45th Winter School on Wave and Quantum Acoustics

PROGRAMME and ABSTRACTS

Organizers of WSWQA 2016

Upper Silesian Division of the Polish Acoustical Society

in cooperation with the

Committee of Acoustics of the Polish Academy of Sciences

29th February to 3rd March 2016,
Hotel "META"
Szczyrk - Beskidy Mountains, POLAND

http://ogpta.pl

Dear Participants

of 45th WINTER SCHOOL on WAVE and QUANTUM ACOUSTICS 2016

Organizers welcome All of You very cordially in Szczyrk, in the beautiful scenery of the Beskidy Mountains.

The 45th Winter School consists of:

- 12th Workshop on Acoustoelectronics;
- 12th Workshop on Molecular Acoustics, Relaxation and Calorimetric Methods.

We wish all Participants of the 45th Winter School plenty of scientific satisfactions and many professional and social impressions.

Organizers

This book contains Programmes of both Workshops and summaries of works which will be presented within 45th WINTER SCHOOL on WAVE and QUANTUM ACOUSTICS 2016.

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Wave and Quantum Acoustics

12th Winter Workshop on Acoustoelectronics (AE)

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CONFERENCE PROGRAMME

29.02.2016 Monday	
13:00	Dinner
14:15	**OPENING CEREMONY of the 11th IOS'2016 and 45th WSW&QA Conferences**
14:30-15:50	**Common Session**
14:30-14:50	**THE SESSION DEDICATED TO THE MEMORY OF PROFESSOR JERZY KAPELEWSKI** T. PUSTELNY
14:50-15:10	**Electromagnetic Interference shielding vs surface modifications – the review** M. SZAFRAŃSKI, A. KAWALEC, A. DUKATA, M. OKOŃ-FĄFARA
15:10-15:30	**Analytical model of the acoustically loaded sandwich transducer** P. KOGUT, A. MILEWSKI, W. KARDYŚ, P. KLUK
15:30-15:50	**Surface Acoustic Waves in applications of semiconductor investigations** T. PUSTELNY, B. PUSTELNY
15:50-16:30	Coffee break
16:30-17:00	*Invited lecture* **Application of Microelectronics in High Energy Physics & Space Technology** W. CICHALEWSKI, M. JANKOWSKI, D. MAKOWSKI, M. ORLIKOWSKI, A. NAPIERALSKI
17:00-17:20	*Invited lecture* **Spectral properties of photonic crystal fibers infiltrated with nematic liquid crystals doped with metallic nanoparticles** T. WOLIŃSKI, A. SIARKOWSKA, M. CHYCHŁOWSKI, A. DYBKO
17:20-17:40	**Detection of the trace amounts of selected gas pollutants using cavity enhanced spectroscopy** J. WOJTAS, Z. BIELECKI, M. NOWAKOWSKI, J. MIKOŁAJCZYK, D. SZABRA, B. ZAKRZEWSKA, A. PROKOPIUK
17:40:17:55	**Novel comb polymers as a photonics and electronics sensing materials** E. MACIAK, M. PROCEK, A. STOLARCZYK, T. PUSTELNY
17:55-18:10	**Reliability of high temperature fiber optic sensors** T.STAŃCZYK, D. BUDNICKI, K. WYSOKIŃSKI, J. FIDELUS, A. KOŁAKOWSKA, M. KUKLIŃSKA, T. TENDERENDA, T. NASIŁOWSKI
18:10	Supper
20:00	**Theatrical performance**

01.03.2015 Tuesday	
13:00	Dinner
14:30-15:00	*Plenary lecture* **Polish optical atomic clock** W. GAWLIK
15:00-15:20	**Optical fibre technology as a creator of economy development** T. NASIŁOWSKI
15:20-15:35	**Multicore optical fibers for telecommunications and sensors** M. NAPIERALA, A. ZIOLOWICZ, Ł. SZOSTKIEWICZ, A. PYTEL, M. FILIPOWICZ, D. BUDNICKI, A. KOŁAKOWSKA, T. STANCZYK, T. TENDERENDA, B. BIEŃKOWSKA, Ł. OSTROWSKI, M. MURAWSKI, M. MAKARA, K. POTURAJ, G. WOJCIK, P. MERGO, T. NASILOWSKI
15:35-15:50	**A „colorful" polymers** P. MERGO, R. ŁYSZCZEK, M. GIL, L. CZYŻEWSKA, J. PĘDZISZ, A. JUSZA, R. PIRAMIDOWICZ
15:50-16:05	**Fiber optic displacement sensor with signal analysis in spectral domain** K. KARPIENKO, M. MARZEJON
16:05-16:30	Coffee break
16:30-16:50	**Research and modeling of mechanical crosstalk in linear arrays of ultrasonic transducers** M. CELMER, K. J. OPIELIŃSKI
16:50-17:10	**The assessment of parameters of the selected ultrasonic medical devices and their conformity with the standards of the International Electrotechnical Commission (IEC)** T. GUDRA, A. ROSIAK
17:10-17:30	**Deposition of polymer sensor films on SAW surface by electrospraying technology** M. GRABKA, S. NEFFE, K. JASEK, M. PASTERNAK
17:30-17:50	**Numerical analysis of non-steady stage in recovery step of the response of SAW to toxic gas** T. HEJCZYK, B. WSZOŁEK, W. JAKUBIK
19:30	**Festive Supper (Banquet)**

02.03.2016 Wednesday	
13:00	Dinner
14:30-14:50	**Acoustic Emission as nondestructive testing method** A. OLSZEWSKA, F. WITOS
14:50-15:10	**Analysis of the properties of acoustic emission signals generated in the pressure vessel during the hydraulic test** F. WITOS, Z. OPILSKI, A. OLSZEWSKA, M. SETKIEWICZ
15:10-15:30	**Evaluation of the technical condition of the active part of the high power transformer based on measurements and analyzing of vibroacoustics signals** S. BORUCKI, A. CICHOŃ, H. MAJCHRZAK, D. ZMARZŁY
15:30-15:50	**The computer measuring system for registration of acoustic emission signals and location of acoustic emission sources within oil power transformers** G. SZERSZEŃ, F. WITOS, Z. OPILSKI, M. SETKIEWICZ
15:50-16:30	Coffee break
16:30-16:50	**Prezentacja firmy Svantec**
16:50-17:10	**Prezentacja firmy EC Test Systems**
17:10-17:30	**Prezentacja firmy Bruel & Kjaer Polska**
17:30-17:50	**Prezentacja firmy Systemy Pomiarowe**
	Closing Ceremony of Workshop on Acoustoelectronics 2016
18:00-20:00	**Poster Session**
18:30	Supper

03.03.2016 Thursday	
8:00	Breakfast

POSTER SESSION

Application of the Acoustic Emission Method in On-Load Tap Changer Diagnosis

A. CICHOŃ, S. BORUCKI, H. MAJCHRZAK

Study on descriptors of acoustic emission signals generated by partial discharges under laboratory conditions and in on-site electrical power transformer

M. KUNICKI, A. CICHOŃ, S. BORUCKI

Comparison of low frequency signals emitted by wind turbines of two different generator types

T. MALEC, T. BOCZAR, D. WOTZKA, P. FRĄCZ

ABSTRACTS

BORUCKI Sebastian, CICHOŃ Andrzej, MAJCHRZAK Henryk, ZMARZŁY Dariusz

Institute of Electrical Power and Renewable Energy, Opole University of Technology, Prószkowska 76, 45-758 Opole, Poland

Evaluation of the technical condition of the active part of the high power transformer based on measurements and analyzing of vibroacoustics signals

The subject of article refers to the results of research related to the development and industrial use of vibroacoustic methods for the assessment of the technical condition of the active part of transformers. The article presents results the analysis of the mechanical vibrations of the transformer high power, for which on the basis of chromatographic oil has been identified defect parts active. In order to confirm damage to the transformer active part vibroacoustic measurements were taken in three states work. Measurement using the classical vibroacoustic method include the registration of vibration in the idle state and the load operating of the transformer. During the measurements also used an author's diagnostic method, so called modified vibroacoustic method, which relies on the measurement and analysis of vibration of the transformer at the time of switching. The analysis shows that for the generation of elevated levels of mechanical vibration diagnosis transformer responds the magnetic circuit and the part of the windings vibration, caused by the current passing through it, is relatively insignificant. The presence of a narrow frequency band in the structure of vibroacoustic signal registered at the start-up of the transformer and the first few seconds of his unknown work, as well as a significant increase in the value of the components of band 5 - 1000 Hz for t> 4 seconds, can attest to the gradual loss of the rigidity of the mechanical structure of its core.

