

Zakopane, Poland

13-16 December 2015

SGS 2015

IX International Workshop on Semiconductor Gas Sensors

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SGS 2015

Organized by

Silesian University of Technology
Institute of Electronics
European Center of Excellence CESIS
Gliwice, Poland

under auspices of:
Polish Vacuum Society





Centre of Excellence in Physics and Technology of Semiconductor Interfaces and Sensors

INTERNATIONAL SCIENTIFIC COMMITTEE

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Andreas SCHÜTZE - Saarland University, Saarbrücken, Germany

Kengo SHIMANOE - Kyushu University, Fukuoka, Japan

Yasuhiro SHIMIZU - Nagasaki University, Japan

Kasia ZAKRZEWSKA - AGH University of Science and Technology, Kraków, Poland

INVITED SPEAKERS

Mike ANDERSSON - Linköping University, Sweden

Jerome BRUNET - University B. Pascal, Clermont-Ferrand, Aubiere, France

Carlo CANTALINI - University of L'Aquila, Italy

Jyrki LAPPALAINEN - University of Oulu, Finland

Eduard LLOBET - University of Tarragona, Spain

Cesare MALAGU - University of Ferrara, Italy

Gemma GARCIA MANDAYO - University of Navarra, San Sebastian, Spain

Philippe MENINI - Paul Sabatier University, Toulouse, France

Joan R. MORANTE - University of Barcelona, Spain

Laurent PICHON - University of Rennes, France

Andrej PLECENIK - Comenius University Bratislava, Slovakia

J. Daniel PRADES - University of Barcelona, Spain

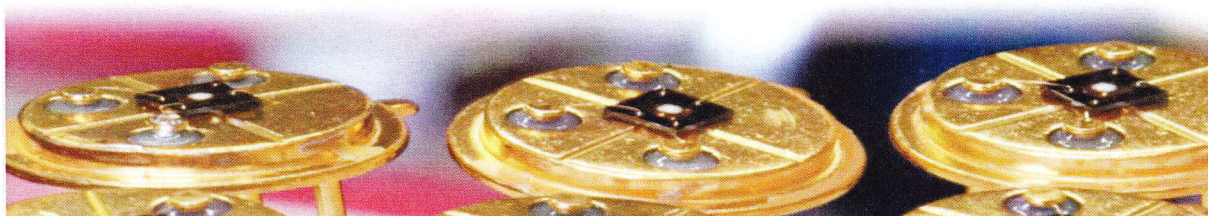
Marina N. RUMYANTSEVA - Moscow State University, Russia

Tilman SAUERWALD - Saarland University, Saarbrücken, Germany

Andris ŠUTKA - Institute of Silicate Materials, Riga Technical University, Latvia

Helena TETERYCZ - Wrocław University of Technology, Poland

Kasia ZAKRZEWSKA - AGH University of Science and Technology, Kraków, Poland



Sunday, 13 December 2015

	Arrival of Participants
18:00 - 20:00	Registration
18:00 - 22:00	Supper

Monday, 14 September 2012

07:00 - 09:00 Breakfast

Session I**Chairman: Eduard LLOBET**09:00 - 09:10 **Opening of the Workshop – Jacek SZUBER**, Silesian University of Technology, Poland09:10 - 09:40 **Huan LIU** - Huazhong University of Science and Technology, Wuhan, Hubei, China (Invited)
*Solution-processed semiconductor gas sensors: sensor fabrication and gas detection at room temperature*09:45 - 10:15 **Cristian FABREGA** - University of Barcelona, Spain (Invited)
*Nanomaterial integration for low power gas sensors*10:20 - 10:50 **J. Daniel PRADES** - University of Barcelona, Spain (Invited)
Low power gas sensors strategies

11:00 - 11:30 Coffee break

Session II: Trends in Semiconductor Gas Sensors**Chairman: Huan LIU**11:30 - 12:00 **Cesare MALAGU** - University of Ferrara, Italy (Invited)
*Non oxide semiconductors to reduce oxygen in and out-diffusion: characterizations and applications as gas sensors*12:05 - 12:35 **Carlo CANTALINI** - University of L'Aquila, Coppito, Italy (Invited)
*2D-layered metal dichalcogenide (TMDs) gas sensors*12:40 - 13:10 **Helena TETERYCZ** - Wroclaw University of Technology, Poland, (Invited)
Study of gas-sensing and catalytic properties of one-dimensional ZnO structures modified with gold nanoparticles

13:10 - 15:00 Lunch

Session III: Metal Oxides based Gas Sensors (A)**Chairman: J. Daniel PRADES**15:00 - 15:30 **Andris ŠUTKA** - Riga Technical University, Latvia (Invited)
*Complex metal oxide chemical gas sensors*15:35 - 16:05 **Eduard LLOBET** - University of Tarragona, Spain (Invited)
p-type MOX nanoparticles onto n-type MOX nanowires for selective gas sensing

16:10 - 16:30 Coffee break

Session IV: Metal Oxides based Gas Sensors (B)**Chairman: Kasia ZAKRZEWSKA**16:30 - 17:00 **Marina N. RUMYANTSEVA** - Moscow State University, Russia (Invited)
*Visible light activation of MOS gas sensitivity*17:05 - 17:35 **Jyrki LAPPALAINEN** - University of Oulu, Finland (Invited)
Tailored metal oxide nanoparticles, agglomerates, and nanotrees for gas sensor applications

17:40 - 18:00 Coffee break

Session V: Metal Oxides based Gas Sensors (C)**Chairman: Andrej PLECENIK**18:00 - 18:30 **Gemma GARCIA MANDAYO** - Ceit and Tecnun (University of Navarra), San Sebastian, Spain (Invited)
*Nanostructured conductometric sensors for the detection of low concentrations of gaseous pollutants*18:35 - 18:50 **Min Li** - Huazhong University of Sciences and Technology, Wuhan, Hubei, China (Oral)
Sensitive NO₂ gas sensors employing spray-coated colloidal quantum dots

