

COST Action TD1105: European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability - EuNetAir

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Abstract

This is a short overview of the COST Action TD1105 *EuNetAir - European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability* - funded in the framework *European Cooperation in the field of Scientific and Technical Research* (COST) during the period 2012-2016. The international networking has involved more than 120 teams from academia, research, agencies and industry from 31 COST Countries and 7 Non-COST Countries (June 2015).

Key words: Sensing technologies, air pollution modelling, methods and protocols, air quality control, environmental sustainability

Introduction

The main objective of the Concerted Action *EuNetAir* is to develop new sensing technologies for Air Quality Control at integrated and multidisciplinary scale by coordinated research on nanomaterials, sensor-systems, air-quality modelling and standardised methods for supporting environmental sustainability with a special focus on Small and Medium Enterprises.

This international Networking, coordinated by ENEA (Italy), includes over 120 big institutions/organizations and over 200 international experts from 31 COST Countries (EU-zone: *Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Luxembourg, The Former Yugoslav Republic of Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom*) and 7 Non-COST Countries (extra-Europe: *Australia, Canada, China, Morocco, Russia, Ukraine, USA*) to create a S&T critical mass in the environmental issues.

This COST Action [1-4] (see logo in Fig. 1) will focus on a new detection paradigm based on sensing technologies at low cost for Air Quality Control (AQC) and set up an interdisciplinary top-level coordinated network to define innovative approaches in sensor nanomaterials,

gas sensors, devices, wireless sensor-systems, distributed computing, methods, models, standards and protocols for environmental sustainability within the European Research Area (ERA). The state-of-the-art showed that research on innovative sensing technologies for AQC based on advanced chemical sensors and sensor-systems at low-cost, including functional materials and nanotechnologies for eco-sustainability applications, the outdoor/indoor environment control, olfactometry, air-quality modelling, chemical weather forecasting, and related standardisation methods is performed already at the international level, but still needs serious efforts for coordination to boost new sensing paradigms for research and innovation.



Fig. 1. COST Association, ESSEM Domain and Action TD1105 EuNetAir logo.

Only a close multidisciplinary cooperation will ensure cleaner air in Europe and reduced negative effects on human health for future generations in smart cities, efficient management of green buildings at low CO₂ emissions, and sustainable economic development.

The aim of the Action is to create a cooperative network to explore new sensing technologies for low-cost air-pollution control through field studies and laboratory experiments to transfer the results into preventive real-time control practices and global sustainability for monitoring climate changes and outdoor/indoor energy efficiency. Establishment of such a European network, involving Non-COST key-experts, will enable EU to develop world capabilities in urban sensor technology based on cost-effective nanomaterials and contribute to form a critical mass of researchers suitable for cooperation in science and technology, including training and education, to coordinate outstanding R&D and promote innovation towards industry, and support policy-makers.

Objectives

The main objectives of Action include:

- to establish a top-level Pan-European multidisciplinary R&D platform on new sensing paradigm for AQC contributing to sustainable development, green-economy and social welfare
- to create collaborative research teams in the ERA on the new sensing technologies for AQC in an integrated approach to avoid fragmentation of the research efforts
- to train Early Stage Researchers (ESR) and new young scientists in the field for supporting competitiveness of European industry by qualified human potential
- to promote gender balance and involvement of ESR in AQC
- to disseminate R&D results on AQC towards industry community and policy makers as well as general public and high schools

Working Groups

The Action Workplan is organized in four complementary Working Groups (WGs), each devoted to a progressive development of synthesis, characterization, fabrication, integration, prototyping, proof-of-concepts, modeling, measurements, methods, standards, tests and application aspects. The four WGs with the specific objectives are:

- **WG1: Sensor materials and nanotechnology**
- **WG2: Sensors, devices and sensor-systems for AQC**
- **WG3: Environmental measurements and air-pollution modeling**

WG4: Protocols and standardisation methods

This Action focusses on the study of sensor nanomaterials and nanotechnologies exhibiting unique properties in terms of chemical and thermal stability, high sensitivity, selectivity. Nanosize effects of functional materials are explored for integration in the gas sensors at low power-consumption. Furthermore, specific nanostructures with tailored sensing properties will be developed for gas sensors and sensor-systems with advanced functionalities. Selected high-quality research products and innovative technologies developed by the partnership of COST Action TD1105 are shown in Fig. 2 and Fig. 3.

