50th Jubilee Winter School on Wave and Quantum Acoustics

AGENDA AND BOOK OF ABSTRACTS

Organizers of WSWQA 2022:

Upper Silesian Division of the Polish Acoustical Society

in cooperation with

The Committee on Acoustics of the Polish Academy of Sciences

28 February – 3 March 2022
Hotel „Meta”
Szczyrk, Beskidy Mountains, POLAND

https://ogpta.pl

Dear Participants of the 50th JUBILEE WINTER SCHOOL

on WAVE and QUANTUM ACOUSTICS 2022

The organizers of the WSWQA have a very great pleasure to welcome all of you to Szczyrk, the heart of the Beskidy Mountains, Poland. This year the conference is special, as it is the 50th time we meet.

The 50th Jubilee Winter School consists of:

- 17th Workshop on Acoustoelectronics;
- 17th Workshop on Molecular Acoustics, Relaxation and Calorimetric Methods.

We wish all the Participants of the 50th Jubilee Winter School plenty of scientific satisfaction and many professional and social impressions.

Dariusz Bismor
Secretary, WSWQA Organizing Commitee

This book contains Programmes of both Workshops and summaries of works which will be presented within 50th WINTER SCHOOL on WAVE and QUANTUM ACOUSTICS 2022.

50th Jubilee Winter School on Wave and Quantum Acoustics

17th Winter Workshop on Acoustoelectronics (AE)

AGENDA AND ABSTRACTS

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PROGRAMME OF THE 17TH WORKSHOP ON ACOUSTOELECTRONICS

Szczyrk, 28 February – 3 March 2022

28.02.2022 Monday	
14:00	***Lunch***
16:00-16:10	**OPENING CEREMONY of the Conferences** **50th Jubilee WSW&QA** **49th WSEA&V** **16th IOS'2022**
16:10-16:45	**Jubilee Session**
16:00-16:30	*Plenary lecture:* **The Golden Jubilee of the 50th WINTER SCHOOL ON WAVE AND QUANTUM ACOUSTICS - historical reminiscences** T. PUSTELNY, R. BUKOWSKI
16:30-16:35	*Address by the Chairman of the Honorary Committee:* A. ŚLIWIŃSKI, (online)
16:35-16:45	*Other speeches*
16:45-17:30	***Coffee Break***
17:30-18:15	**"ALTRA VOLTA" - MUSIC GLANCE**
18:30	***Supper***

20:00	**50 YEARS HAVE GONE BY … – AN EVENING OF REMEMBRANCE** **50 LAT MINĘŁO … – WIECZÓR WSPOMNIEŃ** **GRAŻYNA GRELOWSKA** „Dzieci i narty” **KRZYSZTOF J. OPIELIŃSKI, TADEUSZ GUDRA** „Przegląd udziału zespołu ultradźwiękowego z Politechniki Wrocławskiej w konferencjach Winter School on Wave and Quantum Acoustics” **BOGUMIŁ B. J. LINDE** „Akustyka Molekularna – badania w Instytucie Fizyki Doświadczalnej Uniwersytetu Gdańskiego i ich prezentacje na Szkołach Zimowych” **JERZY BODZENTA** „Fotoakustyka i fototermika - badania w Instytucie Fizyki Politechniki Śląskiej i ich prezentacje na Szkołach Zimowych” **TOMASZ BOCZAR** „Badania naukowe prowadzone na Politechnice Opolskiej w obszarze diagnostyki transformatorów z wykorzystaniem metod nieniszczących” **JACEK GLIŃSKI** „50 lat akustyki molekularnej we Wrocławiu" **ADAM KAWALEC** „Udział pracowników naukowych WAT w Szkołach Zimowych” **ARKADIUSZ JÓZEFCZAK** „Ultradźwięki jako narzędzie badań ośrodków ciekłych i nanomateriałów” **EDWARD ZORĘBSKI, MARZENA DZIDA** „40 lat badań akustycznych cieczy w Instytucie Chemii UŚ w Katowicach i ich prezentacja na Szkołach Zimowych” **ZBIGNIEW RANACHOWSKI** „Związki Oddziału Warszawskiego PTA ze Szkołą Zimową” **LUCYNA LENIOWSKA** „Przegląd zagadnień prezentowanych przez członków PTA – Oddział Rzeszów na Zimowej Szkole” **ROMAN BUKOWSKI** „Szkoła Zimowa AFiK w fotografiach”

