



**COE
2020**

16th INTERNATIONAL CONFERENCE ON OPTICAL AND ELECTRONIC SENSORS

29.03–2.04.2020 Kraków, POLAND

<https://coe2020krakow.jordan.pl/>

PROGRAMME



• APTIV •



Dear Participants and Sponsors of COE'2020,

At the beginning of March, this opening address could have started as:

"It is my great pleasure to announce that the inauguration of the 16th International Conference on Electronic and Optical Sensors, COE'2020 will take place on the 29th of March at AGH-UST Kraków, Poland. On behalf of the organizers, i.e., the Scientific Committee, International Advisory Board, and Technical Committee, I would like to wish you an excellent stay in Kraków."

Now regretfully, I am forced to make the following statement:

The 16th International Conference on Optical and Electronic Sensors COE'2020 cannot take place as planned. Cancellation of this event is due to the force majeure, that is a pandemic caused by an uncontrolled development of COVID-19 over the territory of Poland and many other countries.

On behalf of the organizers of the COE'2020 conference, I would like to thank all its participants for contributing their works in a form of abstracts and express my opinion that thanks to the involvement of many scientific centres in the preparation of this conference, it would have had a chance of success. Let me express my profound gratitude to the members of the International Advisory Board as well as the Scientific and Honorary Committees for their personal engagement towards successful realization of this task. Despite unfavourable circumstances, we are still working, in order not to waste the huge scientific potential associated with COE'2020.

That is why we have decided to proceed with this booklet that was supposed to serve you as a guide to the conference program on the basis of which you could have arranged your personal plans for COE'2020.

The program, presented in this booklet, could not have been constructed without your valuable contribution. Thanks to the support of all participants of COE'2020, especially the Keynote Speakers, Invited and Regular Speakers, Poster Presenters, as well as the Sponsors, the conference seemed to offer quite a rich scientific content enclosed in the diverse sessions devoted to:

1. Chemical Sensors
2. Optical Sensors
3. Magnetic Sensors
4. Biosensors/Sensors for Medical Applications
5. Microsystems for Sensing
6. Sensors for Internet of Things, IoT

A need for creation of an additional session entitled "Emerging Issues" has appeared during submission of abstracts.

16th International Conference on Optical and Electronic Sensors COE'2020 has been organized at AGH-UST by Faculty of Computer Science, Electronics and Telecommunications, Faculty of Materials Science and Ceramics, and Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering.

The President of AGH-UST, JM Rector prof. dr hab. inż. Tadeusz Słomka has granted his honorary patronage and became Chair of the Honorary Committee of the conference.

COE conferences have a cyclic character, they are held every 2 years and have a long tradition dating back to 1990 when the first meeting was initiated by the sensor community in Poland under auspices of the Polish Sensor Society, PTTS. Since 2016, COE has reached a status of an international conference. Two past COE conferences were hosted by Gdansk University of Technology in 2016 and Warsaw University of Technology in 2018. Therefore, the chairmen of these conferences, professors Piotr Jasiński from Gdansk and Jerzy Weremczuk from Warsaw have kindly agreed to co-chair COE'2020 in Krakow.

The scope of the COE covers, in general, the most important issues: new sensor materials, nanosensors, nano- and micro-systems, including MEMS, MOEMS, RF MEMS, NEMS, sensor networks, biosensors and lab-on-chip devices, semiconducting and electrochemical gas sensors, optical and magnetic sensors, sensors of physical quantities, theory and modelling of sensing behaviour, application of sensors especially in medicine as well as emerging topics such as wearable electronics, the Internet of Things (IoT) and Internet of Energy (IoE). The invitation to participate in this event has been addressed to the members of the scientific community representing many disciplines in the hope that the conference would serve as a broad forum for the exchange of ideas and experiences.

This is the first time in the 30-years history of COE conferences that this carefully planned event will not be launched as scheduled. However, I hope that quite soon, in agreement between the AGH authorities and the Board of the Polish Society of Sensor Technology PTTS, we will decide on the future of the COE conference, both in terms of its date and the form.

Conference website at <http://coe2020krakow.jordan.pl/> will continue to deliver the most important information. Please refer to it in order to get the latest news about publication of the special issues dedicated to the conference contributions.

Best regards,

Professor Katarzyna Zakrzewska
Chair of the COE'2020 and PTTS Secretary

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SHORT PROGRAMME

MONDAY, 30.03.	09:00-09:45	Opening Ceremony (AGH – bldg. A-0)	
	09:45-10:30	Plenary Session 1	
	10:30-11:00	Coffee Break	
	11:00-12:30	Plenary Session 2	
	12:30-13:00	A0 –> D17	
	13:00-14:00	LUNCH	
	14:00-16:00	CHEMICAL SENSORS	MICROSYSTEMS for SENSING
	16:00-16:30	Coffee Break	
	16:30-17:00	MAGNETIC SENSORS and EMERGING ISSUES	SENSORS for IoT
	17:00-19:00	POSTER SESSION I	
	19:00-21:00	GENERAL ASSEMBLY of Polish Sensor Society (PTTS)	
TUESDAY, 31.03.	09:00-10:30	Plenary Session 3	
	10:30-11:00	Coffee Break	
	11:00-12:30	Plenary Session 4	
	12:30-13:30	LUNCH	
	13:30-16:00	CHEMICAL SENSORS	MAGNETIC SENSORS
	16:00-16:30	Coffee Break	
	17:00-19:00	Walking Tour around Old Town (optional)	
	19:00-21:00	CONFERENCE DINNER – SUKIENNIC	
WEDNESDAY, 1.04.	09:00-10:30	Plenary Session 5	
	10:30-11:00	Coffee Break	
	11:00-12:30	OPTICAL SENSORS	BIOSENSORS
	12:30-13:30	LUNCH	
	13:30-15:00	OPTICAL and CHEMICAL SENSORS	BIOSENSORS
	15:00-15:30	Coffee Break	
	15:30-17:00	SPONSOR SESSION	
	17:00-19:00	POSTER SESSION II	
THURSDAY, 2.04.	09:00-09:45	Plenary Session 6	
	09:45-10:30	SENSORS for IoT	EMERGING ISSUES and MICROSYSTEMS
	10:30-11:00	Coffee Break	
	11:00-12:00	SENSORS for IoT	EMERGING ISSUES and MICROSYSTEMS
	12:00-12:30	Closing Ceremony	
	12:30-13:30	LUNCH	