CELMER Mateusz, OPIELIŃSKI Krzysztof J.

Faculty of Electronics, Wroclaw University of Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wroclaw, Poland

Research and modeling of mechanical crosstalk in linear arrays of ultrasonic transducers

Linear arrays of ultrasonic transducers are commonly used as ultrasonic heads in medical diagnostics ultrasonography for imaging the interior of a human body in vivo. The crosstalk phenomenon occurs during the operation of transducers in which electrical voltages and mechanical vibrations are transmitted to adjacent components. As a result of such additional excitation of the transducers in the array, the directivity characteristics of the aperture used changes, and consequently there is interference with proper operation of a given array and the emergence of distortions in the reconstructed ultrasound image that reduce its quality. This paper studies the manner of propagation of mechanical crosstalk in a linear array of ultrasonic transducers on the basis of the recorded mechanical crosstalk, which appeared on elementary piezoelectric transducers when power is supplied to the selected transducer in the array. The paper includes a proposition of the model of a linear array of ultrasonic transducers and a simulation using finite element method (FEM) in order to confirm the results of the research.

CICHALEWSKI Wojciech, JANKOWSKI Mariusz, MAKOWSKI Dariusz, ORLIKOWSKI Mariusz, NAPIERALSK Andrzej

Department of Microelectronics and Computer Science, Lodz University of Technology, Wolczanska 221/223, 90-024, Lodz, Poland

Application of Microelectronics in High Energy Physics & Space Technology

The paper presents achievements of TUL DMCS electronic design team, related to circuitry designed for operation in tough environments and for control of extreme environments. TUL DMCS has participated and participates in design of electronic circuitry for High energy physics projects. One set of projects results from cooperation with Deutsches Elektronen-Synchrotron (DESY) in Hamburg [1]. This cooperation resulted in design of electronic control systems for several accelerators like European X-ray Free Electron Laser (XFEL) accelerator, for example. Another large entertainment is International Thermonuclear Experimental Reactor (ITER) [2]. This long-term project aims at building experimental thermonuclear fusion reactor based on tokamak concept, first in the world to produce net energy. ITER Members are China, the European Union, India, Japan, Korea, Russia and the United States (35 counties in

Apart from large scale projects, also smaller designs related to high energy physics are carried out in TUL DMCS. For example, a specialized design of digital register, intentionally designed to be susceptible to particle hits. The circuit was fabricated with use of only available Polish technology line in Piaseczno.

Microelectronic designs of small complication scale are now followed by project of DC/DC converter for space applications. This project is realized in cooperation with Astri Polska Company and Center of Space Research of Polish Academy of Sciences and is funded by European Space Agency.

This project is the first of its kind in Poland. It is focused on design and full space qualification of the designed ASIC, so the outcome is intended to be fully mature product applicable for wide range of applications in which electronics are exposed to thermal and radiative influences.

The circuit under design is expected to be applicable in both carriers/rockets (short term missions) and satellites (long term missions with no possibility of maintenance). Market for space grade DC/DC converters may be considered limited, so other applications are possible, like military equipment, for example.

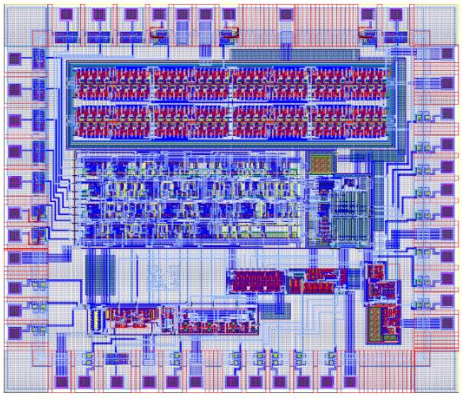

Fig. 1 Layout of an ASIC circuit containing a register optimized for detecting particle hits (upper part)

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CICHOŃ Andrzej, BORUCKI Sebastian, MAJCHRZAK Henryk

Faculty of Electrical Engineering, Automatic Control and Computer Science, Opole University of Technology, Prószkowska 76, 45-758 Opole, Poland

Application of the Acoustic Emission Method in On-Load Tap Changer Diagnosis

This paper provides example of application of the acoustic emission (AE) method for diagnosis of technical condition of three-phase on-load tap-changer (OLTC) of GIII type. Measurements were performed for a population of 10 items of OLTCs, installed in power transformers with a capacity of 250 MVA. The study was conducted in two OLTC operating conditions: during the tapping process under load and free running conditions. The analysis of measurement results is presented in time domain and time - frequency. Description of AE signals generated by the OLTC in the time domain was performed using analysis of waveforms and determined characteristic times. Within time-frequency domain, measured signals were described by spectrograms for power density spectra by use of short-time Fourier transform.

GRABKA Michał[1], NEFFE Sławomir[1], JASEK Krzysztof[1], PASTERNAK Mateusz[2]

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Deposition of polymer sensor films on SAW surface by electrospraying technology

One of the most important problem in the surface acoustic wave (SAW) sensors technology is deposition of chemosensitive films having appropriate sorptive properties and morphology characterised by homogeneity, adhesion and durability high enough. Very promising method of film deposition in this case seems to be electrospraying technology. It allows to obtain the chemosensitive layers of almost any chemicals and its mixtures in a controllable way. The control of the process parameters gives a possibility to deposit the specific films having properties unattainable by other methods.

In the paper the results of experiments with electrospraying in order to obtain of nafion film with platinum catalyst is described. In their framework the influence of the process parameters on film morphology and sensitivity have been studied.

GUDRA Tadeusz, ROSIAK Agata

Faculty of Electronics, Wroclaw University of Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland

The assessment of parameters of the selected ultrasonic medical devices and their conformity with the standards of the International Electrotechnical Commission (IEC)

The paper presents the problem of compliance with international standards for ultrasonic medical diagnostic and therapeutic devices. The assessment of compliance of parameters of such devices has been carried out in relation to three standards: IEC 61157, IEC 61161, and IEC 61391. In particular, technical data contained in the documentation of four ultrasound devices used in medical diagnostics and five devices used in ultrasound therapy were analyzed. Data from the technical sheets of devices have been compared with the requirements of these standards, pointing out the lack of some important data in the cards of individual devices. It is especially disturbing that the manufacturers do not provide a lot of important data on the equipment used in ultrasound therapy and even the lack of specific technical sheets, which in practice makes it impossible to refer to the applicable IEC standards. The lack of a lot of information may result in exceeding the safe limit of ultrasound intensity that can cause damage to certain tissues in the body of a patient.

HEJCZYK Tomasz[1], WSZOŁEK Bartłomiej[1], JAKUBIK Wiesław[2]

[1]ENTE Sp z o.o., Gaudiego 7, 44-100 Gliwice, Poland
[2]Institute of Physics SUT, Konarskiego 22B, 44-100 Gliwice, Poland

Numerical analysis of non-steady stage in recovery step of the response of SAW to toxic gas

The paper presents the results of numerical analyses of the SAW gas sensor in the steady and non-steady state. The effect of SAW velocity changes vs. the surface electrical conductivity of the sensing layer is predicted. The conductivity of the porous sensing layer above the piezoelectric waveguide depends on the profile of the diffused gas molecule concentration inside the layer. Knudsen's model of gas diffusion was used.