01.03.2022 Tuesday	
8:00	***Breakfast***
13:00	***Lunch***
15:00- -18:30	**SESSION**
15:00-15:30	**The simulation analysis of selected pulse waveforms in application to echolocation systems** A.M. KAWALEC
15:30-16:00	**Retrospective outline of the electroacoustic system in the National Museum „Panorama Racławicka" in Wrocław (1985-2020)** T. GUDRA
16:00-16:30	**Mercury vapour SAW sensor with enhanced sensitivity.** K. JASEK, M. GRABKA, M. PASTERNAK
16:30-17:00	***Coffee break***
17:00-17:30	**Application of vibroacoustics in diagnostics of power transformers – case study** M. KUNICKI, S. BORUCKI, A. CICHOŃ, D. ZMARZŁY
17:30-18:00	**Characterization of acoustic emission signals generated by partial discharges under DC stress** M. KUNICKI
18:00-18:30	**Minimizing the effect of glottal flow on the scatter of HFCC coefficient values to increase the quality of speech signal frames classification** S. GMYREK, R. MAKOWSKI, R. HOSSA
20:00	***Festive Supper (Banquet)*** ***in the initial part, the performance of the jazz band "CSW Trio"***

02.03.2022 Wednesday	
8:00	***Breakfast***
13:00	***Lunch***
15:00- -18:00	**SESSION**
15:00-15:30	**Analysis of the possibility of using coded pulses in ultrasound tomography** K. J. OPIELIŃSKI, P. PRUCHNICKI
15:30-16:00	**Correction of errors occurring during the detection of pulse arrival time in ultrasound tomography** P. PRUCHNICKI
16:00-16:30	**Noninvasive ultrasounds Doppler effect based method of liquid flow velocity estimation in pipe** P. BIERNACKI, S. GMYREK, W. MAGIERA
16:30-17:00	***Coffee break***
17:00-17:30	**Application of artificial intelligence methods to signal enhancement for predictive maintenance of rotating element bearings** M. AHSAN, D. BISMOR
17:30-18:00	**Numerical Analysis of the non steady state in response and recovery stage of a new SAW Structure with RR-P3HT in detection DMMP** T. HEJCZYK
18:30-19:00	***Poster session – preparation of posters***
19:00-20:00	***Supper***

20:00	**POSTER SESSION**
20:00	**POSTER SESSION** **Analysis of the noise impact of VAWT wind turbines registered in a public building** M. KOZIOŁ, T. BOCZAR, I. URBANIEC **Application of piezoelectric structures for gas density testing** J. ZYGARLICKI, Ł. NAGI, M. KOZIOŁ, D. ZMARZŁY, T. BOCZAR **Application of piezoelectric structures for gas density testing** M. KOZIOŁ, Ł. NAGI, J. ZYGARLICKI, D. ZMARZŁY

03.02.2022 Thursday	
8:00	***Breakfast***

ABSTRACTS
FOR THE 17TH WORKSHOP ON ACOUSTOELECTRONICS

Application of Artificial Intelligence Methods to Signal Enhancement for Predictive Maintenance of Rotating Element Bearings

Muhammad Ahsan, Dariusz Bismor

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Every rotating machine consists of rotating element bearings and when a fault occurs in these rotating elements bearing due to any reason, the whole machine suffers. When a sudden shut down take place in industrial or military machines, it costs financial as well as personal damages. Therefore, these sort of sudden shut down of rotating machines are avoided by means of predictive maintenance using different signal processing techniques. Vibration signals acquired from the faulty bearings are analyzed to find out the fault frequency spectrum and then fault source. But when the noise to signal ratio is high, the traditional signal processing techniques such as kurtosis or spectral kurtosis – are not capable to find out the fault frequency spectrum. In this research work, we proposed a band-pass filter that filter out the background noise and helps to find out the fault frequency spectrum. The fault frequency can occur in any bandwidth and therefore, it is challenging to find out the precise bandwidth and center frequency of the band-pass filter. Failure to find the precise band-pass filter can lead to serious damage in rotating machines. To solve this serious issue, Harmony Search (HS) Algorithm is used to estimate the precise band-pass filter. In the proposed method, we use two fitness functions: kurtosis and spectral kurtosis. To validate the performance of the proposed method, different vibration signals were tested including early-stage roller element fault signal, early-stage outer race fault signal, and outer race fault signal with different loads. From the simulation study, it was concluded that the performance of the spectral kurtosis is better than the kurtosis as a fitness function to distinguish the healthy and faulty bearing. The results were further compared with the traditional way of designing band-pass filter using kurtogram and it was concluded that band-pass filter designed using the HS algorithm with spectral kurtosis as a fitness function performs better than the band-pass filter designed using kurtogram.