Sunday, 29th March

17:00-19:00	REGISTRATION (AGH – bldg. D-17)
19:00-21:00	Meeting of International Advisory Board (IAB) and Scientific Committee (S.C.) and Welcome Party

Monday, 30th March

09:00-09:30	Opening Ceremony (AGH – bldg. A-0)	
09:30-09:45	Ryszard JACHOWICZ – Short history of COE conferences over 30 last years	
09:45-10:30	Plenary Session 1 (Chair: Katarzyna Zakrzewska)	
	UDO WEIMAR – Role of surface p-n heterojunctions in the gas sensing with SMOX based devices – the example of SnO ₂ :Au, Pt and WO ₃ :Rh, Pd, Pt <i>Institute of Physical and Theoretical Chemistry, University of Tübingen, Germany</i>	
10:30-11:00	Coffee Break	
11:00-12:30	Plenary Session 2 (Chair: Jan Dziuban, Udo Weimar)	
11:00-11:45	BOGDAN STASZEWSKI – Quantum computing and sensing on a CMOS Chip <i>School of Electrical & Electronic Engineering, UCD Engineering & Materials Science Centre, University College Dublin, Ireland</i>	
11:45-12:30	LARS ÖSTERLUND – Hybrid solid state chemoresistive and fluctuation-enhanced gas sensors by Advanced Gas Deposition methods: exhaled breath and indoor air analysis <i>Div. Solid State Physics, Dept. Engineering Sciences, Uppsala University, Sweden</i>	
12:30-13:00	A-0 -> D-17	
13:00-14:00	LUNCH	
14:00-16:00	CHEMICAL SENSORS (Chair: Helena Teterycz and Paweł Gryboś)	MICROSYSTEMS for SENSING (Chair: Anna Górecka-Drzazga and Rupert Schreiner)
14:00-14:30	Inv. – Microelectronic processing in oxide-based sensors for biomedical and gas sensing applications <u>Michał BORYSIEWICZ</u> and J. Jankowska ¹ , M. Kwoka ² , J. Szuber ² , P. Struk ³ , E. Kamińska ¹ , A. Piotrowska ¹ and A. Szerling ¹ ¹ <i>ŁUKASIEWICZ Research Network – Institute of Electron Technology, Warsaw, Poland;</i> ² <i>Institute of Electronics, Silesian University of Technology, Poland;</i> ³ <i>Faculty of Electrical Engineering, Silesian University of Technology, Poland</i>	Inv. – Micromachined silicon-glass mirau micro-interferometers as key components for miniature MOEMS-based optical instruments <u>Sylwester BARGIEL</u> ¹ and F.-E. Garcia Ramirez ¹ , P. Struk ^{1,2} , Q. Tanguy ¹ , J. Albero ¹ , N. Passilly ¹ , O. Gaiffe ¹ , P. Lutz ¹ , J.-L. Skora ¹ , M. Wiemier ³ , W.-S. Wang ³ , J. Froemel ³ , C. Gorecki ¹ ¹ <i>Dep. MN2S, FEMTO-ST (UMR CNRS 6714), UBFC, Besançon, France;</i> ² <i>Silesian University of Technology, Gliwice, Poland;</i> ³ <i>Fraunhofer Institute for Electronic Nanosystems (ENAS), Chemnitz, Germany</i>

