71st Annual Meeting of the International Society of Electrochemistry

30 August - 4 September 2020 Belgrade, Serbia

Electrochemistry towards Excellence



https://annual71.ise-online.org e-mail: events@ise-online.org



Organizing Committee

Plamen Atanassov, Albuquerque, NM, USA Jelena Bajat, Belgrade, Serbia (co-chair) Aleksandar Bojić, Niš, Serbia Stanko Brankovic, Houston, TX, USA Aleksandar Dekanski, Belgrade, Serbia (co-chair) Nevenka Elezović, Belgrade, Serbia Marilia Goulart, Maceio, Brazil Gyöngyi Vastag, Novi Sad, Serbia Zhong-Qun Tian, Xiamen, China Gunther Wittstock, Oldenburg, Germany

Invitation to ISE 2020

You are warmly invited to the **71st Annual ISE Meeting** to be held in Belgrade, Serbia from **30st August to 4st September 2020**. The meeting will take place at the Sava Conference Center.

Belgrade is an important conference, cultural and business centre in the region. It is centrally located in Europe and presents the hub of all regional activities, as well as scientific ones. The University of Belgrade has a long-standing tradition of electrochemistry. Due to a high level of education in this field the University has given significant scientific contributions to electrochemical science, associated to the "Belgrade electrochemistry school", founded by prominent electrochemists, professors Despić and Dražić. Their successors are important Serbian and world's scientists whose goals of achieving excellence and recognition are what the 71st ISE Meeting is striving to accomplish through its theme. The scientific program will consist of symposia supported by all ISE Divisions and will cover all topics significant to the electrochemical community.

We look forward to welcome you in Serbia to enjoy the excellent science in an inspiring environment.





Summary of Symposia

Symposium 1	Membrane-based electrodes: from traditional potentiometry to dynamic electrochemistry
Symposium 2	Nanomaterials in electroanalysis and nanoelectrochemical sensors
Symposium 3	Electrochemical conversion of CO ₂ : Sensing, monitoring, mechanism and technological development
Symposium 4	New trends in bioelectrochemistry
Symposium 5	Coupling electrochemical and optical methods to study chemo- and bioobjects: light as sensor and actuator
Symposium 6	Advances in microbial electrochemistry for energy conversion, biotransformation, biotransformation,
Symposium 7	Electrochemical capacitors: beyond double-layer storage
Symposium 8	Next generation batteries – S&T challenges and opportunities
Symposium 9	Fuel cells and electrolyzes: promising energy for the future
Symposium 10	Electrochemical and electroless deposition: tailoring growth from monolayers and nanostructures to functional applications
Symposium 11	Corrosion and corrosion protection strategies
Symposium 12	Electrochemical engineering for environmentally friendly processing and environmental protection
Symposium 13	Electrochemistry in the digital age: model-supported process analysis and design
Symposium 14	Future of molecular electrochemistry
Symposium 15	When molecular electrochemistry meets luminescence: from fundamentals to analytical applications
Symposium 16	Two-dimensional materials: An electrochemical perspective
Symposium 17	Electroactive materials: polymers, inorganic solids, nanocomposites and hybrid materials
Symposium 18	Nanoelectrochemistry and electrocatalysis – from fundamentals to applications
Symposium 19	Electrochemical surface and interface
Symposium 20	Cutting edge electrochemical measurement techniques
Symposium 21	Education and transmission of knowledge from the past to the new generations of electrochemists
Symposium 22	General Session

2019 ISE Prize Winners and Award Lecturers

Frumkin Medal

Hector Abruña, Cornell University, Ithaca, USA

ISE-Elsevier Prize for Experimental Electrochemistry Ethan Crumlin, Case Western Reserve University, Cleveland, OH, USA

ISE-Elsevier Prize for Green Electrochemistry Wei Jin, Chinese Academy of Sciences, Beijing, China

Alexander Kuznetsov Prize for Theoretical Electrochemistry Jan Rossmeisl, University of Copenhagen, Copenhagen, Denmark

Tajima Prize

Shinsuke Inagi, Tokyo Institute of Technology, Yokohama, Tokyo, Japan

- ISE Prize for Electrochemical Materials Science Laifa Shen, Max Planck Institute for Solid State Research, Stuttgart, Germany
- ISE Prize for Applied Electrochemistry Jiayan Luo, Tianjin University, Tianjin, China
- Early Career Analytical Electrochemistry Prize of ISE Division 1 Sabina Kuss, University of Manitoba, Winnipeg, Canada
- Jaroslav Heyrovsky Prize for Molecular Electrochemistry Christian Amatore, CNRS, Ecole Normale Superieure, Paris, France

Oronzio and Niccolò De Nora Foundation Young Author Prize of ISE Mounika Kodali, University of California, Irvine, USA

Zhaowu Tian Prize for Energy Electrochemistry Zhichuan Xu, Nanyang Technological University, Singapore, Singapore

Katsumi Niki Prize for Bioelectrochemistry Eugene Katz, Clarkson University, Potsdam, USA



Electrochemistry Tutorials

Tutorial 1

Electrochemical thin film growth, fundamentals and applications

Stanko Brankovic, University of Houston, USA **Natasa Vasiljevic**, University of Bristol, UK

Tutorial 2

Solving research problems by means of scanning electrochemical microscopy (SECM) and related techniques

Gunther Wittstock, University of Oldenburg, Germany **Wolfgang Schuhmann**, Ruhr-University Bochum, Germany