Numerical results for the gas CH4 for layers: WO3, TiO2, NiO, SnO2 in the steady state and CH4 in the non-steady state in recovery step in the WO3 sensing layer have been shown. The main aim of the investigations was to study thin film interaction with target gases in the SAW sensor configuration based on simple reaction-diffusion equation.

The results of numerical analyzes allow to select the sensor design conditions, including the morphology of the sensor layer, its thickness, operating temperature and layer type. The numerical results basing on the code written in Python, are described and analyzed. The theoretical results were verified and confirmed experimentally.

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Fiber optic displacement sensor with signal analysis in spectral domain

Optical fiber sensors are often used for measurements of various physical quantities, such as temperature or strain, especially in the applications where their small size, all-dielectric construction of the sensing part or immunity to electromagnetic interference (EMI) are needed. In some instances, the transducer has to be placed remotely from the source and the detection setup, with the length of lead-in and lead-out fibers reaching several hundred meters. With increasing length of these fibers the changes in their attenuation, induced by environmental factors, such as vibrations, adversely affect the operation of these sensors. While accuracy of most fiber optic sensors, especially intensity-modulated ones, is degraded by changes in attenuation of lead-in and lead-out fibers, a few classes of fiber optic sensors are immune to attenuation changes. These include sensors in which the measurand changes phase, fluorescence lifetime, or optical spectrum. An important class of sensors using changes in optical spectrum are low-coherence optical fiber sensors. They are used, among others, for the measurement of the refractive index dispersion, temperature or displacement [1, 2].

In this paper, a preliminary study of a low-coherence fiber optic displacement sensor is presented. The sensor consisted of a broadband source whose central wavelength was either at 1310 nm or 1550 nm, a sensing Fabry-Pérot interferometer operating in reflective mode and an optical spectrum analyzer acting as the detection setup. All these components were connected by a single-mode fiber coupler. Metrological parameters of the sensor were investigated for different lengths of the fiber connecting the sensing Fabry-Pérot interferometer (1 m, 10 m and 1000 m). For each length of the fiber, displacement in the range of 0 μm to 500 μm, in increments of 50 μm were measured. Representative measurement results of displacement of 200 μm are shown in Fig. 1.

Obtained results indicate that the developed sensor is not sensitive to changes in attenuation in the optical path, thus enabling remote measurement of the displacement on long distances while maintaining a satisfactory accuracy.

Acknowledgements

This study was partially supported by the National Science Centre under the grant No. 2011/03/D/ST7/03540, as well as DS Programs of the Department of Metrology and Optoelectronics, Faculty of Electronics, Telecommunications and Informatics of the Gdańsk University of Technology.

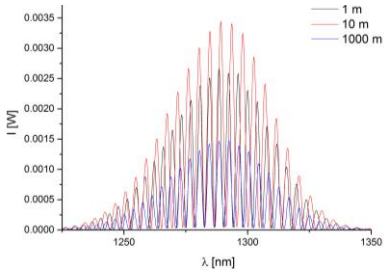

Fig. 1. Representative measurement results of displacement of 200 μm. Central wavelength was 1310 nm

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KOGUT Paweł, MILEWSKI Andrzej, KARDYŚ Witold, KLUK Piotr

Tele and Radio Research Institute, Ratuszowa 11, 03-450, Warsaw, Poland

Analytical model of the acoustically loaded sandwich transducer

Ultrasonic transducers used in a high power applications such as ultrasonic welding or cleaning systems are mostly constructed as a piezoelectric stack systems known as sandwich transducers. Explicit formulation of the sandwich transducer parameters is well known and documented but only in reference to unloaded conditions and in parallel resonance working regime only. To overcome those difficulties many authors have been using lumped models such as Mason model or T-network model of the acoustic transmission lines as well as the finite element modeling. This approach takes time and obviously is less transparent than explicit formulation of the basic transducer parameters. This article provide an extent to the existing explicit formulations of the sandwich transducer parameters such as resonant frequencies, electromechanical coupling factor, mechanical amplitude gain factor and power gain factor. Authors derived explicit relations for those parameters taking into consideration acoustic loading conditions and both series and parallel resonant frequencies working regime. Designated formulas can be use to optimize transducer geometry dimensions such as piezoceramic stack length and position in order to maximize the transducer acoustic power capabilities under certain acoustic loading medium. Obtained results have shown that acoustic loading and resonant frequency working regime have strong influence on the transducer parameters.

KUNICKI Michał, CICHOŃ Andrzej, BORUCKI Sebastian

Faculty of Electrical Engineering, Automatic Control and Computer Science, Opole University of Technology, Prószkowska 76, 45-758 Opole, Poland

Study on descriptors of acoustic emission signals generated by partial discharges under laboratory conditions and in on-site electrical power transformer

An acoustic emission method (AE) is widespread and often applied for partial discharge (PD) diagnostics, mainly due to its ease of application as well as noninvasiveness and relatively high sensitivity. This paper presents comparative analysis of AE signals measurement results archived under laboratory conditions as well as on-site actual AE signals generated by inside PDs in electrical power transformer during its normal service.

Three different PD model sources are applied for laboratory research: point to point, multipoint to plate and surface type. A typical measuring set up commonly used for on-site transformer PD diagnostics is provided for the laboratory tasks: piezoelectric joint transducer, preamplifier, amplifier and measuring PC interface. During the on-site research there are three measuring tracks applied simultaneously. Time domain, time-frequency domain and statistical tools are used for registered AE signals analysis. A number of descriptors are proposed as a result of the analysis.

In the paper, attempt of AE signals descriptors, archived under laboratory condition application possibilities for on-site PD diagnostics of power transformers during normal service is made.

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Novel comb polymers as a photonics and electronics sensing materials

Sensors based on semiconductor oxides are generally low in cost and show high stability [1]. At present market offers sensors enabling measuring and detection NO2 in relative high temperatures and concentration in ppm levels [1]. It is related with using semiconductor oxides as receptors because for them chemisorption takes place at relatively high temperatures (hundreds of Celsius degree), and it is important in context sensors power consumption. Therefore, it would be necessary to develop and fabrication practical, small, and low-cost sensor devices that can detect low gas concentrations. This leads to search new materials, provides considerable growing up sensitivity, speed and accuracy of measure, thus, in consequence safety. Gas sensors based on organic receptor as like phthalocyanines (Pc) or conducting polymer layers (including poly(3-hexylotiophene) - P3HT) become increasingly popular [2-5].

Grafting, in our case, involve reaction of functional groups (Pc or P3HT and PEG) located at chain ends of one kind of polymer with another functional groups which distributed randomly on the main chain of the poly(metyl-hydro-siloxane) (PMHS) polymer backbone. This work presents an investigation on novel graft comb copolymer of polymethylsiloxane (PMS) with phthalocyanine (Pc) side group and polymethylsiloxane (PMS) with poly(3-hexylotiophene) (P3HT) and poly(ethylene) glycol (PEG) as functional side groups. Those segmented copolymers were investigated as gas sensing materials. Gas sensing, optical and electrical properties of thin films of graft polymers are tested and compared. Thin films of investigated materials obtained by spin coating method on interdigital transducers and surface plasmon resonance (SPR) sensor structure are characterized using AFM method and Raman spectroscopy.

Chemosensors obtained by spin coating of comb copolymer-based films reveal good sensing characteristics and general good stability. In addition, it is worth noting that it has been demonstrated that the simple and low cost of the sensor fabrication technique provide to development in the field of novel sensing material.

Acknowledgements

Syntheses of graft combcopolymer material was performed with the support from the Foundation for Polish Science grant POMOST 2011-3/8. This work is partially financed by the Polish National Science Centre (NCN) within Grant no. 2012/ 07/B/ST7/01 471.

