



TCM 2012  
The 4<sup>th</sup> International Symposium on Transparent  
Conductive Materials  
October 21- 25, 2012, Hersonissos, Crete, Greece

Open Satellite Workshop:

## **Materials, Nanostructures and Technologies for Environmental Sensors**

organized by the COST Action TD1105 **EuNetAir**

*European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability*

**TCM 2012 - 4<sup>th</sup> International Symposium on Transparent Conductive Materials** (former TCOs),  
21 - 25 October, 2012 Hersonissos, Crete, Greece

Visit link: <http://www.tcm2012.org/>

### **SPECIAL SESSION PROGRAM**

*Open Satellite Workshop Chair(s)*: Prof. Giorgio Sberveglieri (MC Member), Prof. Juan Ramon Morante (MC Member) and Dr. Michele Penza (Action Chair)

## **Materials, Nanostructures and Technologies for Environmental Sensors**

**Two-hour Session on 21 October 2012 (Sunday) - Tentatively**

### **AIM of OPEN SATELLITE WORKSHOP**

The **Workshop** aims to provide to the scientific community of Smart Materials and Nanostructures, as well as to anyone else interested, with information on the current state of play in new sensor technologies, advanced nanostructures for gas sensors and new sensing concepts. The tutorial will be based on research results achieved by members of the COST Action TD1105 **EuNetAir** and is part of the Action's efforts for dissemination of results and for cross-domain scientific collaborations.

Current trend in the solid-state sensing technology is the development of nanomaterials and nanostructures with novel functionalities and innovative properties at the nanoscale for high-performance chemical sensing. In this direction, great efforts in the ongoing research have been doing to fabricate environmental sensors with advanced sensing nanostructures and high-resolution transducers coupled to proper electronic interfaces and new algorithms of pattern recognition and signal processing.

The key role for high-performance environmental sensors and sensor-systems is the engineering of sensing devices, ICT hardware, ad-hoc software/firmware, emerging transducers and sub-systems to develop air quality control applications with ubiquitous and mobile sensor-systems, including participating sensing and wireless sensor networks.

This **Tutorial** will be completely devoted to **Materials, Nanostructures and Technologies for Environmental Sensors**. This event is based on Tutorial Session focussing environmental hot-issues from at least 3 Speakers from COST Action TD1105 EuNetAir and an Overview of the COST Action TD1105 from Chair (or a MC Delegate) towards large and specialized target audience with high benefit for COST Action TD1105.



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## Call for papers

This **Tutorial** openly calls for perspective and original contributions in the field of environmental sensors, sensor-systems, sensor technology and applications, from science and technology worldwide community, over COST Action and move towards new interested researchers and stakeholders working in the field of Action core-themes. These contributions related to Action-issues from extra-Action scientists would be submitted free of charge to the new open-access **Journal of Sensors and Sensor Systems (JSSS)** ([www.journal-of-sensors-and-sensor-systems.net](http://www.journal-of-sensors-and-sensor-systems.net)). The regular issue JSSS accepts contributions to cover a full range of sensors and sensor-systems such as theory, basic properties, design, fabrication, processing, calibration, measurements, integration, characterization, applications. We invite the submission of the manuscripts related to the fundamental and applied aspects for the environmental sensory, sensors science, sensor materials, nanomaterials and nanostructures processing, materials science and nanotechnology, gas sensors, air quality control sensor-systems applications, measuring systems, sensor technologies, environmental smart systems, sensing solutions, environmental ICT applications, mobile sensing, participatory environmental sensing, etc.

Topics of interest include, but not limited to:

- smart sensor materials
- advanced nanostructures for gas sensing
- nanomaterials processing
- functional nanomaterials
- environmental sensors
- outdoor/indoor air quality monitoring
- mobile sensing and participatory sensing
- sensor networks
- gas sensors and sensor arrays
- pattern recognition and signal processing
- electronic interfaces for sensors
- applications of sensor systems

Authors should follow the Journal of Sensors and Sensor Systems (JSSS) manuscript format described at the open-access journal site [www.journal-of-sensors-and-sensor-systems.net](http://www.journal-of-sensors-and-sensor-systems.net). Prospective authors should submit an electronic copy of their complete manuscript. Papers should be submitted either in a doc or in a pdf form and they will be peer reviewed by at least 2 academic referees. Notice of submission from authors should be emailed to Open Satellite Workshop Chairs.