Noninvasive Ultrasounds Doppler Effect Based Method of Liquid Flow Velocity Estimation in Pipe

Paweł Biernacki, Stanisław Gmyrek, Władysław Magiera

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The article discusses the estimation of the flow velocity from a calmed on multi-sensor. Several different estimation methods of real Doppler shift in a noisy environment are used and based on it calculate flow velocity in the pipe. For the collected estimates decision level information fusion is proposed to establish flow velocity with high precision and low variations. Simulation results for plastic and steel pipes demonstrate the possibility of accurate liquid flow measurements without installing sensors inside the pipe.

Minimizing the Effect of Glottal Flow on the Scatter of HFCC Coefficient Values to Increase the Quality of Speech Signal Frames Classification

Stanislaw Gmyrek, Ryszard Makowski, Robert Hossa

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The voiced parts of the speech signal are shaped by: glottal excitation, vocal tract, and the speaker's lips. The semantic information contained in speech is mainly shaped by the vocal tract. However, the periodicity of the glottal excitation, is one of the factors affecting the significant scatter of HFCC coefficient values, by introducing spectral ripples.

This paper proposes a method to reduce the effect of glottal flow excitation by correcting the amplitude spectrum of the voiced frames of the speech signal. The estimators of the correction functions were determined using inverse filtering (IAIF). Then, using HFCC parameters, statistical models of individual phonemes of Polish speech were developed in the form of a mixture of Gaussian distributions (GMM). The purpose of the amplitude spectrum correction was to narrow and spread the GMM distributions, which, according to the detection theory, reduces classification errors. The results confirm the effectiveness of the proposed method.

Retrospective Outline of the Electroacoustic System in the National Museum “Panorama Racławicka” in Wrocław (1985-2020)

Tadeusz Gudra

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"The Panorama of the Battle of Racławice", a monumental masterpiece by Jan Styka and Wojciech Kossak - a work of national culture of great historical value, required both an appropriate facility and technical equipment. This paper presents a designed and produced electroacoustic system assisting the tour of an exhibition intended for a great numbers of visitors. A structure, principle of operation and basic technical equipment of sound system are presented. The main idea of applied system has proved itself in practice during 35 years of operation, but lots of equipment parts were changed due to new technical possibilities.

Numerical Analysis of the Non Steady State in Response and Recovery Stage of a New SAW Structure with RR-P3HT in Detection DMMP

Tomasz Hejczyk

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The paper presents the results of numerical analyses of the SAW gas sensor in the non-steady state. The effect of SAW velocity changes vs. the surface electrical conductivity of the sensing layer is predicted. The conductivity of the roughness sensing layer above the piezoelectric waveguide depends on the profile of the diffused gas molecule concentration inside the layer.

Numerical results for the gas DMMP (CAS Number 756-79-6) for layer (RR)-P3HT in the non-steady state have been shown (recovery and response step). The main aim of the investigations was to study thin film interaction with target gases in the SAW sensor configuration based on diffusion equation for polymers. Numerical results for profile concentration in non-steady state for concentration, thickness, roughnes and temperature have been shown.

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 (in steady state). The numerical results basing on the code written in Python, are described and analyzed. The theoretical results were verified and confirmed for profile concentration gas numerically.

Mercury Vapour SAW Sensor With Enhanced Sensitivity

Krzysztof Jasek, Michał Grabka, Mateusz Pasternak

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The new kind SAW sensor for mercury vapour detection is presented in the work. The increase of sensitivity was achieved by exploiting both mechanical and electrical phenomena on piezoelectric surface.