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MALEC Tomasz, BOCZAR Tomasz, WOTZKA Daria, FRĄCZ Paweł

Institute of Electric Power and Renewable Technologies, Opole University of Technology, Prószkowska 76, 45-758 Opole, Poland

Comparison of low frequency signals emitted by wind turbines of two different generator types

Paper present results of comparative analysis of infrasound noise generated by wind turbines of two types: asynchronous type REPOWER MM92 with power equal to 2 MW and synchronous type Vensys 62 with power equal to 1.2 MW. Frequency spectra of sound pressure levels generated during operation by both turbines for exemplary chosen wind speed values are depicted. Within the shown spectra the resonant frequencies have been indicated, for which sound pressure variations over time are shown. Based on the achieved frequency spectra it was stated that in general the asynchronous type turbine produces lower pressure levels, which are less stable over time, and indicates higher pressure values around the resonant frequencies as compared to the synchronous type turbine. Also it was stated that the asynchronous type turbine is more influenced by the wind conditions and generates higher pressure values by higher wind speeds then the synchronous type turbine.

NAPIERALA Marek[1], ZIOLOWICZ Anna[1,3], SZOSTKIEWICZ Lukasz[2], PYTEL Anna[1,3], FILIPOWICZ Marta[1], BUDNICKI Dawid[1], Agnieszka KOŁAKOWSKA Agnieszka[1], STANCZYK Tomasz[1], TENDERENDA Tadeusz[1], BIEŃKOWSKA Beata[2], OSTROWSKI Lukasz[2], MURAWSKI Michal[2], MAKARA Mariusz[1], POTURAJ Krzysztof[4], WOJCIK Grzegorz[4], MERGO Pawel[4], NASILOWSKI Tomasz[1]

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Multicore optical fibers for telecommunications and sensors

There are several challenges in terms of multicore fiber (MCF) design, which are different from the point of view of final application of MCFs: whether they are intended for the use in telecommunications [1] or for sensing applications [2]. In telecommunications, MCFs are used to increase the link capacity, so fiber designs are mainly oriented on assuring low core-to-core crosstalk (XT), since each core is treated as independent transmission channel. When one wants to combine MCF with mode division multiplexing (MDM), there is a need to take into account additional aspect of crosstalk which can occur between modes, which play in this case a role of the transmission channels. On the other hand the core-to-core power transfer may be considered as a beneficial effect in other applications, such as sensors. To take advantage of the MCF design flexibility we performed a research, which was aimed at investigating the XT phenomenon in MCFs. The research allowed us to form a theoretical model of the XT (based on supermode theory) and its consequences on signal transmission in MCFs.

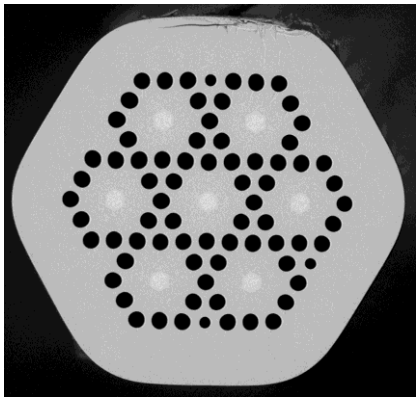

Fig. 1. Cross-section of manufactured seven-core hole-assisted fiber

The studies on the XT let us to optimize a structure of seven core fiber for telecommunications, which is presented in Fig. 1 and allowed to investigate multicore fibers also for sensing applications.

We examined the series of dual-core hole-assisted fibers [3] (see Fig.2) to verify the compatibility of the model with experimental results and to check whether the fibers can be used as sensors. The research was conducted on fiber elements based on post-processed dual-core fibers, whereas post-processing relied on air hole collapse.

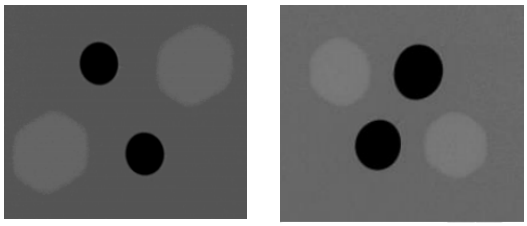

Fig. 2. Dual-core hole assisted fibers under test.

In this way, we created an area with increased level of core-to-core XT. The application of such element is twofold: it can be used as optical fiber coupler or it can serve as the strain sensor (with low cross-sensitivity to temperature). The experiments showed that such fiber element is very sensitive to strain, which was manifested with switching of the signal between the cores at the fiber output together with fiber elongation. The power detected at the output of one of the cores reflects therefore the strain applied to the fiber.

Measurements of sample series proved that the XT, which is regarded as undesirable effect in telecommunications, can be used as operation principle of new type of sensors. Similar approach of changing the conditions of interference of supermodes in multicore fibers was also used to create all-fiber power splitter.

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Optical fibre technology as a creator of economy development

In order to accelerate the development of the Polish economy, it is absolutely necessary to build up a solid base of strong hi-tech industries using indigenous, innovative technologies. As early as the 1970s, Polish scientists had already established the early foundations for research in optical fibre technology, quite independently of research centres in the West. This resulted in a number of patents which must be respected internationally, thus giving rise to a native specialty in the field of advanced technology. Years of research have built up a unique wealth of knowledge and experience, giving rise to tremendous opportunities for developing practical solutions. So far in Poland, we have developed and manufactured many different types of fibre, from classical solutions to highly specialized applications using microstructures or photonics. Polish scientific development is on-going, and now our advanced research and development, combined with close cooperation between science and industry is beginning to deliver tangible results in the form of new applications. Recently a world class plant has been established in Poland, using innovative methods to produce fibre optic cables and microstructural fibres. The unique technology of microstructured optical fibres could revolutionize areas such as: the new generation of telecommunications, precision fibre optic sensors, and innovative light sources. These innovations are capable of modernizing almost all branches of Polish industry, and could thus have considerable influence on the development of the whole economy. Creating a strong sector for applications of photonics based on optical fibre technology will not only provide accelerated development for Poland, but will also enable us to compete effectively with the more technologically developed countries around the world.

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Acoustic Emission as nondestructive testing method

Non-destructive testing is a group of testing methods that provide information about the properties of the object under test without causing damage. Common NDT methods include ultrasonic, magnetic-particle, radiographic or eddy-current testing give information only about local properties of the tested object. The method of acoustic emission testing (AT) due to its specificity stands out among the other NDT methods. AT method treats inspected object in a global manner. This technique is used to examination of structures, material study and control over manufacturing processes.

In this paper an overview of the application of AT method within petrochemical industry (pressure vessels, oil and gas pipelines, tanks), power distribution systems (i. e. transformers), railway transport and concrete constructions is presented. One of the most common application of AT method is metal pressure vessels inspection. The technique is valuable for detection of defects and damage during active load of tested object such as growth of cracks and other discontinuities in the structure of the material, local plastic deformation, material degradation due to corrosion causing local weakening of the structure of the material. Research methodology (equipment, arrangement of sensors, load curve, location of AE sources, classification of activity of AE sources) on the example of pressure vessels testing according standard PN-EN 14584:2013-07 is presented.

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Surface Acoustic Waves in applications of semiconductor investigations

Among the methods of investigations of semiconductor surfaces, there are no methods of investigating the kinetic properties of electrical carries in fast and very fast surface states. The existing methods allow only investigations of the surface sates with a carrier life-time τ of above 10^{-8} s. In the case of extrinsic semiconductors the surface states may, however, be considerably faster (the carrier life-time in surface traps is usually less than 10^{-8} s). In such cases the existing methods of determining the parameters of fast surface states allow only to estimate these parameters, since the obtained results exhibit a considerable uncertainty. For this reason, investigations of the kinetic properties of fast surface states are not popular and there are not any new results concerning their determination.