Plenary Lecturers

Vojislav Stamenković, Argonne National Laboratory, USA



Vojislav Stamenkovic is a Senior Scientist, Technical Leader and Principal Investigator at the US Department of Energy's Argonne National Laboratory in Argonne, Illinois. He earned Ph.D. degree in physical chemistry from University of Belgrade in 2001, after spending three years as a visiting scientist at the University of California at Berkeley. Dr. Stamenkovic is an expert in the design and synthesis of functional materials for electrochemical applications, primarily in the fields of polymer electrolyte membrane fuel cells, electrolyzers and batteries. His research interests include materials for energy conversion and storage, electrocatalysis, spectroelectrochemistry, as well as functional bio materials. His work published in high impact journals such as Science and Nature series is often featured in the headlines of Lawrence Berkeley National Laboratory and Argonne National Laboratory. Dr. Stamenkovic serves as an Associate Editor of the ACS Catalysis journal and on the editorial board of Surface Science and Surface Science Letters. In 2004 Dr. Stamenkovic received a Recognition Award from Lawrence Berkeley National Laboratory for implementation of fundamental science into nanoscale applications, in 2012 he was awarded the Distinguished Performance Award from University of Chicago and in 2014, he received a prestigious US DOE Hydrogen and Fuel Cells Award in recognition for his outstanding contributions in catalysts R&D.

Sharon Hammes-Schiffer, Yale University, USA



Sharon Hammes-Schiffer is a physical chemist who has contributed to theoretical and computational chemistry. She is currently the John Gamble Kirkwood Professor of Chemistry at Yale University.

Sharon Hammes-Schiffer completed her B.A. in chemistry at Princeton University in 1988 and her Ph.D. in chemistry at Stanford University in 1993. She then worked with John C. Tully at AT&T Bell Laboratories as a postdoctoral research scientist.

She held positions on the faculty at the University of Notre Dame (1995-2000) and at Pennsylvania State University (2000-2012). As of 2012 she joined the University of Illinois at Urbana-Champaign.

Hammes-Schiffer studies chemical reactions in solution, in proteins and at electrochemical interfaces, particularly the transfer of charged particles driving many chemical and biological processes. She also researches the effects of Quantum tunnelling and hydrogen bonding on enzymatic reactions and has pioneered work in what she calls the Nuclear-Electronic Orbital Method (NEO) which allows for a more accurate estimate of nuclear properties such as density, geometry, frequencies, electronic coupling, and nuclear motions.

She is an author or co-author of over 250 papers and has given more than 200 invited talks.

She has served as Editor-in-Chief of Chemical Reviews, member of the Board of Reviewing Editors of Science and advisory editor for Theoretical Chemistry Accounts.

Nick Birbilis, Australian National University, College of Engineering and Computer Science, Australia



Nick Birbilis is Deputy Dean, College of Engineering and Computer Science at The Australian National University (ANU). He was Head of the Department of Materials Science and Engineering at Monash University (2013-18); where he was also the inaugural Woodside Innovation Chair. He has a PhD (2004) in Materials Engineering, and was a postdoctoral fellow at The Ohio State University.

His main research interests are related to materials and involve the development of materials, including materials design, modeling and production. He has been involved in the practical development of numerous light alloys and 3D printed alloys - with several patents. His research is highly interdisciplinary, eccompassing both use of machine learning and aaplying projects of social relevance and impact.

He is Associate Editor of Electrochimica Acta (an ISE journal) since 2010, and has been active in a number of societies, including the ISE, ECS and NACE. He has received a number of awards and presented numerous invited lectures. He is a Fellow of the Electrochemical Society, Fellow of the National Association of Corrosion Engineers (NACE, USA) and an ARC Australian Research Fellow. He was awarded the ATSE Batterham Medal and named a Victorian Tall Poppy and in 2016 he was awarded the 'Woodside Innovation Chair' at Monash, an industrially funded personal chair associated with durability of next generation materials.



Yi Cui, Stanford University, USA



Yi Cui is a Professor in Department of Materials Science and Engineering at Stanford University. He received a Bachelor's degree in Chemistry at University of Science and Technology of China in 1998 and attended graduate school from Harvard University. He was a Miller Postdoctoral Fellow at University of California, Berkeley.

His current research is on nanomaterials and electrochemistry for energy storage, catalysis, solar cells and environment. He is an Associate Editor of Nano Letters, a Co-Director of Battery 500 Consortium and he founded Amprius Inc. in 2008, a company to commercialize the high-energy battery technology. The high-energy batteries, that he invented, have started to be used in commercial. In 2017, he co-founded EEnovate Technology Inc. to serve as a technology incubator to commercialize water, textile, large-scale energy storage and new materials technology from his group.

He has won numerous awards, including ECS Fellow (2018), Blavatnik National Laureate in Physical Sciences (2017), MRS Fellow (2016), MRS Fred Kavli Distinguished Lectureship in Nanoscience (2015), Fellow of Royal Society of Chemistry (2015), Resonate Award for Sustainability (2015), Inaugural Schlumberger Chemistry Lectureship (University of Cambridge, 2015), Top 10 World Changing Ideas for His Work on Batteries to Capture Low-Grade Waste Heat (Scientific American, 2014), NO. 1 "Hottest Researchers of Today" in Materials Science (Thomas Reuters, 2014), Inaugural Nano Energy Award (2014), the IUPAC Distinguished Award for Novel Materials and Synthesis (2013), the Global Climate and Energy Project Distinguished Lecturer (2009), ONR Young Investigator Award (2008), MDV Innovators Award (2007), the Technology Review World Top Young Innovator Award (2004).

Frumkin Medal Hector Abruña, Cornell University, USA



Hector Abruña, Emile M.Chamot Professor of Chemistry, is Director of the Energy Materials Center at Cornell (emc2). He completed his graduate studies with Royce W. Murray and Thomas J. Meyer at the University of North Carolina at Chapel Hill in 1980 and was a postdoctoral research associate with Allen J. Bard at the University of Texas at Austin. After a brief stay at the University of Puerto Rico, he moved to Cornell in 1983. He was Chair of the Department of Chemistry and Chemical Biology from 2004-2008.