## Open Satellite Workshop Chairs

**Michele Penza**, ENEA - Italian National Agency for New Technologies, Energy, and Sustainable Economic Development, Technical Unit of Technologies for Materials Brindisi, Italy; [michele.penza@enea.it](mailto:michele.penza@enea.it)

**Juan Ramon Morante**, IREC, Barcelona, Spain; [jrmorante@irec.cat](mailto:jrmorante@irec.cat)

**Giorgio Sberveglieri**, University of Brescia, Italy; [giorgio.sberveglieri@ing.unibs.it](mailto:giorgio.sberveglieri@ing.unibs.it)



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## **Materials, Nanostructures and Technologies for Environmental Sensors**

**Two-and-half-hour Session on 21 October 2012 (Sunday) - Tentatively**

30 minutes (14.00 - 14.30)

Title: *Overview of COST Action TD1105 EuNetAir*

Speaker: Dr. Michele Penza, ENEA, IT - [michele.penza@enea.it](mailto:michele.penza@enea.it) (or MC Delegate)

**CONFIRMED**

30 minutes (14.30 - 15.00)

Title: *Carbon nanotubes as chemical sensors: true and false stories*

Speaker: Dr. Andrea Goldoni, ELETTRA, Trieste, IT - [goldonia@elettra.trieste.it](mailto:goldonia@elettra.trieste.it)

**CONFIRMED**

30 minutes (15.00 - 15.30)

Title: *Localized growth and in situ integration of metal-oxide nanowires for gas-sensing applications*

Speaker: Prof. Albert Romano-Rodriguez, University of Barcelona, ES - [aromano@el.ub.es](mailto:aromano@el.ub.es)

**CONFIRMED**

30 minutes (15.30 - 16.00)

Title: *Materials advances for ppb gas detection*

Speaker: Dr. John Saffell, Alphasense Ltd, Essex, UK - [jrs@alphasense.com](mailto:jrs@alphasense.com)

**CONFIRMED**

20 minutes (16.00 - 16.30)

Title: *High pressure chemical processes for the development of new nanostructured complex systems*

Speaker: Dr. Roxana Mioara Piticescu, IMNR, Pantelimon, RO - [roxana@imnr.ro](mailto:roxana@imnr.ro)

**CONFIRMED**

Closing Session



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## Open Satellite Workshop: Materials, Nanostructures and Technologies for Environmental Sensors

### Invited Talk 1

#### Overview of COST Action TD1105 EuNetAir

Michele Penza - ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, PO BOX 51 Br-4, I-72100 Brindisi, Italy - [michele.penza@enea.it](mailto:michele.penza@enea.it)

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 main objective of the Concerted Action 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 60 big institutions from 21 COST Countries (EU-zone) and 5 Non-COST Countries (extra-Europe) to create a S&T critical mass in the environmental issues.

### Invited Talk 2

#### Carbon nanotubes as chemical sensors: true and false stories

Andrea Goldoni - Sincrotrone Trieste, SCpA, S.S. 14 Km 163,5 in Area Science Park, 34149 Trieste, Italy - [goldonia@elettra.trieste.it](mailto:goldonia@elettra.trieste.it)

In this talk we will discuss and present data [1] on the possibility to use carbon nanotubes (CNTs) as chemical sensors. There are two main characteristics that suggest CNTs as promising candidates for extremely sensitive gas sensors. First, as one-dimensional systems, their "quantum nature" makes the CNT intrinsic properties highly sensitive to very tiny external perturbations. Second, the amount of active surface area is huge. Many experimental works [2] demonstrate the high sensitivity of CNTs to several molecular species in gas phase. Although most of the experimental reports must be taken *cum grano salis* and a number of technical problems must be deeply investigated and solved, there is the effective possibility to a sensor technology based on CNTs. Metal coatings and/or functionalization or hybrid materials are the goals.