The Simulation Analysis of Selected Pulse Waveforms in Application to Echolocation Systems

Adam M. Kawalec, Marta Walenczykowska

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Sonar systems are divided into active and passive. In passive sonars, main tasks are detection and classification. In active sonars, it is particularly important to ensure adequate coverage and resolution. In addition, the active sonar system should provide adequate Doppler resolution, which is an important parameter necessary to track moving objects/targets. For both types of sonar systems, an important problem is the selection of the appropriate waveform that will ensure the required level of detection and the ability to determine the parameters of the received echoes in interference and noise conditions. Previously used CW (continuous wave) pulses require an increase in pulse duration and/or pulse amplitude to ensure the acceptable range, resolution and detection level in the presence of noise. This resulted in the need for compression techniques that provide a shorter pulse duration and an increase in pulse amplitude at the output of the filter matched to the transmitted signal. Commonly used LFM (linear frequency modulation) pulses provide very good distance resolution, but Doppler performance is not sufficient. Therefore, in sonar applications, the use of other waveforms such as pulses with phase coding (e.g. Barker or Frank codes), frequency hopped trains of pulses (such as Costas codes), pulses with polyphase modulation (e.g. P4 waveform) or even hybrid waveforms are considered

This research work was conducted with using the ambiguity function (AF) and cross- ambiguity function (CAF), which are excellent tools for determining the characteristics of selected waveforms and their usefulness in echolocation applications. The analysis was carried out taking into account the possibility of signal detection in noise and interference conditions and resolution abilities at distance and Doppler frequency.

Analysis of the Noise Impact of VAWT Wind Turbines Registered in a Public Building

Michał Kozioł, Tomasz Boczar, Ireneusz Urbaniec

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Opole University of Technology,
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Noise and vibration are factors that can potentially affect the comfort of people working and living in buildings. Possible internal sources of noise in buildings are its equipment and technical installations. The source of noise can also be a installations and external devices that are integrated with the building or mounted on it. An example of such an external source could be a wind turbine, installed on the roof of a building or integrated with it (built-in). This issue is poorly explored and was undertaken by the authors for recognition.

As part of the research work undertaken, noise measurements were carried out in the range of low acoustic frequencies and infrasound, emitted by operating wind turbines with a vertical axis of rotation (VAWT). The registration was made in the building of the Opole University of Technology which has three VAWT turbines installed on the roof. Noise measurements were carried out in various weather conditions. The aim of the research was to analyze the level of low-frequency and infrasound noise, which could potentially affect inside the building.

Application of Piezoelectric Structures for Gas Density Testing

Michał Kozioł, Łukasz Nagi, Jarosław Zygarlicki, Dariusz Zmarzły

Faculty of Electrical Engineering, Automatic Control and Informatics,
Opole University of Technology,
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The undertaken research topic concerns to the multivariate analysis of piezoelectric structures depending on the environmental conditions in which they operate. The aim of the preliminary research work was to investigate the possibility of using piezoelectric structures to determine the gas density based on the resonance frequencies of the components used. Two structures with different frequencies were analyzed and tested in gases such as air, helium and CO_2 for different meteorological conditions. The obtained results indicate some possibilities and reveal limitations of the adopted resonance frequencies. The issue requires further recognition on a wider range of resonant frequencies and under various operating conditions of piezoelectric structures.

Characterization of Acoustic Emission Signals Generated by Partial Discharges Under DC Stress

Michał Kunicki

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Opole University of Technology,
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This paper presents results and analysis of acoustic emission (AE) signals generated by partial discharges (PD) in oil under DC voltage. The primal objective of this study is to describe fundamental characteristics of the PD under DC in order to propose adequate features that can be extracted from signals in order to further classification of different types of PD sources. Moreover, this paper compares AE signals emitted by several types of PD sources and analyzes influence of voltage level and polarization on these signals. Results show that different types of PD sources are characterized by unique characteristics, voltage influence is not crucial regarding this characteristics while voltage polarization confirms much more significant affection. This results can be used to support the diagnostic process of electric power apparatus in DC systems, especially regarding the correct interpretation of PD signals and their relation to the experience acquired in AC systems.

Application of Vibroacoustic in Diagnostics of Power Transformers – Case Study

Michał Kunicki, Sebastian Borucki, Andrzej Cichoń, Dariusz Zmarzły

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This paper presents results and analysis of diagnostics tests on power transformers performed under on site conditions using vibroacoustic (VA) method. The primal objective of this study is to propose the optimal methodology for technical condition assessment of power transformers using VA supported by dissolved gas analysis (DGA) method. Moreover, this paper analyzes the influence of disturbances generated by transformer cooling system on results achieved. This case study investigates two transformers: one with probable core defect and the other with no defects. Two sets of measurements recorded one year apart on these units are used in the study to illustrate the development of the potential defect. Results show that cooling system hardly affects the VA results, and relative rather than absolute changes of the measuring signals are essential from the diagnostic point of view. Experience presented in this paper may be used to support the diagnostic process of power transformers, especially regarding the routine tests conducted under normal exploitation conditions.