Abruña has been the recipient of numerous awards including a Presidential Young Investigator Award, Sloan Fellowship, J. S. Guggenheim Fellowship, and J. W. Fulbright Senior Fellow. He is the recipient of the Electrochemistry Award for the American Chemical Society (2008), and the C.N. Reilley Award in Electrochemistry for 2007. He was elected Fellow of the American Association for the Advancement of Science in 2007, member of the American Academy of Arts and Sciences in 2007, and Fellow of the International Society of Electrochemistry in 2008. He received the D. C. Grahame Award from the Electrochemical Society for 2009, the Faraday Medal of the Royal Society for 2011, and the Brian Conway Prize from the International Society of Electrochemistry for 2013. In 2013, he was made Fellow of the Electrochemical Society. Abruña is the co-author of over 440 publications and has given over 575 invited lectures world-wide. Out of the 50 students that, to date, have obtained a Ph.D. under his direction, 14 have gone on to faculty positions.

Membrane-based electrodes: from traditional potentiometry to dynamic electrochemistry

Sponsored by :

Division 1, Analytical Electrochemistry Division 3, Electrochemical Energy Conversion and Storage Division 6, Molecular Electrochemistry

Membranes are used in many different applications in which electrochemistry techniques act as the analytical signal readout or to fully tune ion transfer processes across the membrane. This symposium aims to bring together current studies involving membrane-based electrodes and also the use of ion exchange membranes for miscellaneous purposes. Thus, the scope of this symposium include (among others):

- Ion selective electrodes: fundaments and analytical applications
- Novel concepts involving ion exchange membranes
- Tuned ion transfer processes (in terms of selective receptors and the readout)
- Theoretical modelling of the working mechanism of membrane-based electrodes
- The exploration of new materials in membrane-based electrodes
- Water remediation processes
- Proton exchange membranes fuel cells and electrolyzers
- Healthcare and other applications
- Nanopore electrochemistry
- Biomembrane electrochemistry
- Electroanalysis based on microdialysis

Symposium Organizers

Maria Cuartero Botia (Coordinator), KTH Royal Institute of Technology, Sweden

Gaston Crespo, KTH Royal Institute of Technology, Sweden

Maria Assunta Navarra, Sapienza University of Rome, Italy

Guobao Xu, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

Valentin Mirčeski, Ss. Cyril and Methodious University, North Macedonia

Symposium 2

Nanomaterials in electroanalysis and nanoelectrochemical sensors

Sponsored by: Division 1, Analytical Electrochemistry

This Symposium would like to be a focus on recent advances in the use of nanomaterials in electroanalytical chemistry, to understand if the game (i.e. the effort and commitment for their preparation) is worth the candle (i.e. their unique properties yielding unforeseen interesting analytical performances).

The manufacturing effort includes not only the synthetic and functionalization work, but also the increasing use of electrochemical simulation to enhance nanoelectrochemical sensor device design and architecture definition prior to fabrication, which enable more autonomous systems for sensing applications in different fields, such as health, environment protection and agriculture.

Moreover, recent advances on lab-on-a-chip devices, single-use sensors, paper-based electrodes, wearable or smartphone-based electrochemical systems and multiplexed or orthogonal analysis with integrated spectroscopic analysis, will be developed.

Finally, the use of electroanalytical techniques for investigating the properties of nano-objects will be considered, particularly focusing on the impact of these materials on human health and environmental safety.

Symposium Organizers

Luigi Falciola (Coordinator), Università degli Studi di Milano, Italy

Alain Walcarius, Université de Lorraine, France James Rohan, University College Cork, Ireland Sotirios Sotiropoulos, Aristotle University of Thessaloniki, Greece

Biljana Šljukić, University of Belgrade, Serbia **Aleksandar Radu**, Keele University, UK



Electrochemical conversion of CO₂: Sensing, monitoring, mechanism and technological development

Sponsored by: Division 1, Analytical Electrochemistry Division 4, Electrochemical Materials Science Division 5, Electrochemical Process Engineering and Technology

This symposium aims to embrace all relevant (fundamental and technological) aspects of CO_2 capture and conversion to value-added chemicals. This symposium is co-organized by three of the ISE Divisions (1, 4 and 5) and is devoted to explore all different approaches provided by the electrochemistry in order to detect, monitor and mitigate the CO_2 accumulation, with the possibility to synthesize valuable products.

Contributions are welcome in, but not limited to, the following areas:

- Sensing of airborne CO₂, monitoring during its transformation upon application of any electrochemical technology.
- CO₂ conversion by homogeneous or heterogeneous catalysts in different solvent media, including ionic liquids.
- Mechanism studies, including reaction products and intermediates detection and quantification by spectroscopic and spectrometric techniques.
- Sustainable advanced electrodes including metals, alloys, semiconductors, metal-organic frameworks (MOFs), carbon-based and electrochemically synthesized materials.
- Reactor design for CO₂ electrolysis systems
- Technological application of CO₂ conversion processes and economic analysis

Symposium Organizers

Carlos M. Sánchez-Sánchez (Coordinator), Sorbonne Université, France

Tom Breugelmans, University of Antwerp, Belgium Ignacio Sirés Sadornil, University of Barcelona, Spain Nejc Hodnik, National Institute of Chemistry, Slovenia

Symposium 4

New Trends in Bioelectrochemistry

Sponsored by: Division 2, Bioelectrochemistry

The main symposium of division 2 will cover all aspects of bioelectrochemistry from basic investigations to different fields of application including photobioelectrochemistry. Studies of different biomolecules, biomimetica, cell compartments and whole cells will be described. New materials and material combinations will be covered as well as new developments in methodology and hyphenated techniques.