For some years attention has been paid to the influence of the physical state of the near-surface region of a semiconductor on the results of investigations of the acoustoelectric effects in piezoelectric-semiconductor systems. Also recently attention has been paid to the possibility of applying Rayleigh's surface acoustic waves SAWs for investigations of various parameters of solid states.

The theoretical and experimental results of the application of acoustoelectric effects (longitudinal and transverse) for the determination of carrier properties in near surface region (e.g. the surface electrical potential, carrier concentration, electrical conductivities,…) have been presented. Problems connected with the determination of the chemical and mechanical means of surface treatments in the first step of preparation of semiconductor plates for technology on their kinetic properties have analysed.

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Reliability of high temperature fiber optic sensors

In this work, authors describe and analyze the problem of fiber optics sensors' reliability at high temperatures. As an example we use InPhoTech's high temperature fiber optic sensor based on the MachZehnder interferometer principle. Well-developed fiber optics technology allows to produce sensors that are able to work at extremely high temperatures (up to 900 ˚C [1]). However, from the industrial point of view, not only the maximum working temperature of the sensor is important, but also its reliability and long term operation. As reliability is an essential aspect of overall product quality, it is important to remember that fiber optics sensors introduced into the market should remain functional after operating in target environment (e.g. ammonia [2]) for particular period of time.
Authors describe the methodology of reliability investigation and experimental test results. B
y performing the accelerated life tests of the sensors, and analyzing the samples infant mortality effects, authors were able to identify potential week points of the sensors and eliminate them in order to provide fully functional product to the customer. What is more, performed accelerated life tests, allowed to calculate mean life of the sensors in order to provide more detailed information about developed sensors' durability.

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Electromagnetic Interference shielding vs surface modifications – the review

Even before Maxwell's equations were formed, humanity was exposed to numerous electromagnetic fields. However it was not until 20th century when manmade electromagnetic fields became more and more abundant. Many systems and platforms are sources of unintentional EM fields, which are potentially harmful to other electronic hardware. On top of that, at some point, these emissions may reach power levels that pose serious threat even to human health.

This issue required a new branch of electromagnetic devices to be designed to protect against adverse emissions. Nowadays this branch bears the name of EMI shielding (Electromagnetic Interference - EMI). It covers every possible aspect of modifying original materials in order to increase their shielding effectiveness against electromagnetic fields. Furthermore it applies to gaskets, physical layers, that cover desired circuits and even special paints that absorb EM energy.

This paper presents the review of theoretical and practical works describing EMI shielding among various frequency bands. Special attention has been paid to the methods regarding surface modifications.

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The computer measuring system for registration of acoustic emission signals and location of acoustic emission sources within oil power transformers

The computer measuring system, designed, built and called by Authors as 8AE-PD, dedicated for location and description of partial discharges within power oil transformers investigated by means of acoustic emission method is presented. Within the work detailed issues concerning the construction and operation of preamplifiers, instrumentation amplifiers, measurement card, magnetic holders of sensors, power supply and control system are described. The system is equipped with eight measurement channels and ensures provides monitoring of signals, data recording in the real time within the band of 20-1000 kHz in laboratory and real conditions and as well the basic and advanced analysis of recorded data.

The measuring system has been calibrated and tested in laboratory conditions which were carried out with the use of modeled partial discharges sources. Obtained results confirm the high sensitivity of 8EA-PD measurement system and its usefulness in the study of partial discharges within oil power transformers.

WITOS Franciszek, OPILSKI Zbigniew, OLSZEWSKA Aneta, SETKIEWICZ Maciej

Department of Optoelectronics, Faculty of Electrical Engineering, Silesian University of Technology, Krzywoustego 2, 44-100 Gliwice, Poland

Analysis of the properties of acoustic emission signals generated in the pressure vessel during the hydraulic test

The results of analysis of the properties of acoustic emission signals recorded in the pressure vessel during a modified hydraulic test are shown.

On the tested object, signals were recorded in two stages: preliminary and main. Within preliminary study, the set of curve attenuation and wave velocity of acoustic emission were carried out. From this, the EA sensor arrangement during the main research was determined. The main research has been carried out as part of the hydraulic test on the examined object. Course of hydraulic test has been modified by determining the course in two cycles in line with the requirements of the standard PN-EN 14584:2013-07. During main research, acoustic emission signals were recorded using the AMSY 6 Vallen system equipped with 30 tracks of measuring AE sensors arranged in the planned measuring points on the test object.

Properties of registered acoustic emission signals have been analyzed in terms of checking of Kaiser effect, the effect of felicity and integrity of the structure of the object. Location of acoustic emission sources active during the study and classification of these sources were carried out.

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Detection of the trace amounts of selected gas pollutants using cavity enhanced spectroscopy

Sensors providing the detection of trace amounts of various compounds are essential in the effort to minimize the level of the environment contamination, control very costly and complex technological processes in industry, support medical diagnosis, ensure a higher level of security and find use in many other applications. During the last decades, many methods have been applied for in-situ detection and concentration measurement of volatile substances. The most common are mass spectrometry, gas chromatography, chemiluminescence, semiconductor gas sensors or electrochemical devices. Their main inconveniences are the size and cost of the apparatus, complicated maintenance, drifts and cross-response issues, e.g. to humidity, high detection limit and limited lifetimes.

We demonstrated optoelectronic sensors employing cavity enhanced spectroscopy (CES) in detection of the trace amounts of selected gas pollutants. The sensors use the phenomenon of optical radiation absorption to detect and measure the concentrations of the molecules, provide achieving low detection limits and high selectivity [1]. For this purpose, it is necessary to apply radiation, the wavelength of which is matched to the spectral range characterized by strong absorption of the tested molecules. In our experimental setups, we applied visible and mid-IR semiconductor lasers [2]. Initially, the research were focused on the development of nitrogen oxides sensors. Nitrogen oxides together with sulphur dioxide are the main gas air pollution. They cause strong acidification of precipitation, the formation of photochemical smog and highly toxic secondary pollutants (ozone, aromatic hydrocarbons). They also rapidly accelerate corrosion of stone buildings and metal structures, threaten human health, irritate the respiratory system and general weaken the body's resistance to infectious diseases. We developed portable NO_2 sensor that is characterized by a low detection limit (1 ppb) and a short measurement time (~ 3 sec). This sensor was applied in outdoor tests consisting in determination its applicability for measuring NO_2 concentrations in the atmosphere. The sensor uses a blue-violet semiconductor laser (414 nm) developed at the Institute of High Pressure of the Polish Academy of Sciences. The mid-IR lasers were applied to investigate gases, the absorptions lines of which are located in the infrared region of spectrum. There were applied quantum cascade lasers (4.53 μm and 5.27 μm) from Alpes Lasers SA and the prototype quantum cascade laser (4.78 μm) from the Institute of Electron Technology [3]. The developed setups enabling a detection such gases like: nitric oxide (NO), nitric dioxide (N_2O) and carbon monoxide (CO) in laboratory conditions. Carbon monoxide is a highly poisonous, colorless, odorless and tasteless gas. It causes irreversible damage to the central nervous system, coronary insufficiency and myocardial infarction. In preliminary experiments of CO sensors, the tunable laser system PG711-DFG-SH from the Ekspla company was applied. Results of the sensors tests were summarized in Tab. 1.

Tab. 1. The test results of our sensors

Type of sensor	Operation wavelength	Detection limit	Measurement uncertainty	Comments
NO_2	414 nm	1 ppb	5%	Outdoor tests
N_2O	4.53 μm	45 ppb	13%	Laboratory tests
NO	5.27 μm	30 ppb	12%	Laboratory tests
CO	4.78 μm	Approx. 150ppb	-	Laboratory tests
CO	4.78 μm	10 ppb	10%	Tests using PG711

The experiments showed that CES sensors are more sensitive and selective than many other detection techniques. They offer fast and continues concentration measurements. For that reason, such sensors can be very useful tools the effort to minimize the level of the environment contamination.