20:00 - Welcome party

→ Champion Structures
Jens Knoblauch

Tuesday, 15 December 2015**07:00 - 09:00**

Breakfast

Session VI: Metal Oxides based Gas Sensors (D)**Chairman: Marina N. RUMYANTSEVA****09:00 - 09:30****Katarzyna ZAKRZEWSKA** - AGH University of Science and Technology, Krakow, Poland (Invited)
*Nano-TiO₂ gas sensors - steady state vs. dynamic mode of operation***09:35 - 10:05****Andrej PLECENIK** - Comenius University Bratislava, Slovakia (Invited)
*Titanium dioxide-based hydrogen gas sensors on the nanoscale***10:10 - 10:25****Sergio ROSSO** - University of Tarragona, Spain (Oral)
*Synthesis of single crystalline In₂O₃ octahedra for detecting oxidizing and reducing gases at trace levels***10:30 - 11:00**

Coffee break

Session VII: Metal Oxides based Gas Sensors (E)**Chairman: Mike ANDERSSON****11:00 - 11:30****Tilman SAUERWALD** - Saarland University, Saarbrücken, Germany (Invited)
*Model based improvement of temperature cycled operation of tin oxide gas sensors***11:35 - 11:50****Jens KNOBLAUCH** - Karlsruhe University of Applied Sciences, Germany (Oral)
*Thermally modulated noble metal decorated tin oxide based gas sensor arrays***11:55 - 12:10****Giulia ZONTA** - University of Ferrara, Italy (Oral)
*Chemoresistive gas sensors for colorectal adenomas screening through faecal analysis***13:00 - 15:00**

Lunch

Session VIII: Carbon and Organic Materials based Gas Sensors (A)**Chairman: Marcel BOUVET****15:00 - 15:30****Jerome BRUNET** - University B.Pascal, Clermont-Ferrand, Aubiere, France (Invited)
*Room-temperature detection of monocyclic hydrocarbons in air by metallophthalocyanines-based microsensors***15:35 - 15:50****Lucyna GRZĄDZIEL** - Silesian University of Technology, Gliwice, Poland (Oral)
*How environment affects gas sensor? Photoemission and thermal desorption spectroscopy inspection of morphology-related degradation processes in ambient air of CuPc sensing layers***15:55 - 16:15**

Coffee break

Session IX: Carbon and Organic Materials based Gas Sensors (B)**Chairman: Jerome BRUNET****16:15 - 16:45****Marcel BOUVET** - Université de Bourgogne Franche-Comté, Dijon, France (Invited)
*Conducting polymer-phthalocyanine hybrid materials, from solution processing to chemosensing***16:50 - 17:05****Amadou L. N'DYAYE** - Université B.Pascal Clermont-Ferrand, France (Oral)
*The used of organic semiconductors for the functionalization of carbon nanotubes: example of gas sensing application devoted to atmospheric pollutants***17:10 - 17:55**

Coffee break

18:00 - 19:00

POSTER SESSION

20:00

WORKSHOP DINNER

Wednesday, 16 December 2015**07:00 - 09:00**

Breakfast

Session X: Silicon and related Materials based Gas Sensors**Chairman: Jacek SZUBER****09:00 - 09:30****Mike ANDERSSON** - Linköping University, Sweden (Invited)
*SiC based field effect sensors - from basic understanding to tailoring of devices for high temperature applications***09:35 - 10:05****Philippe MENINI** - Paul Sabatier University, Toulouse, France (Invited)
*Micro and nanotechnology evolution towards vertical Si nanowires for ultrasensitive gas detection***10:05 - 10:20****Manuel BASTUCK** - Saarland University, Saarbrücken, Germany (Oral)
*Quantification of ppb-level volatile organic compounds***10:25 - 10:55****Laurent PICHON** - University of Rennes, France (Invited)
*Technologies and performances of silicon nanowires based sensors for ammonia detection***11:00 - 12:00**

Coffee break

12:00 - 14:00

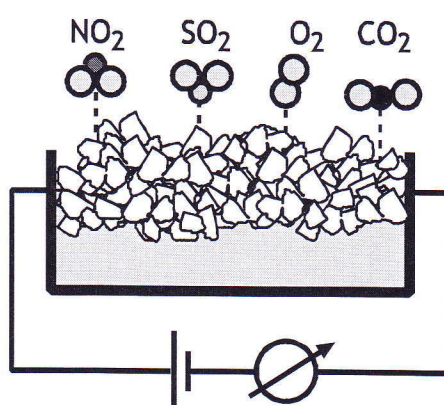
Lunch

14:00

Departure of Participants

ABSTRACTS OF INVITED LECTURES

(in alphabetical order of first author)



COMPLEX METAL OXIDE CHEMICAL GAS SENSORS

Andris Šutka

Riga Technical University, Latvia

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The demand for alternative gas sensor materials is increasing following the progress in the electronic industry. Complex ternary oxide materials have been emerging rapidly over 10 last years. Among ternary metal oxide compounds, the spinel ferrites are the most attractive materials due to structural and compositional versatility. This report will highlight the recent developments and will show the potential of the spinel ferrites on gas sensor technology. Sensing mechanisms for a range of gasses and humidity will be explained for n-type, p-type, mixed and substituted spinel ferrite gas sensors. The change in conduction mechanism will be discussed outlining electronic and chemical sensitization that both increase the gas response. This discussion surveys synthesis methods for producing spinel ferrites and discusses future prospects for further improvements.