14:30-15:00	Inv. – 2D transition metal dichalcogenides materials for gas sensing application Fatima Ezahra ANNANOUCH <i>Universitat Rovira i Virgili, Spain</i>	Inv. – Ultra fast digital detection systems based on application specific integrated circuits of pixel architecture Piotr KMON <i>Department of Measurement and Electronics, AGH University of Science and Technology, Krakow, Poland.</i>
15:00-15:30	Inv. – Co-precipitation synthesis, characterization and high temperature H₂ sensing properties of Ni-doped TiO₂ <u>Roussin Lontio FOMEKONG^{a, b}</u> and B. Saruhan^a ^a<i>Department of High-Temperature and Functional Coatings, Institute of Materials Research, German Aerospace Center (DLR), Koeln, Germany;</i> ^b<i>Chemistry Department, University of Yaounde I, Yaoundé, Cameroon</i>	Inv. – MEMS Transmission Electron Microscope <u>Michał KRYSZTOF</u> and M. Białas, P. Szyszka, T. Grzebyk, K. Laszczyk, J. Dziuban, A. Górecka-Drzazga <i>Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>
15:30-15:45	Inv. – Development of potentiometric gas sensors – materials issues Paweł PASIERB <i>Department of Inorganic Chemistry at Faculty of Materials Science and Ceramics, AGH University of Science and Technology, Poland</i>	Reg. talk: Quantum sensing and optical quantum gates based on semiconductor photon enhanced entangled qubits P. Giouannlis^a, E. Blokhina^a, I. Bashir^b, E. Koskin^a, A. Sokolov^a, D. Leipold^b, and <u>R. Bogdan Staszewski^{a, b}</u> ^a<i>School of Electrical and Electronic Engineering, University College Dublin, Ireland;</i> ^b<i>Equal1. Labs, Fremont, USA</i>
15:45-16:00		Reg. talk: Quantum sensor array for ultra-high-resolution medical imaging G. Reza Nikandish, A. Zhu, <u>R. Bogdan Staszewski</u> <i>Department of Electrical and Electronics Engineering, University College Dublin, Ireland</i>
16:00-16:30	Coffee Break	
16:30-17:00	MAGNETIC SENSORS and EMERGING ISSUES <i>(Chair: Bogusław Cyganek)</i>	SENSORS for IoT <i>(Chair: Jarogniew Rykowski)</i>
16:30-16:45	Reg. talk: Magnetic sensors: from microwires to nanowires <u>Pavel Ripka</u>, V. Grim and M. Mirzaei <i>Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic</i>	Reg. talk: Evaluation of energy harvesting for IoT sensor nodes in surgical instrument lifecycle – industrial perspective <u>Mateusz Danio^{a, b}</u>, L. Böhler^{a, b}, A. Keller^b, R. Sroka^a ^a<i>Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering, AGH University of Science and Technology, Poland;</i> ^b<i>Aesculap AG, Tuttlingen, Germany</i>

16:45-17:00	Reg. talk: Printed strain sensors: opportunities and challenges involved in their applications to structural health monitoring of civil structures <u>Daniel Żymełka</u> and T. Kobayashi <i>National Institute of Advanced Industrial Science and Technology, Sensing System Research Center 1-2-1, Namiki, Tsukuba, Ibaraki, Japan</i>	Reg. talk: Elucidating the blind spots of the sterile good life-cycle: a technical approach L. Böhler^{a,b}, <u>Mateusz Danioł</u>^{a,b}, A. Keller^a, R. Sroka^b ^a<i>Aesculap AG, Tuttlingen, Germany;</i> ^b<i>AGH University of Science and Technology, Poland</i>
17:00-19:00	POSTER SESSION I (Chemical Sensors and Microsystems for Sensing) <i>(Chair: Grzegorz Pankanin, Paweł Pasierb)</i>	
19:00-21:00	GENERAL ASSEMBLY of Polish Sensor Society (PTTS)	

Tuesday, 31th March

09:00-11:00	Plenary Session 3 (Chair: Monika Kwoka, Jacek Szuber, Lars Österlund)	
09:00-09:45	ELISABETTA COMINI – Metal oxides and composites: applications in chemical sensing <i>SENSOR Laboratory, Dept. of Information Engineering (DII), University of Brescia, Italy</i>	
09:45-10:30	RUPERT SCHREINER – Miniaturized sensor and actuator elements based on the heat transport in gases or the ionization of gas particles <i>Faculty of Applied Natural Sciences and Cultural Studies, Ostbayerische Technische Hochschule Regensburg, Germany</i>	
10:30-11:00	Coffee Break	
11:00-12:30	Plenary Session 4 (Chair: Rafał Walczak, Bogdan Staszewski)	
11:00-11:45	SUSANA CARDOSO de FREITAS – Magnetoresistive sensors as a precision tool in biomedical instrumentation <i>INESC-MN and Instituto Superior Técnico, Universidade de Lisboa, Portugal</i>	
11:45-12:30	MARCO CARVALHO – Towards secure and resilient sensor orchestration for the Internet of Things <i>College of Engineering and Science, Harris Institute for Assured Information, Florida Institute of Technology, USA</i>	
12:30-13:30	LUNCH	
13:30-16:00	CHEMICAL SENSORS (Chair: Anna Cysewska-Sobusiak and Marco Carvalho)	MAGNETIC SENSORS (Chair: Piotr Wiśniowski and Susana Cardoso de Freitas)
13:30-14:00	Inv. – Active sensor structures with surface acoustic waves for chemical warfare agent simulant (DMMP) detection Wiesław JAKUBIK <i>Department of Applied Physics, Institute of Physics CSE (Centre of Science and Education), Silesian University of Technology, Gliwice, Poland</i>	Inv. – Ultra-sensitive magnetometer for space exploration Claire BARADUC <i>SPINTEC, Université Grenoble Alpes – CEA - CNRS, Grenoble, France</i>
14:00-14:30	Inv. – Stochastic and deterministic effect of UV radiation on printed metal-oxide electrodes Andrzej PEPEŁOWSKI, D. Janczak, M. Jakubowska <i>Institute of Metrology and Biomedical Engineering, Faculty of Mechatronics, Warsaw University of Technology, Poland</i>	Inv. – Electric current transducers based on magnetic sensors Pavel RIPKA <i>Czech Technical University in Prague</i>
14:30-15:00	Inv. – Surface engineering as a powerful tool to improve the mechanism of sensing Anna KUSIOR <i>Dept. of Inorganic Chemistry, Faculty of Mat. Science and Ceramics, AGH University of Science and Technology, Poland</i>	Inv. – Magnetic vortex state in XMR sensors for automotive application Hubert BRUECKL <i>Department for Integrated Sensor Systems, Danube University Krems, Wiener Neustadt, Austria</i>