Analysis of the Possibility of Using Coded Pulses in Ultrasound Tomography

Krzysztof J. Opieliński, Piotr Pruchnicki

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In conventional ultrasound imaging, significant improvement in the detection of pathological changes in tissue can be achieved by increasing the S/N ratio of received ultrasound echoes using ultrasound coded transmission by means of signals with linear frequency modulation (chirp) and discrete phase modulation with algebraic codes (Barker codes, Golay codes). In all such solutions, echoes are correlated with the standard transmission signal and then averaged. In this way, a large amplitude of the sounding signals is not required because the gain in the S/N ratio results from the compression of the recorded echoes. Coded signals can also be attempted to improve image quality in ultrasound transmission (UTT) and reflection tomography (URT). For this purpose, additional examinations are necessary due to the side lobes of the signals obtained from the emission of coded pulses, a multitude of pulse transitions, and image reconstruction algorithms. In this work, research using coded signals in the UTT and URT method was carried out on the ultrasound tomography scanner developed by DRAMIŃSKI S.A. in cooperation with scientists from Wroclaw University of Science and Technology.

The research was carried out under the project POIR.01.01.01-00-1595/15, entitled: "Development of a prototype of multimodal ultrasound tomography for breast diagnosis".

Correction of Errors Occurring During the Detection of Pulse Arrival Time in Ultrasound Tomography

Piotr Pruchnicki

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An ultrasound tomograph is a device that can be used to visualize the internal structure of the breast. One of the obtained diagnostic images presents the distribution of local sound speed values in the breast cross-section. To reconstruct this image, it is necessary to know the time of transition of the ultrasonic wave through the tissue. The paper presents problems that occur when determining the arrival time with the use of the constant fractionation method and detection of the zero crossing. The procedure of eliminating errors appearing in this situation was also presented. An analysis of the speed sinogram is used during error correction. The value of the speed in the examined point of the sinogram is compared to the values in the neighboring points. It is possible to detect large errors and more frequent shifts only by one or two periods of the measuring impulse.

Influence of Selected Parameters of the Doppler Tomography Method on the Quality of Image Reconstruction

Tomasz Świetlik

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The Doppler Tomography method allows to obtain a cross-sectional image of the examined object. It is possible thanks to the use of ultrasound probe moving around the object. On the basis of registration of Doppler frequency changes from reflected signals it is possible to reconstruct the image. For this purpose the Filtered Back Projection algorithm is used.

The most important signal in this method is the so-called Doppler signal. It contains only the Doppler frequencies recorded during the measurement. It is possible to determine the formula on the basis of which it is possible to determine the waveform of this signal. This makes it possible to simulate any image.

This paper presents the influence of several selected parameters of the Doppler Tomography method on the quality of imaging. The examined object was an infinitesimally small point scattering the ultrasound wave in each direction equally. On its example it was possible to estimate the minimum size of the imaged inclusions.

50th Jubilee Winter School on Wave and Quantum Acoustics

17th Winter Workshop on Molecular Acoustics, Relaxation and Calorimetric Methods (MAR&CM)

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PROGRAMME OF THE 17TH WORKSHOP ON MOLECULAR ACOUSTICS, RELAXATION AND CALORIMETRIC METHODS