ACKNOWLEDGEMENT
The presented works were supported by The National Centre for Research and Development and National Science Centre in the scope of Projects: ID: 179616.

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Spectral properties of photonic crystal fibers infiltrated with nematic liquid crystals doped with metallic nanoparticles

Over the last years, research efforts have been made to improve properties of liquid crystals (LCs) by doping them with different materials as: polymers, dyes, or carbon nanotubes. Recently, there has been a growing interest in dispersing nanopatricles (NPs) in LCs. Even a small amount of metallic NPs should be sufficient to influence the dielectric anisotropy and threshold voltage of LCs. The most common dopants are gold and silver NPs. Both have been shown to improve electro-optical properties and increased thermal stability of LC. Combining the ease of tuning of physical properties of LCs and structure of a photonic crystal fiber, a new type of a fiber, i.e. Photonic Liquid Crystal Fiber (PLCF) with an improved control of spectral, polarization, and guiding properties was proposed more than 10 years ago.

In this paper, preliminary results of PCFs infiltrated with nematic LCs doped with metallic NPs are reported. Two types of NPs: Titanium NPs and Gold NPs and two types of LCs: 6CHBT and 5CB LCs were used to compare an influence of the doping on propagation parameters of the PLCFs and their electro-optical response to external electric field.

45th Winter School on Wave and Quantum Acoustics

12th Winter Workshop on Molecular Acoustics, Relaxation and Calorimetric Methods (MAR&CM)

PROGRAMME and ABSTRACTS

Organizers of WSWQA 2016

Upper Silesian Division of the Polish Acoustical Society

in cooperation with the

Committee of Acoustics of the Polish Academy of Sciences

29th February to 3rd March 2016,
Hotel "META"
Szczyrk - Beskidy Mountains, POLAND

http://ogpta.pl

CONFERENCE PROGRAMME

29.02.2016 Monday	
13:00	Dinner
14:15	**OPENING CEREMONY of the 11th IOS'2016 and 45th WSW&QA Conferences**
14:30-15:50	**Common Session**
14:30-14:50	**THE SESSION DEDICATED TO THE MEMORY OF PROFESSOR JERZY KAPELEWSKI** T. PUSTELNY
14:50-15:10	**Electromagnetic Interference shielding vs surface modifications – the review** M.SZAFRAŃSKI, A. KAWALEC, A. DUKATA, M. OKOŃ-FĄFARA
15:10-15:30	**Analytical model of the acoustically loaded sandwich transducer** P. KOGUT, A. MILEWSKI, W. KARDYŚ, P. KLUK
15:30-15:50	**Surface Acoustic Waves in applications of semiconductor investigations** T. PUSTELNY, B. PUSTELNY
15:50-16:30	Coffee break
16:30-16:40	**Opening of the 12th Winter Workshop on Molecular Acoustics, Relaxation and Calorimetric Methods**
16:40-17:25	*Invited lecture* **Ultrasonic studies of emulsion stability in the presence of magnetic nanoparticles** A. JÓZEFCZAK
17:25-18:10	*Invited lecture* **Conductometric measurements and their significance in the physicochemical studies of electrolyte solutions** A. BORUŃ, A. BALD
18:10	Supper
20:00	**Theatrical performance**

01.03.2015 Tuesday	
13:00	Dinner
14:50-15:20	*Invited lecture* **Hydration of urea and its derivatives** A. BURAKOWSKI, J. GLIŃSKI
15:20-15:40	**Effect of temperature on acoustic and volumetric properties of diluted solutions of water in ionic liquids** J. SKOWRONEK, M. DZIDA, E. ZORĘBSKI, M. GEPPERT-RYBCZYŃSKA, J. JACQUEMIN, P. GOODRICH
15:40-16:00	**Halogen bonding in solution** D. CHĘCIŃSKA-MAJAK, A. BALD
16:00-16:30	Coffee break
16:30-17:10	**Kinetics of acoustic relaxation processes in aromatic hydrocarbons and their halogensubstituted** V. N. VERVEYKO, M. V. VERVEYKO
17:10-17:40	**FT-EoS: data processing for determination of its parameters** E. POSTNIKOV, Y. NEDYALKOV
17:40-18:00	**High pressure acoustic and thermodynamic properties of 2-methylfuran and 2,5-dimethylfuran - second generation biofuels** S. JĘŻAK, M. DZIDA, M. ZORĘBSKI
19:30	**Festive Supper (Banquet)**

02.03.2016 Wednesday	
13:00	Dinner
14:30-14:50	**Magnetically anisotropic composite systems** P. KOPCANSKY, N. TOMASOVICOVA, V. GDOVINOVA, M. TIMKO
14:50-15:10	**Hyperthermic effect in mechanically treated magnetosomes** M. TIMKO, M. MOLCAN, M. RAJNAK, P. KOPCANSKY
15:10-15:30	**Investigation of liquid crystals – biphenyl derivatives** N. PONIKWICKI, B. J. LINDE
15:30-15:40	**Introduction to poster session (short presentation of posters)**
15:40-15:50	**Closing of the 12th Winter Workshop on Molecular Acoustics, Relaxation and Calorimetric Methods**
15:50-16:30	Coffee break
16:30-16:50	**Prezentacja firmy Svantec**
16:50-17:10	**Prezentacja firmy EC Test Systems**
17:10-17:30	**Prezentacja firmy Bruel & Kjaer Polska**
17:30-17:50	**Prezentacja firmy Systemy Pomiarowe**
18:00-20:00	**Poster Session**
18:30	Supper

03.03.2016 Thursday	
8:00	Breakfast

POSTER SESSION

Mechanical properties and instability of Pickering droplets probed by electric field-induced stress and ultrasonic spectroscopy

Z. ROZYNEK, A. MIKKELSEN, P. DOMMERSNES, A. JÓZEFCZAK, J. O. FOSSUM

Effect of temperature on acoustic and volumetric properties of aqueous mixtures of ionic liquids

M. MUSIAŁ, M. GEPPERT-RYBCZYŃSKA, E. ZORĘBSKI

Application of the magnetic nanoparticles to enhance the effectiveness of the ultrasonic hyperthermia

K. KACZMAREK, A. JÓZEFCZAK, T. HORNOWSKI, M. KUBOVCÍKOVA

ABSTRACTS

BORUŃ Agnieszka, BALD Adam

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Conductometric measurements and their significance in the physicochemical studies of electrolyte solutions

Conductometry is an electroanalytical method involving the measurement of electrolytic conductivity used both in research laboratories as well as in industry. It is one of the simplest, convenient, affordable and most accurate techniques for the investigation and analysis of substances and one of the most appropriate methods for studying of the nature of ion-ion, ion-solvent and solvent-solvent interactions existing in the electrolyte solutions.

It can also be used to determine the many physical quantities such as degree of dissociation, dissociation constants and solubility products. The data allow the calculation of thermodynamic functions of association, standard enthalpy of electrolyte solution, constants of complex formation, emf, free enthalpy of transfer, transfer numbers or the determination of the critical micellization concentration.

Evaluating the conductivity within the framework of present electrolyte theories requires high accuracy in measurements. In order to obtain the sufficiently accurate conductance data, which could be used in various conductance equations, it is necessary to have an equipment which allows reasonably accurate measurement at different temperatures.

The aim of this lecture is to discuss the theoretical and practical aspects of conductivity, the factors that influence the reliability of the measurement, and the techniques, as well as some applications of conductometry.

BURAKOWSKI Andrzej, GLIŃSKI Jacek

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Hydration of urea and its derivatives

A series of dilute aqueous solutions of urea and its selected derivatives (1,3-dimethylurea, 1,1,3,3-tetramethylurea, 1,3-dimethylimidazolidin-2-one, and 1,3-dimethyltetrahydropyrimidin-2(1H)-one) was investigated by sound speed and density measurements.

The hydration numbers were determined using the compressibility data using Pasynski equation.