15:00-15:30	Inv. – Towards handheld applications based on Silicon Photomultipliers Piotr DOROSZ <i>Department of Electronics, AGH University of Science and Technology, Poland</i>	Inv. – Magnetoresistive sensors for automotive applications: challenges and solutions Wolfgang RABERG <i>Infineon Technologies AG, ATV SC D TD BMT, Neubiberg, Germany</i>
15:30-15:45	Reg. talk: Influence of the presence of silver nanoparticles on zinc oxide microrods chlorine detection M. Fiedot-Toboła ^a , <u>Olga Rac-Rumijowska</u> ^b , H. Teterycz ^b ^a Łukasiewicz Research Network – PORT Polish Center for Technology Development, Wrocław, Poland; ^b Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland	Inv. – Application of optical atomic magnetometers in exotic incarnation of nuclear magnetic resonance Szymon PUSTELNY <i>Institute of Physics, Faculty of Physics, Astronomy and Applied Computer Science, Jagiellonian University, Poland</i>
15:45-16:00	Reg. talk: MEMS ionizers developed for chip-scale mass spectrometer <u>Piotr Szyszka</u> , T. Grzebyk, M. Krysztof, M. Białas, A. Górecka-Drzazga, J.A. Dziuban <i>Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>	
16:00-16:30	Coffee Break	
16:30-19:00	Walking Tour around Old Town (optional)	
19:00-21:00	CONFERENCE DINNER - SUKIENNIC	

Wednesday, 1st April

09:00-10:30	Plenary Session 5 (Chair: Piotr Jasiński, Elisabetta Comini)	
09:00-09:45	BILGE SARUHAN-BRINGS – Use of semiconducting Ti-based oxides for gas sensing applications <i>German Aerospace Center (DLR), Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) Institute of Materials Research Linder Hoehe, Cologne</i>	
09:45-10:30	EDUARD LLOBET – Metal oxide nano-heterostructures for gas sensing <i>MINOS-EMaS, Universitat Rovira i Virgili, Tarragona, Spain</i>	
10:30-11:00	Coffee Break	
11:00-12:30	OPTICAL SENSORS (Chair: Jerzy Weremczuk and Eduard Llobet)	BIOSENSORS (Chair: Piotr Augustyniak and Bilge Saruhan-Brings)
11:00-11:30	Inv. – UV-light modulated gas sensing Janusz M. SMULKO <i>Gdansk University of Technology, Faculty of Electronics, Telecommunications and Informatics Department of Metrology and Optoelectronics, Poland</i>	Inv. – Biofunctionalization of surface for biosensors and microanalytical systems Dorota G. PIJANOWSKA <i>Nalecz Institute of Biocybernetics and Biomedical Engineering Polish Academy of Sciences, Warsaw, Poland</i>
11:30-12:00	Inv. – Nanolayers – new possibilities in fiber-optic sensors Małgorzata SZCZERSKA <i>Department of Metrology and Optoelectronics of Gdansk University of Technology</i>	Inv. – Functional conductive nanocarbons and diamond thin films for ultra-sensitive biosensing applications Robert BOGDANOWICZ <i>Department of Metrology and Optoelectronics, Faculty of Electronics, Telecommunications and Informatics, Gdansk University of Technology, Poland</i>
12:00-12:30	Inv. – Functional optical materials for applications in new sensors constructions <u>Piotr MILUSKI</u> , M. Kochanowicz, J. Żmojda, A. Baranowska, D. Dorosz, J. Dorosz <i>Faculty of Electrical Engineering, Białystok University of Technology, Poland</i>	Inv. – Surface characterization to improve biomolecules immobilization in the aspect of biosensor applications Kamil AWSIUK <i>Jagiellonian University in Krakow, Poland</i>
12:30-13:30	LUNCH	
13:30-15:00	OPTICAL and CHEMICAL SENSORS (Chair: Janusz Smulko and Rafał Walczak)	BIOSENSORS (Chair: Robert Bogdanowicz and Tadeusz Pisarkiewicz)
13:30-14:00	Inv. – Towards multi-parameter sensing by means of geometrically and structurally modified fiber Bragg gratings Tomasz OSUCH <i>Warsaw University of Technology, Faculty of Electronics and Information Technology, Institute of Electronic Systems, Poland</i>	Inv. – Label-free selective bacteria detection in microwave frequency range Sławomir GRUSZCZYŃSKI <i>Department of Electronics, AGH University of Science and Technology, Poland</i>