Szczyrk, 28 February – 3 March 2022

28.02.2022 Monday	
14:00	***Lunch***
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16:10-16:45	**Jubilee Session**
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01.03.2022 Tuesday	
8:00	***Breakfast***
13:00	***Lunch***
14:30- -18:00	**SESSION**
14:30-15:30	**Magnetically responsive (nano)textile: Preparation and application** I. SAFARIK, J. PROCHAZKOVA, E. BALDIKOVA, K. POSPISKOVA, M. TIMKO, P.KOPCANSKY (invited lecture)
15:30-16:00	**Magnets for magnetic drug targeting** P. KOPCANSKY, M. TIMKO, J. KOVAC, O. STRBAK, I. SAFARIK
16:00-16:30	**The effect of rotating and alternating magnetic fields on the thermal effect in magnetic fluids** M. TIMKO, A. SKUMIEL, M. MOLCAN, K. PAULOVICOVA, K. ZOLOCHEVSKA, I. SAFARIK, P. KOPCANSKY
16:30-17:00	***Coffee break***
17:00-17:30	**Experimental verification of a predictive model equation for thermal conductivity of ionic liquids** Ł. SCHELLER, J. DZIADOSZ, M. DZIDA
17:30-18:00	**Thermal conductivity of 1-alkyl-3-methylimidazolium bis(trifluoromethylsulphonyl)imide-based nanofluids** J. DZIADOSZ, B. JÓŹWIAK, G. DZIDO, H. F. GREER, A. KOLANOWSKA, R. JĘDRYSIAK, S. BONCEL, M. DZIDA
20:00	***Festive Supper (Banquet)*** ***in the initial part, the performance of the jazz band " CSW Trio"***

02.03.2022 Wednesday	
8:00	***Breakfast***
13:00	***Lunch***
15:30- -18:00	**SESSION**
15:30-16:00	**Characterization of magnetic and non-magnetic nanoparticles in oil suspensions by ultrasound spectroscopy** B. JAMEEL, T. HORNOWSKI, R. BIELAS, A. JÓZEFCZAK
16:00-16:30	**Multi-walled carbon nanotubes influence on isobaric heat capacity of ionanofluids** K. CWYNAR, E. ZORĘBSKI, J. DZIADOSZ, B. JÓŹWIAK, G. DZIDO, A. KOLANOWSKA, R. JĘDRYSIAK, H. F. GREER, S. BONCEL, M. DZIDA
16:30-17:00	***Coffee break***
17:00-17:30	**Physicochemical properties of 2-methyltetrahydrofuran and tetrahydrofurfuryl alcohol as components of second generation biofuels** A. GOLBA, M. DZIDA
17:30-18:00	**Magneto-responsive microcapsules fabricated from Pickering droplets** R. BIELAS, B. JAMEEL, A. JÓZEFCZAK
18:30-19:00	***Poster session***
19:00-20:00	***Supper***

03.02.2022 Thursday	
8:00	***Breakfast***

ABSTRACTS

FOR 17TH WORKSHOP ON MOLECULAR ACOUSTICS, RELAXATION AND CALORIMETRIC METHODS

Characterization of Magnetic and Non-magnetic Nanoparticles in Oil Suspensions by Ultrasound Spectroscopy

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Magnetic nanoparticles have been used in various fields such as biotechnology, material science, and engineering. Additionally, the nanoparticles can be used as stabilizers for the emulsion droplets and create magnetic Pickering emulsion. The use of magnetic nanoparticles causes the modulation of emulsion properties in response to external stimulus - magnetic field. The knowledge of particles properties, especially size, as well as their behavior in suspension is an important issue in the preparation of Pickering emulsions.

In this research, the size of magnetic and non-magnetic nanoparticles were characterized by using ultrasound spectroscopy. The analysis of ultrasonic waves in a function of frequency provided information about the particle size. The experimental results of ultrasound attenuation were analyzed within the framework of the ECAH theory which takes into account contributions to acoustical parameters due to friction and heat exchange between particles and the surrounding carrier liquid and the scattering mechanism.

This work was supported by the Polish National Science Centre grant 2019/35/O/ST3/00503.

Magneto-Responsive Microcapsules Fabricated From Pickering Droplets

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In an upcoming era of individual approach to the therapies of common diseases, particularly cancers, there is a severe need to find solutions that allow for safe and precise delivery and release of pharmaceuticals in the site of interest inside the patient body. One of the possible approaches is the preparation of small capsules that serve as cargo agents. The external stimuli such as gradient magnetic field can non-invasively provide them into the specific location. Recently, we prepared such capsules responsive to external magnetic fields from droplets covered by particles (so-called Pickering droplets) via sintering in an alternating magnetic field.

During the presentation, the method of formation of colloidal capsules from Pickering droplets as precursors using ultrasonic, electric, and magnetic fields will be introduced. We will also show the responsiveness to the external low-gradient static magnetic field. The important issue remains also the proper characterization of capsules when prepared in bulk quantities. Therefore, we will also provide some ideas of the further experiments using capsules and ultrasound analogically to contrast-enhanced agents in ultrasound scanning (ultrasonography).

