EDITORIAL

I am pleased to present in this issue the news about the next Global Congress on Microwave Energy Applications to be held at Cartagena during July 25-29, 2016. A report on the last AMPERE conference held in Krakow is also included thanks to the contribution of Prof. Dariusz Bogdal. Further, Prof. David J. Walton writes a brief report on the Summer School in High-Energy Processing held at the same city during September 9-12, 2015.

Dr. A.C. Metaxas pays tribute in the afterthought piece to one of the giant’s of the Electronics Industry, Gordon Moore.

3RD GLOBAL CONGRESS ON MICROWAVE ENERGY APPLICATIONS

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In a few months the 3rd Global Congress on Microwave Energy Applications (3rd GCMEA) will be held in Cartagena, Spain. As many of you know, this is the occasion to meet the different associations devoted to microwave heating applications. During the past GCMEA’s, held in Long Beach, California, representatives from the Microwave Working Group, IMPI, JEMEA, China and India shared their knowledge about microwaves and microwave heating in a very attractive town. The topics of the conference covered were as follows: Energy and Environment, Microwaves in Everyday Life, Medical and Chemical Applications and Manufacturing and Processing Controls.

The 3rd GCMEA will be held in the Spanish historical City, Cartagena, during July 25-29, 2016 and as the Chair of the conference I am proud to invite you all to know this beautiful place, full of monuments and wonderful beaches. The Faculty of Economics Science will be the venue of the conference. This faculty is next to the port of Cartagena and very near to the city centre where very tasty gastronomic experiences can be found at reasonable prices.
The city of Cartagena was founded around the year 227 BC by the Carthaginian general Hasdrubal the Handsome, son of General Amilcar Barca with Hadasht Qart name (‘New Town’). The entire coast of Cartagena and Mazarrón was extremely coveted in ancient times for its important mineral deposits of lead, silver, zinc and other minerals. Today, some of its mines can be visited in order to know how miners worked decades ago.

The Roman general Scipio Africanus takes Qart Hadasht in 209 AC and renames it with the name of Carthago Nova. The settlement would become one of the most important Roman cities of Hispania and because of this many Roman Buildings can be visited today all around Cartagena. Due to its strategic position in the Mediterranean sea, Cartagena became a very important naval and military city of Spain and as a consequence several military inventions such as submarines and helicopters were developed here.

Nowadays, Cartagena is a very important city in Spain mainly due to the industry of plastics and navy ship production and also because of its wonderful beaches. In fact, Cartagena possesses the biggest amount of Quality beaches in Spain. The most famous beaches in Cartagena are at La Manga del Mar Menor, at around 40 km from downtown and can be easily reached by car or bus. Hotels and transportation will be provided from Congress organization in and from La Manga, respectively. La Manga is a narrow extension of land that separates two different seas: the Mediterranean Sea and the Minor Sea, an extension of still marine water where waves are very seldom seen and where kayak navigation can be easily practiced.

Figure 2. Roman Theatre in Cartagena

Figure 3. Images of La Manga del Mar Menor

Figure 4. Industrial and Telecommunication Engineering Schools.

The Congress will be hold at Universidad Politécnica de Cartagena, a Technical University where industrial, navy and telecommunication engineering, economics, agronomics and architecture studies are learned among others. This is a very young university founded in 2000 but placed at the top ten of the Spain Universities in
technology transfer and research indicators. Around 6000 students stay in Cartagena during lecture periods.

The researchers of the Electromagnetics and Matter Group welcome you all to Cartagena and encourage all of you to visit Cartagena next year and participate at the 3rd GCMEA.

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15TH INTERNATIONAL CONFERENCE ON MICROWAVE AND HIGH FREQUENCY HEATING (AMPERE 2015): CHAIRMAN’S VIEW

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The 15th International Conference on Microwave and High Frequency Heating (AMPERE 2015) was held between 14-17 of September 2015 at Cracow University of Technology (CUT), Krakow, Poland, and run under the auspices of the Rector, Professor Kazimierz Furtak. More precisely, AMPERE 2015 was organized by the Faculty of Chemical Engineering and Technology and took place at the new Conference and Education Center of Cracow University of Technology – Dzialownia, the Canon Hall.

AMPERE, a European non-profit association devoted to the promotion of microwave and radio frequency heating techniques for research and industrial applications, delegates every two years to one of Europe’s research groups the organization of the meeting.

The 15th AMPERE 2015 conference hosted more than 150 participants from 25 countries all over the world. More than 100 high quality contributions were presented. The program included 3 plenary lectures, 6 keynote presentations, over 80 oral presentations and 19 posters. Moreover, the young researchers and students, who are our most important target groups, had a chance to present their contributions since the poster session was limited.