14:00-14:15	Reg. talk: Segmentation of blood vessels in the images from vein viewer sensor for biometric identification <u>Aleksandra Królak</u>, Ł. Derlecki <i>Institute of Electronics, Lodz University of Technology, Poland</i>	Reg. talk: Microfluidic chip for cultivation of lymphocytes – a preliminary study <u>Wojciech Kubicki</u>, A. Sławek, D. Lorek, P. Sypek, P. Śniadek, A. Chełmońska-Soyta, J. A. Dziuban <i>Wrocław University of Science and Technology</i>
14:15-14:30	Reg. talk: Impedimetric sensors based on boron-doped diamond and boron-doped diamond/graphene nanowall electrodes for pathogen detection <u>Anna Dettlaff</u>^a, M. Kowalski^{a,b}, M. Brodowski^{a,b}, K. Dziąbowska^c, M. Ficek^a, K. Siuzdak^d, D. Nidzworski^{b,c}, R. Bogdanowicz^a ^a<i>Dept. of Metrology and Optoelectronics, Faculty of Electronics, Telecommunications and Informatics, Gdansk University of Technology, Poland;</i> ^b<i>Institute of Biotechnology and Molecular Medicine, Gdańsk, Poland;</i> ^c<i>SensDx Ltd, Warszawa, Poland;</i> ^d<i>The Szewalski Institute of Fluid-Flow Machinery, Gdańsk, Poland</i>	Reg. talk: Fast amplification and electrochemical detection of ssDNA tox gene fragment <u>Kasper Marchlewicz</u>, K. Żukowski, E. Jastrzębska, R. Ziółkowski, Z. Brzózka, E. Malinowska <i>The Chair of Medical Biotechnology, Faculty of Chemistry, Warsaw University of Technology, Poland</i>
14:30-14:45	Reg. talk: Dew point sensor temperature compensation method <u>Maksymilian Szczepanik</u>^{a,b}, R. Sroka^a, A. Miczyk^b ^a<i>Department of Measurement and Electronics, AGH University of Science and Technology, Poland;</i> ^b<i>STORK Instruments Sp. z o.o., Krakow, Poland</i>	Reg. talk: Can video plethysmography methods replace medical devices in vital signs monitoring? Jaromir Przybyło <i>Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering, AGH University of Science and Technology, Poland</i>
14:45-15:00	Reg. talk: Nanometric titanium dioxide as a gas sensor W. Maziarski^a, A. Kusior^b, M. Radecka^b, <u>Anita Trenczek-Zajac</u>^b ^a<i>AGH University of Science and Technology, Faculty of Computer Science, Electronics and Telecommunications, Krakow, Poland;</i> ^b<i>AGH University of Science and Technology, Faculty of Material Science and Ceramics, Krakow, Poland</i>	Reg. talk: Dry, 3D printed, carbon nanotubes coated electrodes for bio-potential signals measurements <u>Marek Stencel</u>¹, A. Benko², K. Pietryga² ¹<i>AGH University of Science and Technology, Department of Measurement and Electronics, Poland;</i> ²<i>AGH University of Science and Technology, Department of Biomaterials and Composites, Faculty of Materials Science and Ceramics, Poland</i>
15:00-15:30	Coffee Break	
15:30-17:00	SPONSOR SESSION (Chair: Artur Rydosz)	
	EVG – Harald Wiesbauer, Austria	
	OEM Automatics – Dawid Mieszkowski, Poland	
	VAKPOL – Paweł Winkowski, Poland	
17:00-19:00	APTIV – Poland	
	POSTER SESSION II (Optical and Magnetic Sensors, Biosensors, IoT, Emerging Issues) (Chair: Marta Radecka, Tomasz Osuch)	

Thursday, 2nd April

Plenary Session 6 (Chair: Dorota Pijanowska)		
09:00-09:45	MARCEL BOUVET – Molecular material - based heterojunctions as gas sensors <i>Institut de Chimie Moléculaire de l'Université de Bourgogne (ICMUB), UMR CNRS, Université Bourgogne Franche-Comté, France</i>	
09:45-12:30	SENSORS for IoT (Chair: Janusz Gajda and Aleksander Byrski)	EMERGING ISSUES and MICROSYSTEMS for SENSING (Chair: Leszek Golonka and Katarzyna Zakrzewska)
09:45-10:15	Inv. – RESTful services for BLE Mesh T. Chojnacki, <u>Jarogniew RYKOWSKI</u> <i>Department of Information Technology, University of Economics and Business, Poznań, Poland</i>	Inv. – Source localization and tracking with Spatospectral Masking using drone with an Attached Acoustic Sensor Array S. Woźniak, M. Fraś, M. Guzik, P. Walas and <u>Konrad KOWALCZYK</u> <i>AGH University of Science and Technology, Krakow, Poland</i>
10:15-10:30	Reg. talk: Lua-based hardware-software platform for dynamically reconfigurable IoT nodes J. Czapiga, R. Brzoza-Woch, <u>Tomasz Szydło</u> , A. Byrski <i>Department of Computer Science, AGH University of Science and Technology, Poland</i>	Reg. talk: MEMS based natural gas meter for home applications <u>Paweł Knapkiewicz</u> ^a , J. Dziuban ^a , K. Domański ^b , E. Cieślak ^c <i>^aDepartment of Microsystems, Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland; ^bŁukasiewicz Research Network - Institute of Electron Technology, Warszawa, Poland; ^cElektrometal S.A., Cieszyn, Poland</i>
10:30-11:00	Coffee Break	
11:00-11:15	Inv. – Tensor based signal processing of multi-dimensional sensor data Bogusław CYGANEK <i>Department of Electronics, AGH University of Science and Technology, Poland</i>	Reg. talk: Two-phase flow measurement using electrical capacitance tomography system EVT4 <u>Jacek Kryszyn</u> , D. Wanta, W. T. Smolik, P. Wróblewski, M. Midura <i>Warsaw University of Technology, Poland</i>
11:15-11:30		Reg. talk: New arrangement of a RFID grid for navigation of mobile robots <u>Marcin Hubacz</u> , B. Pawłowicz, B. Trybus <i>Rzeszow University of Technology, Poland</i>
11:30-11:45	Reg. talk: Energy efficient wireless network formation for sensors mounted on railway carriages Łukasz Krzak <i>Department of Electronics, Faculty of Computer Science, Electronics and Telecommunications, AGH University of Science and Technology, Poland</i>	Reg. talk: Lab-on-chip platform as a payload for bio-nanosatellite <u>Agnieszka Podwin</u> , A. Graja, P. Śniadek, J. Dziuban, R. Walczak <i>Department of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>