The work was supported by the Polish National Science Center by the grant 2019/35/N/ST5/00402

Multi-Walled Carbon Nanotubes Influence on Isobaric Heat Capacity of Ionanofluids

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Ionanofluids (INFs) – ionic liquids (ILs) containing dispersed within multi-walled carbon nanotubes (MWCNTs) possess excellent thermal conductivity, whereas effect on isobaric heat capacity (*Cp*) has to be settled yet due to contradictory results presented in the literature. The INFs composed of 1-ethyl-3-methylimidazolium thiocynate [EMIm][SCN], 1-butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl)imide [BMPyr][NTf_2], 1-propyl-1-methyl pyrrolidinium bis(trifluoromethylsulfonyl)imide [PMPyr][NTf_2], 1-hexyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide [HMIm][NTf_2] or 1-ethyl-3-methylimidazolium ethyl sulphate [EMIm][$EtSO_4$] and several types of multi-walled carbon nanotubes (MWCNTs), including functionalized MWCNTs, were investigated.

In general, non-functionalized MWCNTs did not alter *Cp* of investigated INFs. Promising results were observed for INFs composed of MWCNTs functionalized with polar groups, i.e. the obtained *Cp* enhancement of 3.2 % was achieved for [EMIm][SCN] + 0.50 wt% MWCNTs-COOH at 323 K .

This work was financially supported by the National Science Centre (Poland) Grant No. 2017/27/B/ST4/02748.

Thermal Conductivity of 1-alkyl-3-methylimidazolium bis(trifluoromethylsulphonyl)imide-Based Nanofluids

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We examined the effect of alkyl chain length in cation of the ionic liquid on the thermal conductivity of ionanofluids (INFs) at 25°C. We studied four series of INFs in concentrations from 0.25wt% to 5wt% of multi walled carbon nanotubes (MWCNTs) based on 1-alkyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imides with 2, 4, 6 or 8 carbon groups, i.e. [EMIm][NTF_2], [BMIm][NTf_2], [HMIm][NTf_2] and [OMIm][NTf_2], respectively.

Unremarkable thermal conductivity enhancement of 585%, 424%, 410% and 442% with addition of 5wt% of MWCNTs to respectively [EMIm][NTF_2], [BMIm][NTf_2], [HMIm][NTf_2] and [OMIm][NTf_2] has been observed. The conductivity increase shows nonlinear dependence on concentration of MWCNT, characteristic for each series of INFs.

This work was financially supported by the National Science Centre (Poland) Grant No. 2017/27/B/ST4/02748.

Physicochemical Properties of 2-methyltetrahydrofuran and Tetrahydrofurfuryl Alcohol as Components of Second Generation Biofuels

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The 2-methyltetrahydrofuran (2-MTF) and furfuryl alcohol (FA) are considered as attractive fuel bioadditives. The aim of this work is to study of physicochemical properties of 2-MTF and FA as fuel additives. The speed of sound in 2-MTF and FA was measured in the temperature range from 293.15 to 323.15 K using measuring set based on the pulse-echo-overlap method. Additionally, the speed of sound and density were measured in the temperature range from 278.15 to 333.15 K and 278.15 to 363.15 K for 2-MTF and FA respectively using Anton Paar DSA 5000M and vibrating tube densimeter Anton Paar DMA 5000M apparatus. The viscosity was measured at 288.15 K and 313.15 K using Ubbelohde viscometer. The flash-point was measured using Marcusson method. The physicochemical properties of 2-MTF and FA were compared with those of bioalcohols, heptane, dodecane and biodiesel. The density, viscosity, and flash-point were compared with norm EN 590 for diesel and EN 14214 for biodiesel. The physicochemical properties of 2-MTF and FA confirmed their potential as fuel bioadditives.

Magnets For Magnetic Drug Targeting

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This contribution presents development of special magnets for magnetic drug targeting into brain of mousses and/or human in frame of EURONANOMED III project MAGBBRIS (cofund Horizon 2020). This project was devoted to demonstration that growth factors secreted by endothelial progenitor cells, having proven potential to induce tissue repair, can be encapsulated in magnetic biomaterials and successfully and safely transplanted into mice brains, with the guidance of magnetic fields, to induce tissue repair. The main role of our team was to prepare suitable magnetic systems for magnetic drug delivery to desired pathological region. We developed special magnetic systems based on the idea of focusing of magnetic field, magnets for mice and human experiments were constructed and first results with successful delivery are given in following reference bellow. The magnets for human applications were successfully demonstrated on artificial human head too.

