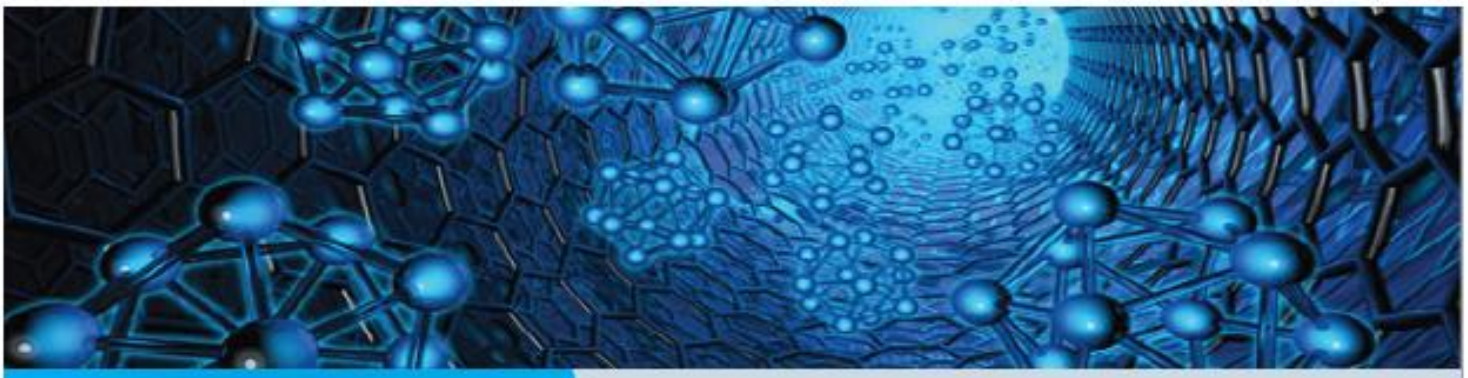


NANODEVICE

Novel Concepts, Methods, and Technologies for the Production of Portable, Easy-to-Use Devices for the Measurement and Analysis of Airborne Engineered Nanoparticles in Workplace Air

Project ID: CP-IP 211464-2

A European Integrated Project supported throught the Seventh Framework Programme for Research and Technological Development

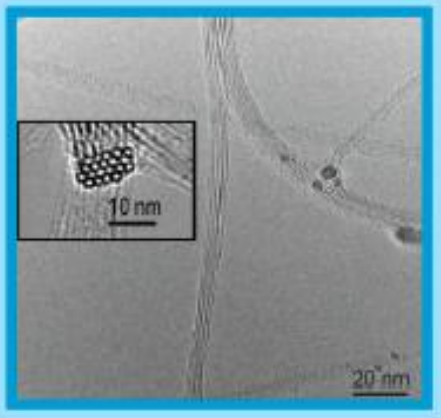
SEVENTH FRAMEWORK PROGRAMME

Background
One of important challenges for assuring a safe production of engineered nanomaterials (ENM) and the promotion of the use of nanotechnologies is reliable assessment of exposure of workers to these materials in the occupational setting, i.e. during the production, storage, handling and preparation of nanotechnology-based products. This information supports the assessment of potential hazards and risks of ENM, and subsequent management of possible risks associated with ENM.

Material Characterization

Material characterization comprises of one activity and the aim is characterisation of physico-chemical properties of reference materials and tailored ENP aerosol and especially producing in-situ tailored ENP aerosols for device testing

Objective of the activity is generation of well-characterized test aerosols of engineered nanoparticle (ENP) aerosols with designed size and morphology, including carbon nanotubes and nanobuds, metals and metal oxides.



TEM-image of Single Walled Carbon Nanotube (SWCNT) bundles.
Source: Prof. Esko I. Kauppinen, AALTO UNIVERSITY

Association Between ENP Properties and Biological Effects

The study between properties of ENP and their biological effects includes 3 different kinds of activities. The main aim of this activity is to investigate the relationships between physical and chemical properties of nanoparticles and their potential toxicity or bioactivity. The activities include the following tasks:

1. To carry out analytical electron microscopy characterisation of nanoparticles to support the non-imaging and toxicological evaluations. Samples will also be analysed to assess whether the same bulk nanopowders aerosolise in a similar physical form using a dustiness test; 2) to establish non-imaging reference characteristics of the selected ENPs for comparison with toxicological studies to provide guidance on the choice of the end-point metrics for the ENP devices developed in the project; 3) to investigate toxicological effects of selected nanomaterials. More than 20 different nanomaterials are studied in primary cells and cell lines to find out their ability to cause cell death, modulate immune responses and cause genotoxic effects.