11:45-12:00		Reg. talk: Influence of water on the mechanical properties of 3D printed micro-beam working as force sensor K. Śliwa, <u>Bartosz Kawa</u> , R. Walczak <i>Wroclaw University of Science and Technology, Faculty of Microsystem Electronics and Photonics, Poland</i>
12:00-12:30	Closing Ceremony	
12:30-13:30	LUNCH	

Poster sessions I and II

CHEMICAL SENSORS	
P1-1	New insights into SnO₂-based nanomaterials sensing behavior K. Michalec, A. Kusior, M. Radecka <i>Faculty of Materials Science and Ceramics, AGH University of Science and Technology, Poland</i>
P1-2	Influence of deposition parameters on properties of coatings based on copper oxides for gas sensing application D. Wojcieszak ¹ , D. Kaczmarek ¹ , K. Zakrzewska ² , A. Obstarczyk ¹ , E. Mańkowska ¹ <i>¹Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland; ²AGH University of Science and Technology, Faculty of Computer Science, Electronics and Telecommunications, Poland</i>
P1-3	TiO₂ nanostructures modified by iron oxides for non-enzymatic immunosensors I. Karoń ¹ , M. Synowiec ² , A. Kusior ² , M. Radecka ² <i>¹Faculty of Mathematical and Natural Sciences, University of Applied Sciences in Tarnow; ²Faculty of Materials Science and Ceramics, AGH University of Science and Technology in Krakow, Poland</i>
P1-4	Study of dynamic changes of the impedance spectra in NO₂ sensing of TiO₂/SnO₂ nanomaterials B. Szafraniak, Ł. Fuśnik, K. Zakrzewska <i>Faculty of Computer Science, Electronics and Telecommunications, AGH University of Science and Technology, Poland</i>
P1-5	Investigation of response in NO₂ gas sensing of CuO thin-film heterostructures Ł. Fuśnik ¹ , B. Szafraniak ¹ , K. Zakrzewska ¹ , D. Wojcieszak ² , M. Mazur ² , D. Kaczmarek ² <i>¹Faculty of Computer Science, Electronics and Telecommunications, AGH University of Science and Technology, Poland; ²Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>
P1-6	The impact of oxygen content in the chamber on the sensor sensitivity for a specific wavelength diode D. Michor ¹ , D. Wojcieszak ² , M. Mazur ² , A. Brudnik ¹ , K. Zakrzewska ¹ <i>¹Department of Electronics, AGH University of Science and Technology, Poland; ²Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>
P1-7	Electronic nose based on electrochemical gas sensors applied to identification of multicomponent gas mixtures M. Dmitrzak ² , G. Jasiński ¹ , P. Jasiński ¹ <i>¹Faculty of Electronics, Telecommunications and Informatics, Gdańsk University of Technology, Poland; ²PM Ecology sp. z o.o., Poland</i>
P1-8	Sensor properties of Ga₂O₃ epitaxial layers R. Korbutowicz, H. Teterycz, O. Rac-Rumijowska <i>Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>
P1-9	Ga₂O₃/SnO₂ nanowires as sensor's structure R. Korbutowicz, A. Stafiniak, J. Prażmowska-Czajka, H. Teterycz, O. Rac-Rumijowska <i>Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>
P1-10	Synthesis and characterization of Ga₂O₃ nanowires for sensor applications R. Korbutowicz, A. Stafiniak, J. Prażmowska-Czajka, P. Suchorska-Woźniak, H. Teterycz <i>Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology, Poland</i>