Endovascular administration of magnetized nanocarriers targeting brain delivery after stroke, Alba Grayston, Yajie Zhang, Miguel Garcia-Gabilondo, Mercedes Arrúe, Abraham Martin, Peter Kopcansky, Milan Timko, Jozef Kovac, Oliver Strbak, Laura Castellote,Sara Belloli, Rosa M Moresco, Maria Picchio, Anna Roig, and Anna Rosell, *Journal of Cerebral Blood Flow&Metabolism 2021, 1-16 DOI:10.1177/0271678X211028816*

Magnetically Responsive (nano)Textile: Preparation and Application

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Currently there is an increased interest in the study of smart multi-functional (nano)textiles that are sensitive to environmental changes and respond to external fields; such (nano)textile can be used for a large number of potential technological applications. Of particular interest is the use of magnetic particles in combination with (nano)textile materials. Different types of magnetic nano- and micromaterials including magnetite, maghemite or ferrite particles can be used for (nano)textile modification. Magnetically responsive (nano)textile can be efficiently used for potential medical applications (magnetic hyperthermia for the treatment of cancer cells, scaffolds for the proliferation of osteoblasts, drug delivery, magnetic resonance visualization of surgical textile implants or biosensing), biotechnology (prevention of fungal biofilms development, antibacterial properties), or shielding of electromagnetic field. Magnetically modified (nano)textile also exhibits peroxidase-like activity. A new analytical procedure “Magnetic textile solid phase extraction” has been developed and used for the preconcentration of target analyzes. Magnetically responsive (nano)textile will certainly find other interesting applications in the near future.

Experimental Verification of a Predictive Model Equation for Thermal Conductivity of Ionic Liquids

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Ionic liquids (ILs) have been recently proposed as components of heat-transfer fluids (HTF). The key property of HTF is thermal conductivity (TC). However, the measurement of the thermal conductivity of ILs can be challenging and time-consuming, therefore a good and reliable predictive model becomes desirable. In 2014 an equation using the speed of sound to determine the thermal conductivity of ILs was proposed[1]. In this work 1-alkyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imides ($[C_nC_1im][NTf_2]$, n = 2, 4, 6, 8), 1-ethyl-3-alkylimidazolium ethyl sulfates ($[C_2C_nim][EtSO_4]$, n = 1, 2), 1-ethyl-3-methylimidazolium tricyanomethanide ($[C_2C_1im][C(CN)_3]$) and 1-ethyl-3-methylimidazolium thiocyanate ($[C_2C_1im][SCN]$) were investigated. The TC of ILs was measured by means of transient hot wire method. The experimental TC was compared with the calculated results. The difference between measured and predicted values is significant and can exceed 20%.

This work was financially supported by the National Science Centre (Poland) Grant No. 2017/27/B/ST4/02748.

[1]K.-J. Wu, Q.-L. Chen, C.-H. He. *AIChE J.* **60**, 1120-1131 (2014).

The Effect of Rotating and Alternating Magnetic Fields on the Thermal Effect in Magnetic Fluids

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In general, the most promising materials for magnetic hyperthermia heating are based on iron oxide particle nanosystems. This is also indicated in some clinical trials studies in biomedical applications (hyperthermia, MRI, magnetic drug targeting) where iron-based oxides were used. In this contribution, magnetite nanoparticles of various configurations (single, chains from bacteria, halloysite chains, aggregated in bacterial cellulose) are measured in hyperthermia experiments. The physical principles of magnetic hyperthermia are based on the heat generation in systems of magnetic nanoparticles due to the influence of applied external magnetic fields such as AC and /or rotational magnetic field (RMF). The choice of a suitable set up for generating of magnetic field can significantly affect the resulting thermal effect and thus the efficiency itself. The technical details of the generating RMF as a new one compared to traditional AC magnetic field will be presented.

It would be good to emphasize that while the mechanisms (magnetic relaxations as Neel and/or Brown and hysteresis) of the temperature rise are in principle the same the heating effect depends on experimental conditions if AC or RMF is applied. It was found that the RMF produces increasing a thermal effect (in some cases two times larger) compared to AC field in measured samples mentioned above under similar experimental conditions. On the other hand, the difference in the efficiency of the RMF versus the AC field was more pronounced for individual nanoparticles than for systems containing chain nanoparticles for example.

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