Processes in ENP Production, Use and Exposure to ENPs

Processes in ENP production, use and exposure measurements consists of one activity and the aim is to analyse the processes in ENP production, use and exposure to ENPs. The task is to make a conceptual model of exposures to ENP identify and quantify key characteristics of industrial processes potentially leading to exposure to ENP (mainly inhalation).

Device Development

Device development comprises of seven different kinds of activities that are related to the development of new devices and sensing technologies for the detection and quantitative characterization of airborne ENP aerosols. The activities include the following tasks:

Prototype personal nano sampler.
Source: Naneum Ltd.

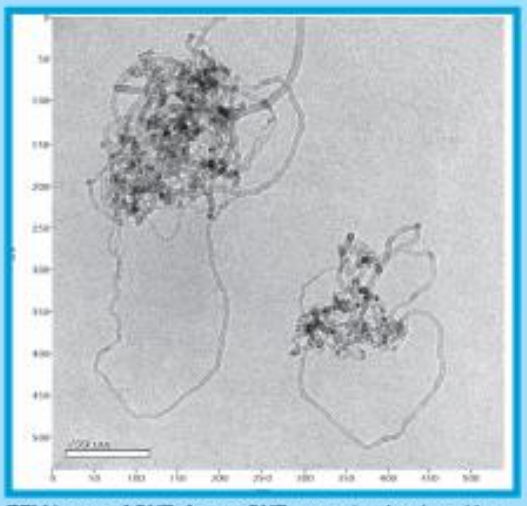
1) Develop a portable active surface area aerosol monitor that measures real-time and is inexpensive.

2) Concentrate on detecting and analyzing quasi on-line only the ENPs occurring in the workplace area eliminating the background of larger and nanoparticles using size discriminating number and surface area monitor and sampler that are operated by batteries.

3) Develop and deliver the prototype of robust, portable, size resolving, wide range systems combining a personal sampler, an online monitor, and two modular pre-separators for selection of aerosol fractions relevant to particle deposition in the human respiratory tract.

4) Develop a high-sensitivity optical sensor for detecting single-particle number & mass using a laser-light scattering optical sensor in combination with an electric mobility measurement device.

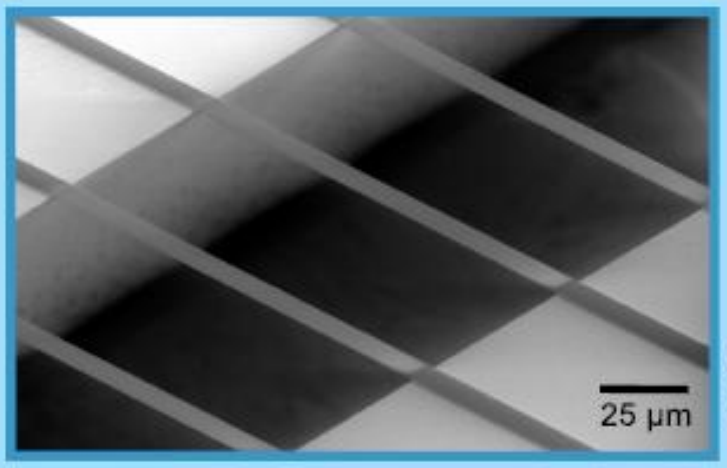
5) Develop a high-sensitivity MEMS-based sensor for single-particle number & mass using micro string resonators.



TEM image of CNTs from a CNT-generator developed by Karlsruhe Institute of Technology (KIT).
Source: Neubauer, KIT

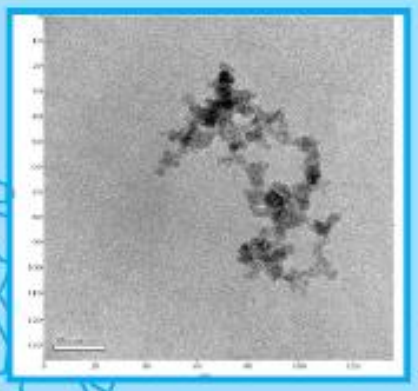
Purpose-designed particle impactor.
Source: Keller, Fraunhofer IPA

6) Develop catalytic & surface-chemical aerosol monitors that are based on novel measurement concepts. These devices will for the first time allow capturing of specific chemical functions of ENPs in their airborne state, in order to assess potential hazards.