Prior to the conference, the young scientists had another great opportunity to learn microwave and ultrasound techniques, given that on September 9-12, 2015 the Cracow University of Technology together with European Society of Sonochemistry (ESS) and Association for Microwave Power in Europe for Research and Education (AMPERE) organized the Summer School in High Energy Processing Ultrasound & Microwave Technologies. The summer school took place at the Faculty of Chemical Engineering and Technology, and, in addition to attending classical lectures the

Figure 1. Rynek Glowny square
participants took part in practical laboratories.

Figure 2. Typical carriages in Cracow for touristic tours.

The conference began on Monday, September 14, 2015 with registration and welcome reception, which was followed by the performance of the Latiga Dancing Group entitled: “Microwave Stories: How did it get so hot, Mr. Marek?”

Figure 3. Image from artistic performance “Microwave Stories: How did it get so hot, Mr. Marek?”

The conference was officially opened the following day by the President of AMPERE, Professor Cristina Leonelli, Vice-Rector for General Affairs of CUT, Professor Andrzej Białkiewicz, Dean of the Faculty of Chemical Engineering and Technology, Professor Zygmunt Kowalski, and Chairman of AMPERE 2015 Conference, Professor Dariusz Bogdal who on behalf of AMPERE and the University welcomed all the participants, exhibitors, and accompanying persons.

The plenary lecture delivered by Professor Yoshio Nikawa on “Microwave Application On Medical Diagnosis And Treatment” showed the application of microwave and high frequency electromagnetic waves for obtaining the cross-sectional image of the human body in order to detect hidden diseases. In addition, by measuring the phase shift of a longitudinal relaxation signal, the cross-sectional distribution of the temperature elevation can be obtained, while transmission and reflection data can be utilized for obtaining detailed biological information noninvasively such as blood sugar level. The second tandem-plenary lecture was given by Professor Andrzej Stankiewicz and Georgios Stefanidis on “Importance of Microwaves for Process Intensification: Power-to-Chemicals Aspects” and examined various opportunities of using microwaves in the “Power-to-Chemicals” context, either directly or as the microwave-induced plasma. It was illustrated with examples from the literature and from their own research projects including: Methane to acetylene and olefins using MW plasma, MW- induced carbon gasification with CO2, CO2 plasmolysis using MW plasma, Biomass gasification using MW plasma, Methane coupling to olefins with MW, and MW-assisted methane steam/dry re-forming.

The Technical Sessions were divided into two parallel sessions. The first group of sessions covered “Nanomaterials”, “Sources” and “Organic and Polymer Chemistry”, while the second group covered
“Processes Intensification”, “Properties”, and “Waste Valorization”. In the meantime, during the Poster Session, 19 posters were presented, and the Technical Committee had a chance to evaluate the posters for the Best Posters Awards.

The AMPERE Management Committee worked during the conference; usually the meetings took place during lunches, while the AMPERE Ordinary General Assembly (OGA) was scheduled just after the last Technical Session.

At the end of the first day, the conference participants were invited for barbeque self-service dinner at the Barque anchored at the Vistula River Corner next to the Royal Castle on the Wawel Hill. The dinner was followed by a short trip along the river on a boat.

The second day started with the plenary lecture presented by Professor Rajender Varma on “Microwave-Assisted Pathways to Nanomaterials and Sustainable Applications of Nanocatalysts with Magnetic Core” in which the utility of nano-catalysts (Pd, Ni, Ru, Ce, Cu, Au etc.) immobilized on biodegradable and recyclable supports (cellulose and chitosan) or on magnetic ferrites via ligands such as dopamine or glutathione, was presented. This helped to fulfil most of the Green Chemistry Principles and producing functional chemicals that may find large-scale use with extreme level of waste minimization. The lecture was followed by two keynote presentations given by Professor Birgitta Raaholt on “Microwave Modelling and Applications in The Food Industry” and Professor Anna-Maria Papini on “The Challenge of Microwave-Assisted Solid-Phase Peptide Synthesis: R&D of Peptide-Based Diagnostics”. Then the Technical Sessions were once again divided into two parallel groups that were concerned with “Modelling” and “Industrial Application” as well as “Green Chemistry” and “Sintering”.