P1-11	Optical sensor fabricated in combined technology T. Matusiak, P. Mańturzyk, A. Dąbrowski, L. Golonka <i>Wroclaw University of Science and Technology, Poland</i>
P1-12	Identification of damaged gas sensors and correction the output signal from an array for measurements of air pollutants P. Kalinowski, L. Woźniak, G. Jasiński, P. Jasiński <i>Department of Electronics, Telecommunications and Informatics, Gdansk University of Technology, Poland</i>
P1-13	Evaluation of gas sensor performance under temperature modulation L. Woźniak, P. Kalinowski, G. Jasiński, P. Jasiński <i>Department of Electronics, Telecommunications and Informatics, Gdansk University of Technology, Poland</i>
P1-14	Wearable pulse oximeter for swimming pool safety E. Kałamajska <i>Warsaw University of Technology, Institute of Electronic Systems, Poland</i>
P1-15	Studies of the interaction vanadium pentoxide with gas phase M. Dziubaniuk ¹ , K. Schneider ² , J. Wyrwa ¹ <i>¹Faculty of Materials Science and Ceramics, AGH University of Science and Technology, Poland; ²Faculty of Computer Science, Electronics and Communications, AGH University of Science and Technology, Poland</i>
P1-16	Sensing mechanism in semiconducting hybrid structures for DMMP detection P. Powroźnik, W. Jakubik, H. Aldahhak, W. G. Schmidt, U. Gerstmann, P. Pander, L. Grządziel, M. Krzywiecki <i>Institute of Physics - CSE, Silesian University of Technology, Gliwice, Poland</i>
P1-17	Automated test apparatus for resistive gas sensor characterization W. Andrysiewicz ² , A. Rydosz ¹ , G. Putynkowski ² , K. Marszałek ¹ <i>¹AGH University of Science and Technology; ²CBRTP Research and Development Center of Technology for Industry in Warsaw, Poland</i>
P1-18	Application of nanomaterials modified sensors in the determination of biologically active substances A. Górka, R. Piech, B. Paczosa-Bator, M. Łysoń, E. Wójcik <i>Faculty of Materials Science and Ceramics, AGH University of Science and Technology, Poland</i>
P1-19	Electrical capacity as significant parameter determining the performance of solid-contact ion-selective electrodes N. Lenar, B. Paczosa-Bator, R. Piech <i>Faculty of Material Science and Ceramics, AGH University of Science and Technology, Poland</i>
MICROSYSTEMS for SENSING	
P2-1	A single-axis accelerometer with differential capacitances made by inkjet printing technology G. Tarapata, J. Janczura, M. Marzęcki <i>Institute of Electronic Systems, Warsaw University of Technology, Poland</i>
P2-2	Electrospray MEMS ion source T. Grzebyk, M. Bigos, M. Białas, P. Szyszka <i>Wroclaw University of Science and Technology, Poland</i>
P2-3	SEM imaging via very thin Si₃N₄ M. Białas, M. Kryzstof, T. Grzebyk <i>Faculty of Microsystem Electronics and Photonics, Wroclaw University of Science and Technology, Poland</i>

P2-4	Thermoelectric properties of PEDOT:PSS-inorganic composite films M. Turkiewicz, A. Dziezic <i>Wroclaw University of Science and Technology, Poland</i>
P2-5	Miniaturized thermal conductivity sensor for wide range hydrogen gas detection D. Berndt, J. Muggli, F. Wittwer, C. Langer, S. Heinrich, T. Knittel, R. Schreiner <i>OTH Regensburg, Vitesco Technologies GmbH, Germany</i>
P2-6	A ceramic skeleton for a miniature analytical system B. Dziurdzia <i>AGH University of Science and Technology, Poland</i>
P2-7	Thermal and vacuum test stand for verification of bio-nanosatellite functionality A. Graja, P. Śniadek, A. Podwin, J. Dziuban <i>Wroclaw University of Science and Technology, Poland</i>
OPTICAL SENSORS	
P3-1	Measurement system of noise spectral density K. Achtenberg, J. Wojtas, Z. Bielecki <i>Institute of Optoelectronics, Military University of Technology, Warsaw, Poland</i>
P3-2	Analysis of the gasochromic effect in the mixed oxides thin films deposited by magnetron sputtering M. Mazur, J. Domaradzki, R. Pastuszek, A. Lubańska, P. Pokora <i>Faculty of Microsystem Electronics and Photonics, Wroclaw University of Science and Technology, Poland</i>
P3-3	Detection of palladium and chromium oxyanion by fluorescein based chemosensor A. Helal <i>King Fahd University of Petroleum and Minerals, Saudi Arabia</i>
P3-4	Coarse sun sensor for nanosatellites M. Gumiel, J. Weremczuk <i>Institute of Electronic Systems, The Faculty of Electronics and Information Technology, Warsaw University of Technology, Poland</i>
P3-5	New two-component luminescent sensory systems for monitoring thermodynamic parameters of systems M. Pilch ^a , J. Ortyl ^a , R. Popielarz ^a , A. Chachaj-Brekiesz ^b ^a <i>Faculty of Chemical Engineering and Technology, Cracow University of Technology, Poland</i> ^b <i>Faculty of Chemistry, Jagiellonian University, Krakow, Poland</i>
P3-6	The properties of ZnO nanostructures prepared with ALD support for potential application as gas sensors base material K. Leszczyńska ¹ , S. Grankowska-Ciechanowicz ¹ , G. Putynkowski ¹ , K. Gawlińska-Nęcek ² , P. Panek ² <i>1) Research and Development Center of Technology for Industry, Warsaw, Poland; 2) Institute of Metallurgy and Materials Science PAS, Krakow, Poland</i>
P3-7	The changes of photodetection properties of silicon solar cells modified by thin films of Al₂O₃+TiO₂ B. Swatowska ¹ , Z. Starowicz ² , P. Panek ² ¹ <i>Department of Electronics, AGH University of Science and Technology, Krakow, Poland;</i> ² <i>Institute of Metallurgy and Material Science PAS, Krakow, Poland</i>
P3-8	Interactions of optical fiber probes with proteins tuned by fluorescent nanodiamonds M. Ficek ¹ , M. Głowacki ¹ , A. Wojciechowski ² , W. Gawlik ² , M. Sawczak ³ , R. Bogdanowicz ¹ <i>Faculty of Electronics, Telecommunications and Informatics, Gdansk University of Technology, Poland;</i> ² <i>Institute of Physics, Jagiellonian University, Krakow, Poland;</i> ³ <i>The Szwalski Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdansk, Poland</i>