Molar volumes determined from density data of solutions were shown to reflect the hydration phenomena, too. Using this quantity, the contribution of carbonyl group, >C=O, to the total observed hydration number was determined.

CHĘCIŃSKA-MAJAK Dorota, BALD Adam

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Halogen bonding in solution

Halogen bonding (XB) is very commonly occurring force of long-range. It is a type of intermolecular non-covalent attractive interaction between a covalently bonded halogen atom and a negative site on an atom or group of atoms. Halogen bonding plays an important role in various scientific fields such as chemistry, biology, medicine or pharmacology. As the hydrogen bonding (HB) interaction is targeted with similar energy. Instead of a hydrogen atom, a halogen atom is collective to bond donor and acceptor. A characteristic property of this bonding is the directionality. The Y- X···B bond angle in most cases close to 180°.

Many organic solvents are halogenated and a large number of reactions accur in halogenated solvents. Consequently halogen bonding should be expected in that cases. Up till now, studies of the halogen bonding in liquids were limited to theoretical and spectroscopic methods, and calorimetry.

This lecture presents the study of tetrachloromethane (CCl_4) with diethylamine (DEA) mixtures. Densities (ρ) and refractive index (n) were measured as a function of mole fraction at 298.15 K. The results were analyzed mainly in terms of the formation of intermolecular complexes by directional halogen bonds.

JĘŻAK Sylwia, DZIDA Marzena, ZORĘBSKI Michał

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High pressure acoustic and thermodynamic properties of 2-methylfuran and 2,5-dimethylfuran - second generation biofuels

The two compounds of the furan family such as 2-methylfuran (MF) and 2,5-dimethylfuran (DMF) are studied. These furan heterocycles can be obtained from cellulosic biomass and are indicated as a potential bioethanol or petroleum-based fuels substitute. The speeds of sound in MF and DMF were measured at temperatures from 293 K to 318 K and pressures from 0.1 MPa to 101 MPa. The densities were measured for MF and DMF under atmospheric pressure in the temperature range from 273 K to 333 K and 273 K to 363 K, respectively. The isobaric heat capacities were measured at atmospheric pressure and the temperature range from 293 K to 323 K. The densities, isobaric heat capacities, isentropic compressibilities, isothermal compressibilities, and isobaric thermal expansions for temperatures from 293.15 K to 318.15 K and for pressures up to 100 MPa were calculated using acoustic method. Differences between densities and isentropic compressibilities of MF and DMF can be compensated by changes of temperature and/or pressure.

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Ultrasonic studies of emulsion stability in the presence of magnetic nanoparticles

Superparamagnetic iron oxide nanoparticles (SPION) as well as composite materials based on them have unique features and many applications. An interesting application of these nanoparticles is to stabilize an emulsion. Solid magnetic nanoparticles are adsorbed strongly at the oil–water interface and are able to stabilize emulsions of oil and water. In this work emulsions stabilized by magnetite nanoparticles were obtained using high-energy ultrasound waves and a cavitation mechanism and, next, their stability in time was tested by means of acoustic waves with a low energy, without affecting the structure. An acoustic study showed high stability in time of magnetic emulsions stabilized by magnetite particles. The study also showed a strong influence of an external magnetic field, which can lead to changes of the emulsion properties. It is possible to control Pickering emulsion stability with the help of an external stimulus – a magnetic field.

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[2]*Institute of Experimental Physics, Slovak Academy of Sciences, Watsonova 47, 040 01 Košice, Slovakia*

Application of the magnetic nanoparticles to enhance the effectiveness of the ultrasonic hyperthermia

Ultrasonic hyperthermia is the method of cancer treatment in which tumors are exposed to elevated, cytotoxic temperature (41–45°C) by means of ultrasound (US). In conventional ultrasonic hyperthermia the ultrasound-induced heating in the tumor is achieved by the absorption of wave energy. However, to obtain appropriate temperature in reasonable time, the high US intensities, which can result in negative impact on healthy tissue, are required. The US effectiveness for medical purposes can be significantly improved by using the so-called sonosensitizers that can enhance the thermal effect of US on tissue by increasing US absorption. One possible candidate for such sonosensitiser are magnetic nanoparticles with mean sizes of 10-300 nm that can be efficiently heated due to additional attenuation and scattering of US.

KOGUT Paweł, MILEWSKI Andrzej, KARDYŚ Witold, KLUK Piotr

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Analytical model of the acoustically loaded sandwich transducer

Ultrasonic transducers used in a high power applications such as ultrasonic welding or cleaning systems are mostly constructed as a piezoelectric stack systems known as sandwich transducers. Explicit formulation of the sandwich transducer parameters is well known and documented but only in reference to unloaded conditions and in parallel resonance working regime only. To overcome those difficulties many authors have been using lumped models such as Mason model or T-network model of the acoustic transmission lines as well as the finite element modeling. This approach takes time and obviously is less transparent than explicit formulation of the basic transducer parameters. This article provide an extent to the existing explicit formulations of the sandwich transducer parameters such as resonant frequencies, electromechanical coupling factor, mechanical amplitude gain factor and power gain factor. Authors derived explicit relations for those parameters taking into consideration acoustic loading conditions and both series and parallel resonant frequencies working regime. Designated formulas can be used to optimize transducer geometry dimensions such as piezoceramic stack length and position in order to maximize the transducer acoustic power capabilities under certain acoustic loading medium. Obtained results have shown that acoustic loading and resonant frequency working regime have strong influence on the transducer parameters.

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Magnetically anisotropic composite systems

This presentation deals with special class of magnetically anisotropic systems ie composite systems consist of liquid crystals and magnetic nanoparticles ie so called ferronematics. These materials were introduced by Brochard de Gennes in 1970 to increase magnetic response of liquid crystals to external magnetic fields. Main aim is to prepare liquid crystalline sensors of magnetic field ie magnetovision camera.

This contribution will present basic theory with description of these materials as well as many experimental data regarding structural changes so called Fredericksz transitions, response of these system to low magnetic field , nematic isotropic transition in presence of magnetic field as well as the idea how to prepare liquid ferromagnets. Nematic-isotropic phase transtion of these systems in the presence of very small magnetic field opens the doors towards application possibilities such as low magnetic field sensors or basic logical elements for information storage technologies.

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Effect of temperature on acoustic and volumetric properties of aqueous mixtures of ionic liquids

Based on the literature speed of sound and density data, the excess speed of sound, excess molar volume and excess molar isentropic compressibility of binary systems containing ionic liquid and water were calculated. All binary systems are completely miscible with water at the analyzed temperatures (288.15 K, 298.15 K and 308.15 K). The binary systems with water were chosen because of their importance and possible application (e.g. as absorption refrigeration systems). Some patterns of behavior for speed of sound and calculated quantities with respect to temperature and cation/anion structure are found. For example, for binary systems of similar ILs with water an inversion of the speed of sound isotherms was found (near IL molar fraction 0.05). Another interesting feature of some systems is that speed of sound changes significantly with concentration only at lower IL molar fraction, but for higher IL molar fraction resembles speed of sound of pure ionic liquid.

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Investigation of liquid crystals – biphenyl derivatives

Liquid crystals selected for experiments were biphenyl derivatives: 4-alkyl-4'-cyanobiphenyls (nCB), which form a homologous series described by the formula C_nH_{2n+1}-C_6H_4-C_6H_4- CN. They are built of two subunits (phenyl rings linked by a C-C bond) that can rotate about each other.

One of the phenyl rings in 4-alkyl-4'-cyanobiphenyl contains a cyano group (–CN) substituted in *p*-position. Other molecules of the series differ in the length of their alkyl chains substituted in *p*-position at the second phenyl ring.

The nCB series have typical liquid crystalline phase sequences depending on chain length: for n = 5, 6, 7 crystal-nematic-isotropic, n = 8, 9, 11 crystal-smectic A-nematic-isotropic, n = 10, 12 crystal-smectic A- isotropic.

