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

FOURTH INTERNATIONAL ACTION WORKSHOP on Innovations and Challenges for Air Quality Control Sensors

Vienna (Austria), 25 - 26 February 2016

hosted at FFG - Austrian Research Promotion Agency - AT COST Association
 Sensengasse 1, 1090 Vienna, Austria

organized by Materials Center Leoben Forschung GmbH	
co-supported by Techkonnex - High-Tech Promotion	

AGENDA	
25 February 2016 - Thursday	
09:00 - 18:00	REGISTRATION
09:30 - 10:00	Welcome Address
10:00 - 11:00	Session 1: Plenary Session
11:00 - 11:30	<i>Coffee Break</i>
11:30 - 13:00	Session 2: Oral Presentations
13:00 - 14:30	<i>Lunch</i>
14:30 - 16:00	Session 3: Oral Presentations
16:00 - 16:30	<i>Coffee Break</i>
16:30 - 18:00	Session 4: Oral Presentations
20:00 - 23:00	<i>Social Dinner</i>
26 February 2016 - Friday	
09:00 - 16:00	REGISTRATION
09:30 - 11:00	Session 5: Oral Presentations
11:00 - 11:30	<i>Coffee Break</i>
11:30 - 13:00	Session 6: Oral Presentations
13:00 - 14:30	<i>Lunch</i>
14:30 - 16:00	Session 7: Poster Presentations
16:00 - 16:30	<i>Discussion and Coffee Farewell</i>
16:30	Closure of Meeting



Thursday, 25 February 2016

COST Action TD1105 EuNetAir WORKSHOP

hosted at FFG - Austrian Research Promotion Agency - AT COST Association
Sensengasse 1, 1090 Vienna, Austria

09:00 - 18:00 COST Event Registration

Welcome Address

09:30 - 10:00 *Chairperson: Anton Köck, Local Organizing Committee Chair and MC AT Member - Materials Center Leoben Forschung GmbH (MCL), Leoben, Austria*

Welcome: Austrian COST Association - FFG, Austria
Nicole Schmidt, Member of AT CNC COST Association, Austria

Welcome: Material Center Leoben Forschung GmbH
Anton Köck, Delegate MCL, Leoben, Austria

Welcome: COST Action TD1105 EuNetAir
Michele Penza, Action Chair, ENEA, Brindisi, Italy

Session 1 - Plenary Session

10:00 - 11:00 *Chairperson: Anton Köck, Local Organizing Committee Chair and MC AT Member - Materials Center Leoben Forschung GmbH (MCL), Leoben, Austria*

10:00 - 10:30 **COST Action TD1105: European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability. Overview and Plans of COST Action TD1105**
Michele Penza, Action Chair, ENEA, Brindisi, Italy

10:30 - 11:00 **Air Quality Current Status in Europe**
Cristina Guerreiro, EEA Report Leader, NILU - Norwegian Institute for Air Research, Kjeller, Norway

11:00 - 11:30 Coffee Break

Session 2 - Environmental Informatics and AQ Sensors Calibration

11:30 - 13:00 *Chairperson: Michele Penza, Action Chair - ENEA, Brindisi, Italy*

11:30 - 12:00 **Air Quality Modelling at Different Scales**
Camillo Sillibello, WG Member, Project manager, ARIANET srl, Milan, Italy

12:00 - 12:20 **Challenges for Environmental Information Services Resulting from Sensors Integrated to Smartphones**
Kostas Karatzas, Aristotle University of Thessaloniki, Greece

12:20 - 12:40 **A New Approach for On-site Calibration and Calibrated Quantification of VOCs with Low-Cost Sensors**
Andreas Schuetze, Action WG2 Leader & MC Member, Saarland University, Saarbrücken, Germany

12:40 - 13:00 **Noise-Based Techniques for Gas Sensing**
Dionyz Pogany, Vienna University of Technology, Institute for Solid State Electronics, Vienna, Austria

13:00 - 14:30 Lunch Break

NOISE-BASED TECHNIQUES FOR GAS SENSING

D. Pogany

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Random fluctuations or noise determine sensitivity of different kind of sensors. In particular, in nano-devices, which are promising due to their high surface to volume ratio, the relative noise (e. g. standard deviation of current fluctuations to mean current) increases with reduction of device dimensions. This is because less and less carriers participate in transport and thus small imperfections or low number of active surface sites modulate the current tremendously. Fluctuations in carrier number and/or carrier mobility can be considered. Noise is usually considered as detrimental factor in sensors as it decreases signal to noise ratio [1-3]. However noise can be considered as information carrier in sensors [4] and this idea led to the development of general concept of fluctuation enhanced sensing (FES) which has been utilized in particular for gas and biological sensing [5-6]. It has been proposed that different gas species can be selectively detected thank to special spectral features in noise spectrum. This could lead to reduction of number of detecting elements in comparison to conventional electronic nose [7] concept which is based on DC or transient measurements in large array of detectors with different gas selectivity.

In frequency domain, the adsorption-desorption noise provides Lorentzian shape of power spectral density with a corner frequency determined by the time constant of adsorption-desorption process [8,9]. Lorentzian spectra attributed to adsorption-desorption noise have been measured in thin film [10-12] and graphene [13] sensors subjected to different gases and volatile species. If the relaxation/correlation time of fluctuations is broadly distributed, $1/f$ spectrum [14] can be observed [3,15].

In time domain, individual adsorption-desorption events result in discrete resistance switching which has been observed in graphene sheets subjected to different gas species [16]. Furthermore, higher order moment statistical analysis of fluctuations [6,17] and wavelet analysis of current waveforms [18] have also been used to find specific signatures of gases in gas sensors.

In this presentation, basics of noise, noise models and noise measurement techniques for FES will be first briefly introduced. Examples of noise studies in gas sensors, in particular FES via adsorption-desorption noise, will be shown. Finally a recent study of influence of air humidity on $1/f$ noise in CuO single nanowire gas sensors [15] will be presented. The observed rise in relative noise in humid atmosphere is attributed to increased surface potential fluctuations and related carrier scattering fluctuations due to random distribution of hydroxyl groups at the nanowire surface.

References:

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Oral Presentation

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