**Figure 4.** Group photo of the 15th AMPERE conference attendants
The day ended up by the Gala Dinner, which was held at the Wieliczka Salt Mine, one of the most valuable monuments of material and spiritual culture in Poland. As an old Polish saying goes, “without salt, a feast is spoiled”. The Wieliczka Salt Mine is thus a dream location to search for the delights of the palette, because the Wieliczka undergrounds are not only unique saline chambers and corridors but also a place that will allow you to develop your culinary horizons. At the dinner, the participants enjoyed and actively took part in the performance of the Regional Folklore Dancing Group!

Figure 5. Marilena, Jean Paul and President Cristina Leonelli in good mood

After the dinner, Professor Ricky Metaxas announced that by the unanimous decision of the AMPERE Management Committee, Professor Cristina Leonelli was elected as the President of AMPERE and Professor Keon Van Reusel as well as Professor Juan Monzo-Cabrera as the Treasurer and General Secretary, respectively. Then three Best Posters were announced and awarded. Finally, a new award was announced, the AMPERE Medal, and was presented to Mr Bernard Krieger, the CEO of Cober Electronics in the USA (see page 10).

The third day began with two keynote presentations by Professor Kama Huang on “Microwave Power Application and China” and Dr. Edward Reszke and Professor Dariusz Bogdal on “Applications of Microwaves in Analytical Chemistry and Organic Synthesis - Selected New Constructions and Methods”. The lectures were followed by short presentations from some exhibitors: Sairem and Cetiat, as well as Richardson Electronics who discussed their latest developments. Following these talks the Technical Sessions were once again divided into two parallel sessions and were devoted to “Industrial Applications” and “Measurements”.

Figure 6. President and Honorary President together

During the conference, the exhibitors had open stands to present their new instruments and solutions from ALTER POWER SYSTEMS, MKS, MUEGGE, NEOPTIX, RICHARDSON ELECTRONICS, S-TEAM, and SAIREM together with CETIAT and RADIANT. The conference was kindly sponsored by the ROYAL CAPITOL CITY OF KRAKOW.

The Conference Book of Abstracts (128 pages) was printed in paper version, while The Proceedings 15th International Conference on Microwave and High Frequency Heating (AMPERE 2015), Bogdal, D. Ed., Krakow, 2015 (ISBN 978-83-928784-4-5) were printed in the electronic version (56 papers), i.e., CDs attached to the Book of Abstracts.

The additional program for accompanying persons consisted of two visits, one to the Old City Center and the other to the Jewish Quarter.
During the Closing Ceremony, the President, Professor Cristina Leonelli, expressed special thanks to Professor Dariusz Bogdal’s research team for their continuous effort and excellent organization, stressing that the conference was a major success and was well received among all the delegates in attendance.

The President concluded with an invitation to the 3rd Global Congress on Microwave Energy Applications during July, 2016 in Cartagena, Spain, and to the 16th International Conference on Microwave and High Frequency Heating (AMPERE 2017) during September, 2017 in Delft, the Netherlands.

**SUMMER SCHOOL IN HIGH-ENERGY PROCESSING**

The third Summer School in this Series was held from September 9th-12th 2015 at the Krakow University of Technology, Poland, under the local Chairmanship of Professor Dariusz Bogdal. The event was co-organised with and co-sponsored by the European Society of Sonochemistry (ESS) and the Association of Microwave Power in Europe for Research and Education (AMPERE), and its timing was directly ahead of the biannual AMPERE 15th International Conference on Microwave and High Frequency Heating, held in Krakow from September 13th to 17th.

Sessions were held in the Physical Chemistry Building of the Faculty of Chemical Engineering and Technology, and the Summer School was most successful, with representatives from 10 countries worldwide and 26 Young Researchers registered.

There was a good spirit in the School, with communal mealtimes allowing attendees and presenters much opportunity for scientific interaction and feedback.

W. Kasprzyk, M. Galica and the local team are thanked for support, including the production of a CD of the course presentations that was given to each attendee at the end. D Bogdal was especially thanked for his contributions, in view of his duties as Vice-Rector of the University for Education and International Affairs, and his commitments towards the AMPERE international meeting.

**Figure 1.** Summer School Chairman, Dariusz Bogdal, with AMPERE president, Prof. Cristina Leonelli.

The presentations covered principles and applications of leading-edge technologies in modern chemical processing, specifically the use of microwaves and ultrasound, with tangential mention of electrochemistry and mechanochemistry, especially used as multiple perturbations to produce further
enhancements. These methodologies were major contributors to the sequential European COST discussion networks: D6 ‘Chemistry in Extreme and Non-Classic Conditions’, D10 ‘Innovative Methods and Techniques for Chemical Transformations’, and D32 ‘Chemistry in High-Energy Microenvironments’. Speakers alternated between the techniques, addressing the key workshop theme of Process Intensification in a range of applications, while commercial manufacturers of ultrasonic and microwave apparatus gave practical laboratory demonstrations.