Topics, the symposium is focused on:

- Fundamental elucidation of electron / proton transfer pathways in biological systems
- Heterogeneous electron transfer at bioelectrodes
- Novel electrodes, materials and electrode arrays for biological systems
- Novel experimental and theoretical tools in bioelectrochemistry
- microelectrochemistry and study of biological systems
- Sensing of small molecules or biomolecules by means of biological recognition elements or modified electrodes including point-of-use sensing
- Energy conversion / storage including biofuel cells, photobioelectrodes, biobatteries, biocapacitors
- Electrosynthesis with biocatalyzed reactions and cascades and electrobiotechnology

Symposium Organizers

Fred Lisdat (Coordinator), Technical University Wildau, Germany

Nicolas Plumeré, Ruhr University Bochum, Germany Julea Butt, University of East Anglia in Norwich, UK Victor Constantin Diculescu, National Institute of Materials Physics, Romania







Coupling electrochemical and optical methods to study chemo- and bioobjects: light as sensor and actuator

Sponsored by: Division 2, Bioelectrochemistry Division 7, Physical Electrochemistry

In a sustainable economy, bio-objects and chemically modified interfaces attract increasing interest for applications including energetics, synthesis and sensing. This symposium will focus on coupling spectroscopic methods with electrochemical potential control for the study of bio-objects, biomimetic systems and electrochemical reactions covering the size range from macroscopic to the single-molecule level. With the focus on methods, the symposium will also include functional systems intended to be used for triggering reactions or sensing applications. Further, it will comprise fundamental studies on the influence of light on (bio)chemical reactions. This highly interdisciplinary topic aims at bringing together experts in bioelectrochemistry, electroanalysis, in situ microscopies (SECM, STM, AFM, light microscopy) and spectroscopic methods, as well as signal processing, technique development and image processing.

Topics may include, but are not limited to, the following:

- rationalisation of behaviour at bioelectrodes
- light-matter interactions at (bio)electrochemical interfaces
- spectroelectrochemistry
- electrochemiluminescence
- plasmonic effects on mechanisms and reaction rate
- new developments in sensor technologies
- integration of bio- and bioinspired objects with semiconductor structures
- single-molecule switching and dynamics.

Symposium Organizers

Elisabeth Lojou (Coordinator), CNRS, Aix Marseille University, France

Kylie Vincent, Oxford University, UK Stijn Mertens, Lancaster University, UK Priscilla G L Baker, University of the Western Cape, South Africa

Symposium 6

Advances in Microbial Electrochemistry for Energy Conversion, Biotransformation, Bioremediation and Electroanalysis

Sponsored by:

Division 2, Bioelectrochemistry Division 3, Electrochemical Energy Conversion and Storage-Division 1, Analytical Electrochemistry Division 4, Electrochemical Materials Science

This symposium covers key recent advances in electrochemical microbial research, from basic studies of microbial electrochemical systems to electrochemical technological applications including energy production, co-generation of chemicals and electricity and bioelectrosynthesis, recovery of environmental resources, wastewater treatment, food and agricultural analysis, and environmental monitoring. Electrochemical engineering contributing to improved bioelectrochemical cell/reactor designs and process control as applied to microbial electrochemical technology are also covered.

Topics the symposium focus on are:

- Fundamental studies of mechanisms of bacterial extracellular electron transfer reactions
- Bioengineering of bacteria to improve extracellular electron transfer
- New experimental and modeling strategies to address electrochemical processes in microbial electrochemical systems
- Environmental, food and agricultural electroanalysis with microbial systems
- Electrochemical detection of bacteria and biofilms
- Microbial energy conversion, production and storage devices, including microbial fuel cells, biosupercapacitors and batteries
- Microbial electrosynthesis and electrotransformation
- New electrodes materials and designs for microbial electrochemical systems

Symposium Organizers

Elena Ferapontova, (Coordinator), Aarhus University, Denmark

Lo Gorton, Lund University, Sweden Carlo Santoro, University of the West of England, UK Mathieu Etienne, Université de Lorraine, France Eileen Hao Yu, Newcastle University, UK Tanja Vidakovic-Koch, Max Planck Institute for Dynamics of Complex Technical Systems, Germany



Electrochemical capacitors: beyond double-layer storage

Sponsored by:

Division 3, Electrochemical Energy Conversion and Storage

The symposium will cover several aspects of electrochemical capacitors development, starting from fundamental aspects concerning the double-layer storage, pseudocapacitive effects and redox-related phenomena at electrode/electrolyte interface in protic and aprotic media. In this term, reports on novel concepts and novel chemistries for high-power and high-energy systems, falling into the scope of capacitive storage, are of symposium interest. The broad scope of this symposium welcomes contributions reporting on the materials, electrolytes and separators in electrochemical capacitors application. Apart from typical electrochemical reports, results on the electrolyte formulation, electrode fabrication and modeling studies are welcome. Since the long-term performance is one of the crucial aspects in electrochemical capacitors development, contributions providing insights into ageing aspects are also expected. Special attention will be focused on the rapidly growing subject of operando techniques in electrochemical capacitors characterization, providing new insights for understanding of capacitive and faradaic charge storage mechanisms.