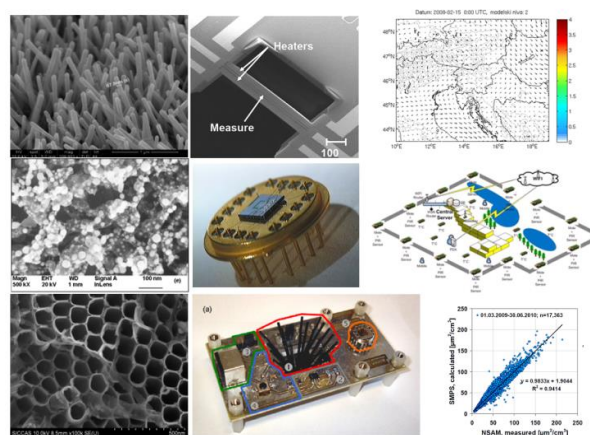


Fig. 2. Selected R&D technological products developed by some partners (academia, research institutes, agencies, industry) involved in the COST Action TD1105 EuNetAir. Courtesy from EuNetAir partnership.

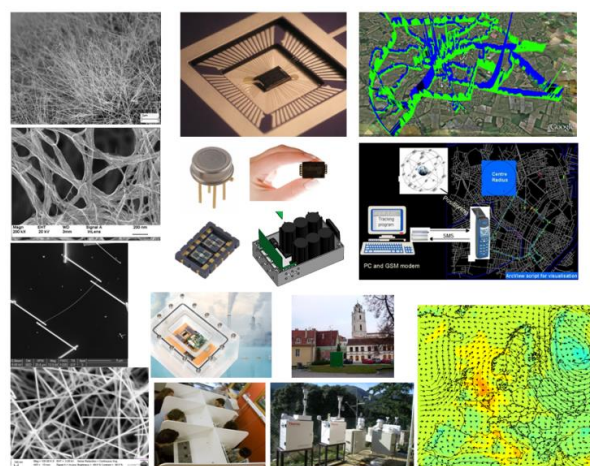


Fig. 3. Selected R&D technological products developed by some partners (academia, research institutes, agencies, industry) involved in the COST Action TD1105 EuNetAir. Courtesy from EuNetAir partnership.

Special Interest Groups

The COST Action TD1105 is composed by four multidisciplinary and focused Special Interest Groups (SIGs), each devoted to a thematic hot-topic in the field of air quality control and related low-cost sensing technologies applications. The four SIGs with the specific objectives are:

- **SIG1:** *Network of spin-offs*
- **SIG2:** *Smart sensors for urban air monitoring in cities*
- **SIG3:** *Guidelines for best coupling air-pollutant and transducer*
- **SIG4:** *Experts comments for the revision of the air quality EU directive*

The SIGs are intra-WGs, as shown in Fig. 4, with interdisciplinary themes of environmental interest including technologies, modeling, methods, standards and regulation.

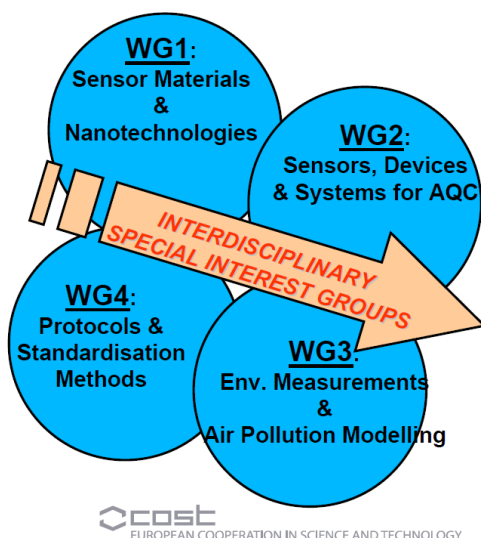


Fig. 4. WGs and SIGs structure of the COST Action TD1105 EuNetAir.