The schedule was as follows: Emeritus Professor D Walton (Coventry – Chair of Management Committee of COST D32 [2004-2009]) gave an introduction to sonochemical principles, with examples taken from organic sonoelectrochemistry; Professor G Cravotto (Turin, President of ESS) described scale-up of ultrasound and microwaves in combination applied to green chemistry, Professor D Bogdal (Krakow) gave an introduction to microwave principles, Dr D Carnaroglio (from equipment manufacturer Milestone) described practical microwave apparatus on the market, Dr K Matras-Postolek (Krakow) discussed microwaves in nanoparticle preparation, Professor C Leonelli (Modena – President of AMPERE) described aspects of microwave-enhanced inorganic chemistry, covering solid-state reactivity, combustion systems and ceramic processing, paying attention to practicalities and safety aspects, Professor D Bogdal returned to discuss applications of microwaves in polymer synthesis and processing, Emeritus Professor B Ondruschka (Friedrich-Schiller University Jena) described the combined use of ultrasound and microwaves in synthesis, and the role of hydrodynamic cavitation, a keynote phenomenon in process intensification. Professor Leonelli returned to describe the design and application of microwave reactors, specifically industrial applicators used in pollution abatement,

Figure 2. Group photo of Summer School attendants at the Physical Chemistry Building.
Professor C. Argirusis (Athens) described the preparation of inorganic materials and nanomaterials using ultrasound, including the use of sonoelectrochemistry. Professor G Bond (University of Central Lancashire at Preston) described the history and applications of microwave-enhanced organic chemistry in both homogeneous and solvent-free media, while Professor C Bianchi (Milan) concluded the presentations by describing the use of ultrasound as a tool for advanced features in heterogeneous catalysis.

A key aim of the Workshop was to let attendees compare the features of the two key techniques, to provide a cadre of Young Researchers with this relatively uncommon blend of knowledge. To this end there were two afternoon sessions in the Summer School dedicated to practical demonstrations of commercial ultrasonic and microwave apparatus, the group of attendees being split so that everyone had an opportunity to learn each methodology. R Di Paolo from REUS demonstrated the extraction of herbal compounds from rose hips using an ultrasonic extractor tub, while Dr D Carnaroglio from Milestone demonstrated microwave assistance in a Diels-Alder cycloaddition, in the hydrolysis of benzamide, and in the extraction of components from orange peels, by hydrodistillation of volatile species and hydrodiffusion under gravity for higher boiling-point compounds.

These were just selected applications from an extensive list of topics discussed by the presenters, which ranged from environmental aspects (including remediation, pollutant degradation, safe synthesis, ‘green systems’, better atom balance, avoidance of waste) as well as improved synthesis and processing of organic, inorganic, catalytic, polymeric and nanometric materials and their applications. Other examples discussed included food science and pharmaceuticals. Major enhancements in reaction rates, diminution of side-reactions, and ease of product extraction all offer economic benefits across-the-board. Advances in methodology and equipment have expanded the effectiveness of the techniques, shown for example by the development of ultrasonic horns that can be safely inserted into a microwave cavity, to allow tandem use of these technologies.

A pleasant event at the Summer School was an award given to Professor Ondruschka, in honour of a research career studying novel chemical technologies, including sonochemistry, microwave chemistry, and mechanochemistry. He has made a valuable lifetime contribution to the popularization of less-commonly used laboratory techniques.

**NEWS AND EVENTS**

**New table top tempering appliance from C-Tech innovation**

C-Tech Innovation has announced in their July Newsletter a new RF defroster, which is capable of thawing up to 4kg of meat, fish and other high value products. It offers a programmable interface which allows to choose of up to 99 different defrosting recipes. For example, the unit will temper 2 kg of chicken breast from -18°C to -2°C in 25
minutes. It is ideal for commercial kitchens and other smaller establishments.

For more information go to
www.ctechinnovation.com

**Meyer Burger subsidiary Muegge GmbH acquires microwave technology specialist Gerling Applied Engineering, Inc.**

A few weeks ago it was announced that Muegge GmbH which is a subsidiary of Meyer Burger Technology Ltd acquired Modesto, USA based Gerling Applied Engineering (GAE), Inc. GAE are suppliers of industrial microwave heating and plasma equipment. The founder of GAE, John F. Gerling remains as Company Vice President to manage the company’s Business operations.