Symposium Organizers

Sonia Dsoke (Coordinator), Helmholtz Institute Ulm & Institute for Applied Materials – Energy Storage Systems, Germany

Krzysztof Fic, Poznan University of Technology, Poland **Wataru Sugimoto**, Shinshu University, Japan **Zoran Mandić**, University of Zagreb, Croatia **Branimir Grgur**, University of Belgrade, Serbia

Symposium 8

Next Generation Batteries – S&T Challenges and Opportunities

Sponsored by: Division 3, Electrochemical Energy Conversion and Storage

Almost 30 years after the commercialization of the first Li-ion battery, the number of applications has rapidly increased and it appears that this technology is presently the only one simultaneously ensuring performance, cost, and safety demands. However, these needs are steadily increasing, which requires continuous advancements towards the existing and the development of new cell components and processing techniques – ideally based on the fundamental understanding of, e.g., the reactions occurring in the bulk and at the interface of the active material particles. These efforts include also the replacement of potentially critical elements, such as cobalt or lithium itself.

Accordingly, this symposium is devoted to recent advances in elucidating fundamental electrochemical mechanisms and reactions occurring in Li-ion and post-Li-ion battery chemistries as well as the development of optimized and new cell components. Studies, which are related to other (applied) aspects of batteries, including also innovative characterization techniques, are welcome as well.

Symposium Organizers

Dominic Bresser (Coordinator), Helmholtz Institute Ulm and Karlsruhe Institute of Technology, Germany **Robert Kostecki**, Lawrence Berkeley National Laboratory, USA

Miran Gaberšček, National Institute of Chemistry, Slovenia

Milica Vujković, University of Belgrade, Serbia



Fuel Cells and Electrolysis: Promising energy for the future

Sponsored by:

Division 3, Electrochemical Energy Conversion and Storage

This symposium covers fundamental and applied studies in the design of novel electrochemical interfaces that improve the efficiency of fuel production in electrolyzers and their utilization in fuel cells.

Specific topics as follows:

- New functional materials and cell components (e.g., electrocatalysts, ionomers, electrolyte membranes/ separators, gas diffusion layers, bipolar plates, etc.) for both low- and high-temperature applications.
- Novel electrocatalysts for oxygen reduction, electrooxidation of hydrogen and organic fuels, oxygen and hydrogen evolution.
- Electrolyte membrane/separators and ionomers for fuel cells, water electrolysis systems, and H₂O-CO2 co-electrolysis: synthesis and characterization of polymeric, ceramic, ionic liquid and nanocomposite systems.
- Improved understanding of electrochemical processes and new insights into the degradation of fuel cell and electrolyzer components in low- and high-temperature applications.
- Operando diagnostics and in situ characterization of fuel cells, water electrolysis systems, and H₂O-CO₂ co-electrolysis.
- Theoretical studies and computational modeling of functional materials and cell components.
- Novel materials for anion exchange membrane fuel cells, electrolyzers and H₂O-CO₂ co-electrolysis systems.
- Development of precious metal free catalysts and anion conductive membranes and ionomers. Understanding electrochemical reactions occurring under alkaline conditions

Symposium Organizers

Nenad Marković (Coordinator), Argonne National Lab, USA

Vojislav Stamenković, Argonne National Lab, USA Hamish Andrew Miller, CNR-ICCOM, Italy Milica Marčeta Kaninski, University of Belgrade, Serbia Frano Barbir, University of Split, Croatia





Electrochemical and electroless deposition: tailoring growth from monolayers and nanostructures to functional applications

Sponsored by:

Division 4, Electrochemical Materials Science

Various processes of electrochemical material growth are now available, capable to control composition, morphology, structure and thickness of a range of materials, from the monoatomic layer to the mm range. Surface methods utilize underpotential procedures, which could be utterly precise but are generally slow; in contrast, overpotential methods are faster but not as precise. This symposium aims to involve the "UPD community" and the "electroplaters" in a forum focused on bridging the gap between these two classes of materials. Contributions in the general areas of UPD, few atomic layers materials and thick films are welcome; however, we aim to concentrate the discussion on the gray area between the two, where novel concepts may be needed to enhance the quality of materials. *In particular, contributions are welcome, but not limited to:*

- Concepts and methods of few monolayer growth
- Two-dimensional materials
- Tailoring micro/nanostructure over length scales via voltage waveforms and/or additives
- Electrochemical synthesis in ionic liquid, novel media
- The origin of growth instability and methods to avoid them
- Electrodeposited alloys, compounds, oxide and chalcogenides
- Functional materials enabled by growth control

Symposium Organizers

Giovanni Zangari (Coordinator), University of Virginia, USA

Fu-Ming Wang, National Taiwan University of Science and Technology, Korea

Piotr Zabinski, AGH University of Science and Technology, Krakow, Poland

Nebojša Nikolić, University of Belgrade, Serbia

Symposium 11

Corrosion and corrosion protection strategies

Sponsored by: Division 4, Electrochemical Materials Science

This symposium includes all aspects of corrosion science and technology with a special focus on growth and characterization of passive films, anodic oxides and smart coatings for corrosion protection of metallic materials. It will cover both theoretical analysis and experimental investigations, including the modelling of the interface and the description of new techniques for the study of corrosion and coatings degradation.