#### References

- [1] Goldoni et al., J. Am. Chem. Soc. **125**, 11329 (2003); A. Goldoni et al., Carbon **42**, 2099 (2004); R. Larciprete et al., Appl. Phys. Lett. **88**, 243111 (2006); R. Larciprete et al., J. Phys, Chem. C **111**, 12169 (2007); A. Goldoni et al., J. Phys: Cond. Matter. **22**, 013001 (2010); M. Chiesa et al., J. Environ. Sci. (2012); P. Mubyisa et al., Carbon (2012) in press.
- [2] For a review: N. Sinha et al., J. Nanoscience Nanotechnology 6, 573 (2006); T. Zhang et al., Nanotechnology 19, 332001 (2008); N.H. Tran et al., Advances in Colloid and Interface Science 145, 23 (2009)



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#### Invited Talk 3

### Localized growth and in situ integration of metal-oxide nanowires for gas-sensing applications

Jordi Samà,<sup>a</sup> Sven Barth,<sup>b</sup> Roman Jimenez-Diaz,<sup>a</sup> Juan Daniel Prades,<sup>a</sup> Isabel Gracia,<sup>c</sup> Joaquin Santander,<sup>c</sup>  
Luis Fonseca,<sup>c</sup> Carlos Calaza,<sup>c</sup> Carles Cane,<sup>c</sup> and Albert Romano-Rodriguez<sup>a\*</sup>

<sup>a</sup> MIND-IN2UB, Departament d'Electrònica, Universitat de Barcelona, Martí i Franquès 1, 08028 Barcelona, Spain

<sup>b</sup> Institute of Materials Chemistry, Getreidemarkt 9/BC/02, 1060 Vienna, Austria

<sup>c</sup> Consejo Superior de Investigaciones Científicas (CSIC), Institut de Microelectrònica de Barcelona, Campus UAB,  
08193 Bellaterra, Spain

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Localized growth of metal-oxide nanowires on top of suspended microhotplates with integrated microelectrodes is presented in this work and demonstrated for the case of single crystalline tin oxide (SnO<sub>2</sub>). The functionality of the fabricated device is tested as gas sensors towards the presence of low concentrations of CO. The presented approach represents a step forward in the integration of nanomaterials onto functional devices, circumventing the problem that represents the growth, assembly and contact formation to these nanomaterials and paving the way for massive post-growth integration processes.

#### Invited Talk 4

### Materials advances for ppb gas detection

*John Saffell, Ronan Baron, Wah On Ho*

Alphasense Limited, 300 Avenue West, Great Notley, Essex CM77 7AA UK - [irs@alphasense.com](mailto:irs@alphasense.com)

Recent requirements for sub-ppm gas detection have pushed chemical sensors to perform at levels previously not achievable.

Both electrochemical and metal oxide sensors have improved their sensing layer and support electronics to enable measurement of inorganic gases to low ppb concentrations.

We will review the recent improvements to detect ppb gas concentrations, how the overall system design is critical and approaches to detect VOCs selectively at ppb levels.

#### Invited Talk 5

### High pressure chemical processes for the development of new nanostructured complex systems

*Roxana Mioara Piticescu, IMNR, Pantelimon, Romania - [roxana@imnr.ro](mailto:roxana@imnr.ro)*

The paper aims to present the importance of high pressure chemical processes in developing new nanostructured complex systems. Some original results regarding modeling, designing and chemical synthesis in solution of:

- i) doped zinc oxide and titanium dioxide based nanopowders for photocatalytic and active coatings;
- ii) complex perovskitic structures for detection of hazardous gases (e.g. H<sub>2</sub>S)

are presented.

Thin/thick films are obtained by spray technique, spin coating, DC magnetron sputtering or e-beam and are characterized by SEM/EDX, TEM, XRD, scratch test.