons (THC) in ambient air, with a standard range of 0-5/10/25/50 ppm, and an optional extension of up to 100 ppm. The detection limit is 0.022 ppm, with repeatability and linearity of ±1.0% of full scale. It operates with a flow rate of approximately 0.5 L/min and a response time of less than 60 seconds

The APCA-370 is a continuous CO2 monitor for ambient air, using non-dispersive infrared (NDIR) absorption with cross-modulation. A single cell and light source are used for sample and reference gases, ensuring precise measurement without zero drift. Its accuracy, long-term stability, and low maintenance make it ideal for monitoring air pollution. It has a range of 0 to 500/1000 ppm and a minimum detection sensitivity of 0.5 ppm. The reproducibility is ±1.0% of full scale, with a linearity of ±2.0%. Zero drift is ±0.1 ppm per day and ±2.0 ppm per week, while span drift is ±2.0% of full scale per day and ±3.0% per week. The response time is 60 seconds or less, with a sample rate of approximately 0.7 L/min.

**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 | x |
| 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 | x |
| Nanostructured heterogeneous catalysts for abatement of pollutants from industrial processes and automotive transport | x |
| 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 the 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 | x |
| 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 |  |
|  | |
| **WP7 NANOTECHNOLOGY FOR TRAPPING AND CHEMICAL DEGRADATION OF POLLUTANTS** | |
| Nanomaterials for sorption | x |
| 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 | x |
| Biosensing by new devises |  |
| Application of new sensors in monitoring of pollutants | x |
| 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**:

Degradation of gaseous pollutants in streaming air, such volatile organic compounds and carbon dioxide.

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

Testing the photocatalytic performance of photocatalytic layers in the degradation of gaseous pollutants.

**Keywords describing the research area:**

Photocatalysis, air pollutants, volatile organic compounds, VOC, carbon dioxide, CO2, ozone, O3, nitrogen oxides, NOx, NO, NO2, streaming air, layers, degradation

**Competence**

**Relevance for applied and industrial research:**

Assessment of the performance of layers and paints under realistic atmospheric conditions. Comparison of the performance of the different photocatalytic materials according to ISO 22197.

**Relevance for fundamental studies:**

Development of methodologies for the determination of the performance of photocatalytic layers and materials. Development of novel photocatalytic materials for degradation of air pollutants.

**Comments**