Topics include but are not limited to:

- Corrosion Mechanisms, Methods, Modelling and Monitoring
- Passive Films: formation, chemistry, structure and properties
- Growth and characterization of chemically and electrochemically formed protective coatings
- Tribocorrosion: fundamentals, materials and prevention
- Electrodeposition for Corrosion and Wear Protection.
- In situ and ex situ characterization of surfaces and relationship between their structure and corrosion resistance
- Advanced electrochemical and analytical tools for assessing corrosion resistance and passive films.
- Passivity and corrosion of Steel in Concrete
- Corrosion studies for safeguard of Archaeological and Historical Artefacts
- Corrosion and corrosion protection of Biomaterials

Symposium Organizers

Vincent Vivier (Coordinator), Sorbonne University – Paris, France

Michele Curioni, University of Manchester, UK Emma Angelini, Politecnico di Torino, Italy Monica Santamaria, Università degli Studi di Palermo, Italy

Liana Muresan, Babeş-Bolyai University, Cluj-Napoca, Romania

Ingrid Milošev, Institut Jožef Stefan, Slovenia



Electrochemical Engineering for Environmentally Friendly Processing and Environmental Protection

Sponsored by:

Division 5, Electrochemical Process Engineering and Technology

Electrochemical engineering provides a platform for the introduction of green chemistry and sustainable processes for the chemical and biological industry. Sustainability of resources such as reduction in air emissions, energy consumption, and water consumption are key for sustainable manufacturing of chemicals and materials. Besides preventing new emissions to the environment, electrochemical technologies are also effective in existing pollutions abatement. This symposium will provide an international forum for the presentation and discussion of the most recent developments on the application of electrolysis and electrochemical processes in traditional chemical processes that had enabled and/or could lead to sustainable manufacturing and green chemistry. *Topics of interest include, but are not limited to*:

- New electrochemical technologies for water processing (treatment, reuse), materials synthesis and/or recycling.
- Electrokinetic soil remediation.

- Electrochemical technologies for air emission control and carbon dioxide utilization.
- Advanced sustainable electrode materials and structures.
- Life-cycle analysis demonstrating the impact of electrochemistry in sustainable manufacturing and/or green chemistry.
- Advanced cell and system design, including reactant and product flow, heat transfer, and stack level materials corrosion.
- Electrochemical performance and cell characterization.
- Development and optimization of the energy conversion and storage processes.
- Applications and economic analysis.
- Scale up demonstration of novel electrochemical processes.

Symposium Organizers

Gerardine Botte (Coordinator), Ohio University, USA Manuel Rodrigo, University de Castilla La Mancha, Spain Vladimir Panić, University of Belgrade Gyozo Lang, Eötvös Loránd University, Budapest, Hungary





Electrochemistry in the digital age: model-supported process analysis and design

Sponsored by: Division 5, Electrochemical Process Engineering and Technology Division 3, Electrochemical Energy Conversion and Storage

Division 7, Physical Electrochemistry

The 21st century is becoming a century of digitalization, where phenomena at surfaces up to industrial processes are analyzed via mathematical modeling, and where technologies are designed, optimized, and monitored with virtual tools. Electrochemical technologies entail intricate interactions and correlations at material to system level. In this realm, modeling provides crucial insights and tools to precipitate advances in materials properties and cell performance and interpret electrochemical measurement data. Also, the route from the discovery of electrochemical principles to highly performing systems and devices requires multiple informed choices, where model-assisted analyses and design play a role.

This symposium aims at discussing these aspects and surveying the recent progress in established or emerging modeling methods and approaches, ranging from computational chemistry and continuum or mean field models to hybrid and data driven methods. It will provide a forum for vibrant scientific exchange among electrochemical engineering, physical electrochemistry and various fields of application, such as in energy and sensor technologies.

Symposium Organizers

Ulrike Krewer (Coordinator), TU Braunschweig, Germany Michael Eikerling, Simon Fraser University, BC, Canada Adam Weber, Lawrence Berkeley National Lab, USA Igor Pašti, University of Belgrade, Serbia





Future of molecular electrochemistry

Sponsored by: Division 6, Molecular Electrochemistry

In recent years, there has been a tremendous resurgence in the field of electrochemical transformations at the molecular level, promoted inter alia, by the development and exploitment of new electrode materials, media, cell configurations and/or of new electrosynthetic strategies, affording new products or improved performances in terms e.g. of improved yield and/or selectivity, lower costs, simpler synthetic pathways and/ or better ecocompatibility; by the increasing need of understanding and rationalizing the electron transfer mechanisms involving complex electroactive organic, organometallic or coordination molecules or related materials to master and optimize their application in e.g. molecular electroanalysis, molecular electrocatalysis, molecular material science, molecular optoelectronics/ non-linear optics/chiroptics/spintronics, molecular (bio) energetics, molecular media (ionic liquid/liquid crystals/ DES...), as well as biology, pharmaceutics, and medicine. The Symposium devoted to the present and future of molecular electrochemistry will therefore cover a broad range of topics including, but not limited to

 fundamental investigations on the mechanisms of action or transformation of the above molecules or molecule materials, on their reactivity initiated by electron transfer and on the relationship between structure and redox properties.

- new tools, protocols and/or strategies for bond activation by ET for (electro)synthetic purposes:;
- investigation, also by application of combined techniques and combining experimental data with theoretical computantions, of the electronic features of complex molecules and molecular systems, dealing e.g. with issues like intramolecular electronic communication, multiple interacting redox centres, host-guest interactions, electrochromism, redox properties affected by conformation change, stereoelectrochemistry, enantioselectivity at electrochemical interphases, toelectrochemistry, etc.