Dr Klaus Baumgärtner, CEO of Muegge GmbH, stated, 'The acquisition of GAE enables us to offer a complete standardized product line across the entire field of industrial microwave and plasma systems in the USA. It therefore provides us with a decisive competitive advantage while extending our footprint and increasing our share of the worldwide market in industrial microwave technology and in the production of complete industrial systems'.

Finally, John F. Gerling commented, 'We have worked closely together with Muegge GmbH and we are excited about the huge potential resulting from this transaction. Intensifying this cooperation by pooling the two companies extensive expertise will provide a basis for the growth of market share and ongoing enhancement of our products for the microwave and plasma industry in the USA and beyond. This will enable us to meet customers requirements even more closely in the future'.

For more information go to:
www.meyerburger.com

**Ampere Medal**

A brand new award was instigated at the AMPERE conference in Krakow. This is shown in the adjoining picture and it is termed AMPERE MEDAL. It is the highest honour that our organisation can bestow and goes to an individual that has worked tirelessly promoting the use of RF/microwave energy.

The first recipient of this award goes to Mr Bernie Krieger, the CEO of Cober Electronics, for his relentless effort in the past forty years in attempting to bridge the gap between industrial applications and academic research. He was the driving force behind the creation of the Microwave Working Group which organised two successful Global Congresses on Microwave Energy Applications (GCMEA).

The idea of staging the GCMEA’s rested on the fact that all the separate groups in the world concerned with microwave and RF applications would be involved each responsible for a theme in the scheduled programme. The third in the series of the global meetings, 3GCMEA, will be held in Catagena in July 2016 under the chairmanship of Prof Juan Monzo-Cabrera.

**Process Intensification for safe and sustainable process reindustrialization of Europe**

September 27th-October 1st
Nice, France. EPIC5 provides an excellent opportunity for academics, industrialists and technology providers to present the latest developments on Process Intensification in the academic and industrial sphere and communicate their present views and vision for the future to the largest possible audience. For more information please visit: http://www.ecce2015.eu/index.php/epic5

EPM 2015, 8th International Conference on Electromagnetic Processing of Materials
Cannes, October 14-16, 2015

The conference is open for any kind of materials processing involving electric or magnetic fields. It intends to bring together people from academic institutions, industry and related equipment manufacturers.

For more information please visit: http://epm2015.sciencesconf.org/

3rd Global Congress on Microwave Energy Applications (GCMEA)
July 25-29, 2016
Cartagena, Spain

The conference is open for any kind of microwave applications and technologies. It intends to bring together people from academic institutions, industry and related equipment and software manufacturers from all over the world.

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Details will be published online in due course at http://cpcd.upct.es/3gcmea/.

AN AFTERTHOUGHT: MOORE’S LAW CELEBRATES HALF A CENTURY

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In the issue I wish to pay tribute to one of the giant’s of the Electronics Industry, Gordon Moore, the retired chairman and CEO of Intel Corporation, which he co-founded in July 1968.

Fifty years ago in 1965 when Moore was then head of research at Fairchild Semiconductor he predicted that the computer chips (a small semiconductor material containing many integrated circuits) would double in complexity every year and, what is more, would fall in price. In 1975 based on what he then had observed he updated his prediction to doubling the complexity every two years. This essentially became known as Moore’s Law and has shaped the semiconductor industry, first in silicon valley and in the USA and of course subsequently all over the world.

Moore originally thought that from 60 elements on a chip one would get 60,000 in ten years and that would be excellent, however, the fact that after 50 years the doubling in complexity continues pretty much as he predicted is amazing. The first Intel microprocessor housing 2500 transistors cost $500 in today’s money, however, the latest i5 microprocessor holds a billion transistors and costs a mere $276. It
is said that today a typical microprocessor is 3500 times faster and 90000 times more efficient than Intel’s 4004 made in 1971. Even Moore admits that at best such expansion may continue for the next 10 years. As he admits, no exponential growth can go on forever! What has to be appreciated is that it is not just about making the transistors smaller and faster but basically Moore’s law was about producing better quality chips and very crucially keeping the cost per transistor down.

One only has to open the console (that is, the cabinet or box) forming the RF or microwave power unit to inspect the electronics in the shape of PLC and other control circuitry to realise how many integrated circuits reside within it. So the fact that the cost of chips have come down and are better designed has meant that the overall cost of the RF or microwave power available has proportionately kept down from what would have been if Moore’s law did not apply.

To get an idea of how Moore’s law will affect society for the next 50 years through new technologies open the following hyperlink and read an interview that wired.co.uk made with Steve Brown the futurist at Intel.

http://www.wired.co.uk/news/archive/2015-04/19/moores-law-50th-anniversary-future-disruption