P3-9	pH sensing in chemical systems and comestible liquids using nitrogen-vacancy centers M.J. Glowacki, M. Sawczak, A. Wciśło, M. Ficek, R. Bogdanowicz <i>Department of Metrology and Optoelectronics, Faculty of Electronics, Telecommunications and Informatics, Gdansk University of Technology, Poland</i>
P3-10	Temperature dependent electrical properties of metallic contact / p-type InAsSb interface dedicated for infrared photodetectors J. Boguski, A. Kowalewski, K. Majkowycz, S. Złotnik, J. Wróbel <i>Institute of Applied Physics, Military University of Technology, Warsaw, Poland</i>
P3-11	Compact optical detector for simultaneous monitoring of absorbance and fluorescence in capillary scale liquid chromatography J. Šesták, J. Planeta, V. Kahle <i>Institute of Analytical Chemistry of the Czech Academy of Sciences, Brno, Czech Republic</i>
P3-12	The optimization of urea determination by non-enzymatic method in liver cell culture E. Remiszewska, K. Malecha, D. G. Pijanowska <i>Nalecz Institute of Biocybernetics and Biomedical Engineering PAS, Warsaw, Poland</i>
P3-13	Highly sensitive planar optical waveguide transducers based on grating couplers P. Karasiński, C. Tyszkiewicz <i>Silesian University of Technology, Department of Optoelectronics, Gliwice, Poland</i>
BIOSENSORS	
P4-1	Smart embedded systems for medical application M. Szymczyk P. Szymczyk <i>Department of Biocybernetics and Biomedical Engineering, AGH University of Science and Technology, Krakow, Poland</i>
P4-2	Electrochemical detection of glucose using non-enzymatic sensors based on copper sulfide hierarchically porous materials J. Mazurków, A. Mikuła, A. Kusior <i>AGH University of Science and Technology, Krakow, Poland</i>
P4-3	MEMS cytometers for oocyte deformation measurements A. Pokrzywnicka ¹ , P. Sniadek ¹ , N. Malyszka-Lukomska ² , R. Walczak ¹ ¹ <i>Faculty of Microsystem Electronics and Photonics, Wrocław University of Science and Technology Poland;</i> ² <i>Department of Genetics and Animal Breeding, Poznań University of Life Sciences, Poland</i>
P4-4	Multichannel pixel integrated circuit in CMOS 40 nm process for medical imaging P. Kmon, R. Szczygieł, R. Kłeczek D. Górni, G. Węgrzyn, A. Niedzielska, K. Sitko, P. Drwal <i>AGH University of Science and Technology, Krakow, Poland</i>
P4-5	Microfluidic dispenser fabricated of photoimageable bonding adhesive W. Kubicki <i>Department of Microsystems, Wrocław University of Science and Technology, Poland</i>
P4-6	A novel thiocyanate-selective sensor based on calix[4]arene derivative M. Urbanowicz, K. Sadowska, D. G. Pijanowska, R. Pomećko, M. Bocheńska <i>Nalecz Institute of Biocybernetics and Biomedical Engineering Polish Academy of Sciences, Warsaw, Poland</i>
MAGNETIC SENSORS	
P5-1	Microwave magnetic field sensor based on perpendicular magnetic tunnel junction with an inductive feedback loop W. Skowroński ^a , S. Ziętek ^a , J. Chęciński ^a , K. Yakushiji ^b ^a <i>Department of Electronics, AGH University of Science and Technology, Krakow, Poland;</i> ^b <i>National Institute of Advanced Industrial Science and Technology, Spintronics Research Center, Tsukuba, Ibaraki, Japan</i>

P5-2	1/f magnetic noise suppression by bias voltage polarity and strength in tunneling magnetoresistance sensors P. Wiśniowski ¹ , M. Nawrocki ¹ , S. Cardoso ² ¹ <i>Department of Electronics, AGH University of Science and Technology, Krakow, Poland;</i> ² <i>INESC-MN and IN- Institute of Nanoscience and Nanotechnology, Lisbon, Portugal</i>
SENSORS for INTERNET of THINGS IoT	
P6-1	Vibrational energy generator fabricated by inkjet 3D printing B. Kawa, K. Śliwa, V.C. Lee, R. Walczak <i>Wroclaw University of Science and Technology, Poland</i>
EMERGING ISSUES and APPLICATIONS	
P7-1	Influence of IMU mounting on inertial measurements of curling stone movement B. Dzikowski, J. Weremczuk <i>Institute of Eletronic Systems, Warsaw University of Technology</i>
P7-2	Design and on-orbit performance of low-cost, COTS-based total ionizing dose sensor for satellites G. Gajoch, M. Gumieła <i>Department of Electronics, AGH University of Science and Technology, Krakow, Poland</i>
P7-3	The novel approach to build three-dimension supercapacitor using the suspensions and 3D printing technique P. Śliwiński, B. Kawa, K. Laszczyk <i>Wroclaw University of Science and Technology, Poland</i>
P7-4	Graphite-glass composite for the screen-printed film electron source K. Laszczyk, T. Matusiak <i>Wroclaw University of Science and Technology, Poland</i>
P7-5	Organic and inorganic layers combined for effective light emitting diodes K. Dyndał ¹ , K. Tkacz-Śmiech ² ¹ <i>AGH University of Science and Technology, Faculty of Computer Science, Electronics and Telecommunications, Krakow, Poland;</i> ² <i>AGH University of Science and Technology, Faculty Materials Science and Ceramics, Krakow, Poland</i>

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