Symposium Organizers

Patrizia Romana Mussini (Coordinator), Universita degli Studi di Milano, Italy Marília Oliveira Fonseca Goulart, Universidade Federal de Alagoas, Brazil Jiří Ludvík, J. Heyrovský Institute, Czech Republic







When Molecular Electrochemistry Meets Luminescence: from Fundamentals to Analytical Applications

Sponsored by: Division 6, Molecular Electrochemistry Division 1, Analytical Electrochemistry

In recent years, the combination of molecular electrochemistry and luminescence has begun to show significant potential for the development of new superior analytical strategies. Accordingly, this symposium will address fundamental aspects, recent developments and (bio)analytical applications of redox molecules (organic, organometallic, coordination compounds) possessing luminescent properties. This symposium will cover a broad range of topics including, but not limited to: electrofluorochromism, electrogenerated chemiluminescence (ECL), new molecular luminophores, mechanistic investigations, the development of new enabling instrumentation for coupling of electrochemistry and luminescence, simulation and theoretical aspects of related phenomena, sensors and biosensors based on electrochemistry and luminescence. The purpose of this symposium is thus to bring together the leading scientists working in all these aspects, in order to stimulate intensive discussion initiate/improve collaborations. and

Symposium Organizers

Olivier Buriez (Coordinator), Ecole Normale Supérieure de Paris, France

Guobao Xu, Chinese Academy of Science, China Conor Hogan, La Trobe University, Australia Neso Sojic, Université de Bordeaux, France Rastko Vasilić, University of Belgrade, Serbia



Two-Dimensional Materials: An Electrochemical Perspective

Sponsored by: Division 7, Physical Electrochemistry Division 4, Electrochemical Materials Science

Two-dimensional (2D) materials possess a range of unique properties that represent the ultimate limit for a range of known phenomena and existing applications, and present opportunities for new disruptive technologies. Realisation of these opportunities requires a fundamental-level understanding of the electrochemical fabrication, responses, performance and applications of these materials. This symposium seeks to deliver these and to point the way forward to intellectual insights of importance for both the scientific and industrial communities. The symposium will cover recent advances in physical and interfacial aspects of 2D material electrochemistry, including:

- Electrochemical charge transfers at 2D material interfaces
- Electrochemical in-situ probes at 2D material interfaces
- Transport through 2D materials
- Reaction in confined environments within 2D materials
- 2D heterostructural and (electro)chemical properties
- Engineering 2D materials for electrochemical applications
- Novel 2D crystal-based electrochemical devices

Symposium Organizers

Robert Hillman (Coordinator), University of Leicester, UK Shen Ye, Tohoku University, Sendai, Miyagi, Japan Nakkiran Arulmozhi, Leiden University, The Netherland Csaba Janaky, University of Szeged, Hungary

Symposium 17

Electroactive materials: polymers, inorganic solids, nanocomposites and hybrid materials

Sponsored by: Division 4, Electrochemical Materials Science

The symposium is designed to cover an extensive area of various electroactive materials and composites of electrochemical interest, including conducting/ conjugated/redox polymers, mixed electron-ion inorganic conductors, mixed-valence inorganic solids, lithium-ion intercalation materials, various electroactive composite materials, etc. Both their synthesis and applications will be among topics of this symposium. Special accent will be made on original concepts for the generation of electroactive materials, on systems possessing unusual properties, on their advanced applications in molecular electrochemistry, electroanalysis, (electro)catalysis, (bio) sensors, actuators, drug delivery, energy storage and electrochromic devices, solar energy conversion, microand nanoelectronics, radical scavenging, corrosion protection, etc., as well as on the relationships between their structure, properties and performance in applications.

Symposium Organizers

Marijana Kraljić Roković (Coordinator), Faculty of Chemical Engineering and Technology, Zagreb, Croatia Mikhail A. Vorotyntsev, M. V. Lomonosov Moscow State University, Russia and University of Burgundy and Franche-Compte, Dijon, France Jürgen Heinze, University of Freiburg, Institute for Physical Chemistry, Freiburg, Germany Gordana Ćirić-Marjanović, University of Belgrade, Serbia





Nanoelectrochemistry and electrocatalysis – from fundamentals to applications

Sponsored by:

Division 1, Analytical Electrochemistry Division 7, Physical Electrochemistry Division 2, Bioelectrochemistry Division 3, Electrochemical Energy Conversion and Storage Division 4, Electrochemical Materials Science

Reactions at complex real systems in sensing, energy conversion and others are characterized by significant heterogeneity. Their properties cannot be resolved accurately when averaging techniques are applied. One way to circumvent this problem is to model the real system by idealized systems, as is e.g. done when single crystal surfaces are used, which also can by methods developed in surface science, like STM. The other option is the utilization of nanoelectrodes or nanoarchitectures enabling electrochemical analysis across different scales in both size and concentration, even down to nanometer scales and the single entity level. The same methods can be applied to study living systems, which are inherently heterogeneous and elucidate this diversity down to the level of individual cells. To even further characterize and understand these complex systems it is often required to apply orthogonal analytical methods, including scanning electrochemical, super resolution and electron microscopy. The symposium covers the entire spectrum of electrocatalytic reactions, nanosensors, nanoelectrode fabrication, spatially resolved measurements and theoretical work. The organizers wish to bring together researchers working on fundamental model systems for fuel cells, electrolyzers, metal-air batteries and artificial photosynthesis including nanoelectrochemical techniques for sensing, electrocatalysis, materials science, and biology and theoretical description thereof.

Topics of interest include, but are not limited to, fundamental research on:

- Electrocatalysis of oxygen, nitrogen, carbon, chloride, as well as oxidation and hydrogenation of small organic molecules
- Electrocatalytic reactions in aqueous and non-aqueous electrolytes, ionic liquids and water in salt.
- Electrocatalyst materials such as metals, oxides, nitrides, phosphides, chalcogenides comprising nanoparticles, nanostructures or single crystals
- Bio-inspired electrocatalysts with relevance to artificial photosynthesis
- Mechanistic studies, property-activity relationships, property-selectivity relationships and property-stability relationships
- Combined electrocatalytic and spectroscopic studies
- Theoretical work on all time and length scales
- Sensor design and simulation to enhance sensitivity, improve selectivity and/or gain greater stability
- Novel device fabrication methodologies and materials for sensing applications
- Electrochemical surface imaging techniques and combinations with other methods
- Investigation of biological objects down to single entities