Governance of COST Action TD1105

The Action is governed by a Management Committee, led by the Chair and Vice-Chair, based on 58 Members and 33 Substitutes, nominated by COST National Coordinators (CNC) from 31 COST Countries. The Grant Holder (GH) as Eurice GmbH (Germany) has been appointed for funding administration. A Core-Group has been established based on Chair, Vice-Chair, GH Representative, 4 WGs Leaders, STSMs Coordinator, Scientific Secretary, Webmaster. Moreover, a Steering Committee and various Ad-Hoc Groups are installed as follows as:

- Editorial Board
- Dissemination

- Training Schools
- Gender Balance
- Early Stage Researchers (ESR)
- Short-Term Scientific Mission (STSM)
- Intellectual Property Rights (IPR)
- Local Organizing Committee (LOC)

EuNetAir Partnership

At the date on June 2015, 123 big Institutions from 31 European Countries (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Luxembourg, The Former Yugoslav Republic of Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom) signed the Memorandum of Understanding (MoU). The Action participants are from 55 Universities (44%), 39 Research Centers (32%), 4 Environmental Agencies (3%) and 25 SMEs (21%) including 9 spin-offs. Additional 8 top-level Institutions from 7 Non-COST (Near Neighbour Countries and International Partner Countries) Countries (Australia, Canada, China, Morocco, Ukraine, Russia, USA) were involved: CSIRO, Chinese Academy of Sciences, National Research Center Kurchatov-Institute, O.M. Marzeiev Institute for Hygiene and Medical Ecology of Academy of Sciences of Ukraine, University of Agadir IBN Zohr, University of Waterloo, Southern Illinois University Carbondale, NASA Ames Nano Research Center. A panorama of the Action partnership is shown in Fig. 5.



Fig. 5. Partnership of the COST Action TD1105.

S&T Challenges

The Action *EuNetAir* addresses significant challenges in science and technology in the field of air quality monitoring and environmental technologies:

- Nanomaterials for AQC sensors
- Low-cost Gas Sensors
- Low-power Sensor-Systems
- Wireless Technology (*Environmental Sensors Network*)
- Air Quality Modelling
- Environmental Measurements
- Standards and Protocols

Innovation Highlights

The Working Program includes multidisciplinary research at integrated approach and trans-domain multi-scale level:

- Nanomaterials for low-cost AQC sensors
- Improved gas sensor systems and low-power sensing microdevices
- Wireless sensor networks and distributed intelligence
- Air-quality modelling and chemical weather forecasting
- New protocols, standards and methods for AQC sensors
- Harmonisation of environmental measurements
- Guidelines for AQC systems and transducers
- Environmental sustainability and energy efficiency

Action Deliverables

The COST Action TD1105 is committed to deliver outcome during the four-year period (2012-2016):

- *Workshops* on sensor materials and nanotechnologies, sensor-systems for AQC, environmental measurements, air-pollution modelling, chemical weather forecasting, distributed computing, wireless sensor networks, protocols and pre-standardisation; organization of open conferences to improve knowledge transfer and dissemination
- *Training Schools* on sensor materials, technologies, processes, methods, modelling, forecasting, applications, environmental certification and validation, project management
- *International ESRs exchange* and Scientists Mobility (STSMs) between partners involved in Action and Non-COST partnership at incoming/outcoming level
- *New collaborative research initiatives* and research projects providing synergies between partners capabilities

- *Participations* in Conferences, Short Courses, Mutual Publications, Reports, White Papers, Position Papers, etc.
- *Outreach* activities
- Enforcement of the *Gender Balance* agenda
- Coordinated *Dissemination* of the networking activities towards Academia, Industry and General Public

Expected Impact

The COST Action TD1105 is expected to impact as follows as:

- European Leadership on AQC Science & Technology
- Development of Green-Economy
- Support to Sustainable Development
- Support to Monitoring System of Clean Air for Europe
- Fostering Research & Innovation on New Sensing Technologies for Environmental Monitoring

Conclusions and Outlook

The COST Action TD1105 *EuNetAir* is proposed to solve problems in the area of:

- Air Quality Control
- Environmental Sustainability
- Indoor/Outdoor Energy Efficiency
- Climate Change Monitoring
- Health Effects of Air-Pollution

The Action is working to elaborate a Strategic Report devoted to the *Innovation on Environmental Sensor Technologies*, expected to be published on the end of 2016.

Acknowledgements

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