There were observed monotropic transition into nematic phase for n = 3 and 4, while cooling as well as photoacoustic spectra.

These molecules can adopt various conformations due to varying dihedral angle between the phenyl rings and different positions of the alkyl chain (all-trans, zig-zag conformation).

Experimental results reported in the literature are concerned with the measurements of the angle between phenyl rings, the effect of the alkyl chain length on the infrared spectrum, and the dipole moment of alkylcyanobiphenyls. The effect of different polar and nonpolar solvents on vibrational and electronic spectra was also investigated.

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FT-EoS: data processing for determination of its parameters

The Fluctuation Theory-based Tait-like Equation of State (FT-EoS) is recently proposed [Int. J. Thermophys. 35 (2014) 2115; Ind. Eng. Chem. Res. 54 (2015) 9645] as an effective isothermal equation of state, which does not require fitting experimental data for each isotherm in order to determine multiple sets of EoS's constants. Instead, on can utilize well-established correlations for the coexistence curve or operate with the fits of data obtained at the normal pressure.

We review available procedures, their numerical realizations and required data: samples of (i) the density and the isothermal compressibility at normal pressure; (ii) the speed of sound and the heat capacity ratio at normal pressure or along the coexistence curve, (iii) the normal boiling point temperature and an approximation of the saturated density. They are illustrated by the examples of normal and halogenated alkanes, aromatic hydrocarbons for the pressure ranges up to hundreds MPa. The developed Excel's user build-in functions suitable for practical applications will be provided.

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Surface Acoustic Waves in applications of semiconductor investigations

Among the methods of investigations of semiconductor surfaces, there are no methods of investigating the kinetic properties of electrical carries in fast and very fast surface states. The existing methods allow only investigations of the surface sates with a carrier life-time τ of above 10^{-8} s. In the case of extrinsic semiconductors the surface states may, however, be considerably faster (the carrier life-time in surface traps is usually less than 10^{-8} s). In such cases the existing methods of determining the parameters of fast surface states allow only to estimate these parameters, since the obtained results exhibit a considerable uncertainty. For this reason, investigations of the kinetic properties of fast surface states are not popular and there are not any new results concerning their determination.

For some years attention has been paid to the influence of the physical state of the near-surface region of a semiconductor on the results of investigations of the acoustoelectric effects in piezoelectric-semiconductor systems. Also recently attention has been paid to the possibility of applying Rayleigh's surface acoustic waves SAWs for investigations of various parameters of solid states.

The theoretical and experimental results of the application of acoustoelectric effects (longitudinal and transverse) for the determination of carrier properties in near surface region (e.g. the surface electrical potential, carrier concentration, electrical conductivities,…) have been presented. Problems connected with the determination of the chemical and mechanical means of surface treatments in the first step of preparation of semiconductor plates for technology on their kinetic properties have analysed.

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Mechanical properties and instability of Pickering droplets probed by electric field induced stress and ultrasonic spectroscopy

Recently, studies of particle laden droplets subjected to external electric fields has increased significantly with promising development in fields like electro-coalescence, destabilization of Pickering emulsions, or arrested coalescence. Here we study both the behavior of microparticle stabilized droplets in electric fields and formation of Pickering droplets via electro-coalescence. Colloidal capsules (composed of jammed microparticles) are made on a surface of oil droplets. The investigation concerns the viscoelastic deformation, shell unjamming, and solid-to-liquid transition of monolayered shell, and dynamics of shell formation. A new unreported method of fabricating Pickering shells is demonstrated. We wish to study the dynamics of formation of Pickering emulsion by indirect methods, e.g. ultrasonic spectroscopy, which may reveal the phase transition of the surface of a droplet (from liquid to solid like, when the droplet is fully covered by particles).

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The effect of temperature on acoustic and volumetric properties of diluted solutions of water in ionic liquids

Acoustic and volumetric properties of diluted solutions of water in 1-butyl-3-methylimidazolium bis[(trifluoromethyl)sulfonyl]imide, [C_4mim][NTf_2], 1-butyl-1-methylpyrrolidinium bis[(trifluoromethyl)sulfonyl]imide, [C_4mpyr][NTf_2], 1-propyl-3-methylimidazolium bis[(trifluoromethyl)sulfonyl]imide, [C_3mim][NTf_2] and 1-ethyl-3-methylimidazolium thiocyanate, [C_2mim][SCN] were investigated. The speeds of sound were measured within the temperatures from 293.15 to 318.15 K. The densities were measured in the temperature range from 293.15 to 328.15 K for [C_4mim][NTf_2] and 293.15 to 353.15 K for the remaining ILs. On the basis of experimental results the molar isentropic compressibility, the molar thermal expansion, partial molar volume, and partial molar adiabatic compressibility were calculated. The molar isentropic compressibilities and the molar thermal expansions of water + [C_4mim][NTf_2] and water + [C_4mpyr][NTf_2] solutions are approximately the same in the whole temperature range. The molar isentropic compressibilities and the molar thermal expansions of water + [C_2mim][SCN] solutions are the lowest among the investigated water + IL systems.

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Electromagnetic Interference shielding vs surface modifications – the review

Even before Maxwell's equations were formed, humanity was exposed to numerous electromagnetic fields. However it was not until 20th century when manmade electromagnetic fields became more and more abundant. Many systems and platforms are sources of unintentional EM fields, which are potentially harmful to other electronic hardware. On top of that, at some point, these emissions may reach power levels that pose serious threat even to human health.

This issue required a new branch of electromagnetic devices to be designed to protect against adverse emissions. Nowadays this branch bears the name of EMI shielding (Electromagnetic Interference - EMI). It covers every possible aspect of modifying original materials in order to increase their shielding effectiveness against electromagnetic fields. Furthermore it applies to gaskets, physical layers, that cover desired circuits and even special paints that absorb EM energy.

This paper presents the review of theoretical and practical works describing EMI shielding among various frequency bands. Special attention has been paid to the methods regarding surface modifications.

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Hyperthermic effect in mechanically treated magnetosomes

The existence of biocompatible phospholipid membrane around magnetosome and the high value of specific absorption rate (SAR) predetermined this bacterial nanoparticles for the biomedical applications. The magnetosomes were prepared by biomineralization process of magnetotactic bacteria Magnetospirillum sp.AMB-1.The magnetosome chains (IM) extracted from the body of bacteria were divergent in length i.e. chains of magnetosomes (IM) have been modified due to mechanical effects during sonication (SM). In this contribution we present the possibility of magnetosome chains characterization via small-angles techniques and the influence length of chains on the hyperthermia effect.

Experimental scattering curves of magnetosome IM and SM samples, indicate the presence of polydisperse particles in the investigated samples. The values of initial scattering intensities confirm the differences in average sizes of two kinds of samples prepared by various methods. This fact causes that SM sample magnetically behaves in a different meaner, showing that energy loss and specific absorption rate are noticeable reduced, and thereby indicates variation in the relaxation process and heat distribution and so can be used for hyperthermia application.

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Kinetics of acoustic relaxation processes in aromatic hydrocarbons and their halogensubstituted

Recently, there are different and sometimes contradictory points of view on the kinetics of acoustic relaxation processes in aromatic hydrocarbons and, especially, their halogensubstituted.

We discuss the results of our measurements related to the speed of ultrasound and its absorption rate at the frequencies 5-110 MHz, and the shear viscosity, the ratio of bulk and shear viscosities and relaxation times within the temperature range 293-373 K and the pressures 0.1-50 MPa and their dependences on PVT parameters and the frequency.

This analysis allows the conclusion that the vibrational relaxation is absent in these liquids within the investigated range of state parameters, which contradicts the previously accepted point of view. The kinetic mechanism for such a behaviour can be assumed, most probably as the processes of restructuring related to the reactions of rupture and formation of weak chemical bonds such as C ... H-C, C ... H-Cl, C ... H-Br with formation energy about 4-6 kJ/mol.

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