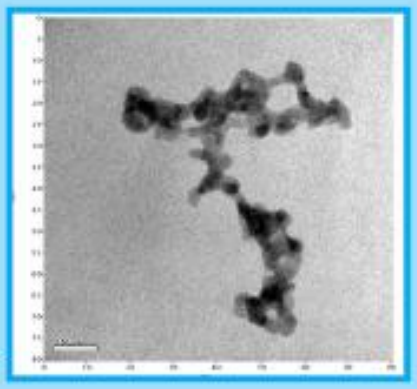


SEM-image of silicon nitride micro string resonators.
Source: Larsen and Schmid, DTU

7) Develop a portable monitor for airborne nanofibres (NF, ENPs in fibre form) based on the concept of depositing and aligning the airborne nanofibres on a moving substrate being continuously passed through the sensing area of a portable, cantilever based nano-scanning device.



TEM-image of Nickel
Source: Neubauer, KIT



TEM-image of Palladium
Source: Neubauer, KIT

Calibration and Testing of the Devices

Calibration and field testing of the devices include two different kinds of activities and the aim is to get a valid, scientifically sound impression of whether the pre-prototypes can be transformed by the manufacturers into a ready-to-market device capable of measuring some properties of ENP with appropriate background distinction and the desired ease-of-use. The activities include the following tasks:

1) Calibration, testing and background distinction for quality control of the measurement devices developed in the NANODEVICE project;

2) Testing of the devices in the field. The main thrust of the work will be a comparison of the performance of novel device pre-prototypes with a range of existing state-of-the-art measurement devices measuring levels of airborne ENP in a number of research and industrial settings.

Dissemination and Assuring Impact of the NANODEVICE Project

Dissemination and assuring impact of the project includes seven different kinds of activities and the aim is to maximize the impact of the NANODEVICE Consortium to assure safe handling of ENP and to promote of development of safe NT within and beyond the EU via several means. The activities to effectively disseminate results of the project and to maximize its impact include the following tasks:

1) Produce educational materials on safety of nanotechnologies and maintain the official webpage www.nano-device.eu. An international workshop will be organized dealing with all aspects of nanosafety. Publications are already done and the presence of NANODEVICE on several conferences enables a large networking between the different projects dealing with ENP-safety. A presentation dealing with basic principles in handling is downloadable from the webpage as well for usage during lectures and courses for personal training;

2) A web-tool that gathers validated information, models, methods, data, and tools useful in the performance of the risk assessment will be produced. SME's will be actively involved in this tasks if needed. This task will also interact and provide support with all tasks related to dissemination and transfer of knowledge and supporting standardization task (to follow);

3) Support for standardization of the safety of ENPs. The task supports the NANODEVICE consortium with identifying relevant existing standards and facilitates the discussion for identifying the most important standardization objectives of the project outputs;

4) To establish an Annual Forum for Nanosafety consisting of members from Europe, Americas, Asia and Africa. The members represent Universities, Governmental bodies, SME's and Industry, and provide outside guidance and expertise to the project;

5) Organize an International Congress on Safety of Engineered Nanoparticles and Nanotechnologies in 2012;

6) Create a handbook on Safety of Engineered Nanoparticles using the knowledge and information generated through the NANODEVICE project as well as that in the literature will to provide information on the application of the newly developed devices for measuring personal exposure to ENP for risk assessment purposes;

7) Promote collaboration and synergy within the project through a mobility programme encouraging researchers working for the project to visit other laboratories involved in the project.

SENN2012 - International Congress on Safety of Engineered Nanoparticles and Nanotechnologies

28-31 October 2012, Marina Congress Centre, Helsinki, Finland

Join us in the next step of the nanosafety discussion!

http://www.ttl.fi/SENN2012

Finnish Institute of Occupational Health

SENN2012

Consortium

29 partners from 10 EU member states including associated partners

Universities, Research institutes, Industry partners

Coordinator: FIOH

Project lasts until March 2013

Project consists of
6 Subprojects
21 Workpackages

Partners

Norway

Sweden

Denmark

Finland

DTU

United-Kingdom

Germany

Netherlands

France

Hungary

Poland

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