Symposium Organizers

Marcel Risch (Coordinator), Helmholtz Center for Materials and Energy, Germany Paolo Actis, University of Leeds, UK Helmut Baltruschat, University of Bonn, Germany Symeon Bebelis, University of Patras, Greece Annamaria Miko, Koç University, Turkey James Rohan, Tyndall National Institute, Ireland Kristina Tschulik, Ruhr-University Bochum, Germany



Electrochemical surface and interface

Sponsored by: Division 7, Physical Electrochemistry

Developing a complete atomistic picture on the complex interrelation between charge transfer, chemical conversion and interfacial potential in the presence of an electrolyte is one of the most imminent challenges in electrochemistry. At the same time, understanding the electrochemical interface at the atomic and molecular level is crucial for the design of new materials and optimization of electrochemical processes. This symposium will provide an interdisciplinary forum to discuss recent developments in experimental and theoretical electrochemistry that aim at a fundamental understanding of interface phenomena relevant for energy conversion and storage, chemical electrosynthesis and material preparation. It will provide a platform, for both electrochemistry and surface science community, to present and debate different key fundamental areas of electrochemical surface science. Main topics will be: structure-reactivity and structure-selectivity relationships, reaction mechanisms and kinetics, adsorption processes, new methods for imaging the electrochemical interface and reactive species, theoretical models and calculations, solvents and electrolyte effects, synthesis and characterization of new materials from thin-films to nanostructures.

Symposium Organizers

Paramaconi Rodriguez, (Coordinator), University of Birmingham, UK **Enrique Herrero**, University of Alicante, Spain

Katrin Domke, Max Planck Institute for Polymer Research, Germany

Julia Kunze-Liebhäuser, University of Innsbruck, Austria Natasa Vasiljević, University of Bristol, UK Daria Vladikova, Institute of Electrochemistry and

Energy Systems – BAS, Bulgaria

Symposium 20

Cutting Edge Electrochemical Measurement Techniques

Sponsored by: New topics division Division 1, Analytical Electrochemistry Division 2, Bioelectrochemistry Division 3, Electrochemical Energy Conversion and Storage Division 7, Physical Electrochemistry

Precision measurements and advanced characterization techniques are critically important in understanding electrochemical processes at the interfaces or within the bulk of materials. Cutting edge measurement and characterization tools are being developed and incorporated in electrochemical researches. This symposium aims at providing a merging discussion forum for advanced measurement techniques and various scientific problems across subfields of electrochemistry. The goal of the symposium is to promote cross-disciplinary exchange of ideas to inspire and fuel future electrochemical research with advanced measurement and characterization tools. The scope of the symposium includes the following advanced in situ or in-operando characterization techniques applied for studying electrochemical systems and processes related to health, energy, environment, etc.:

- Novel electrochemical techniques
- Scanning probe microscopies
- Electron microscopies
- Lab-based spectroscopies
- Synchrotron-based techniques
- Neutron-based techniques
- Free electron laser-based techniques
- Other advanced techniques for precision measurements

Symposium Organizers

Liwei Chen, (Coordinator), Shanghai Jiaotong University, China Bin Ren, Xiamen University, China Olaf Magnussen, Kiel University, Germany Alexandre Bastos, University of Aveiro, Portugal Jose Solla-Gullon, University. of Alicante, Spain

Education and transmission of knowledge from the past to the new generations of electrochemists

Sponsored by: All Divisions

After successful symposia on education during previous ISE annual meetings held recently in Mexico (2013) and the USA (2017), the objective of this Symposium is a transmission of knowledge from prominent electrochemists (chosen as key note and/or invited lecturers), having large experimental and theoretical background, to new generations of electrochemists.

Following O'Mara Bockris's sentence: "Looking back to look forward", particular ambition of this symposium is to obtain a better perspective on future efforts in electrochemical education, research and applications.

The symposium topics cover, but are not limited to:

- "Looking back to look forward" Transfer of knowledge from prominent electrochemists to the coming generations of electrochemists.
- Teaching Electrochemistry in the frame of General Chemistry course what to offer?
- Teaching Electrochemistry in the frame of physical chemistry course what to offer?
- Creation of electrochemistry courses for different levels of studying - what students know when they enter and what they need to know to complete the course.

- From general to highly specialized courses in electrochemistry
- New teaching tools in electrochemistry education.
- Concepts and strategies in electrochemical education.
- Experience in teaching and examination Effect of adopted knowledge.
- The importance of experiments in teaching electrochemistry.
- Combining teaching transport phenomena, chemical catalysis (homogenous and heterogenous) and chemical reactors design with electrochemistry and electrochemical engineering.
- Electrochemical education of engineers and scientistswhat is the difference?
- Combining Electrochemistry and Computational Chemistry
- Modeling Electrochemical Reactions Using Density Functional Calculations

Symposium Organizers

Christos Comninellis, (Coordinator), EPFL, Switzerland Hasuck Kim, Seoul National University, Korea Velizar Stanković, University of Belgrade, Serbia Aleksandar Zeradjanin, University of Bremen, Germany Laszlo Peter, Hungarian Academy of Sciences, Hungary





Symposium 22 General Session

Sponsored by: All Divisions

This Symposium will cover all ISE areas not compatible with topical symposia.

Symposium Organizers

Jun Chen (Coordinator), Nankai University, China Woonsup Shin, Sogang University, South Korea Jelena Lović, University of Belgrade, Serbia Vladislava Jovanović, University of Belgrade, Serbia





Important Dates and Deadlines

Abstract submission opening date: **December 2019** Deadline for abstract submission: **20 March 2020** Conference begins: **2 September 2020**

71st Annual Meeting of the International Society of Electrochemistry

30 August - 4 September 2020 Belgrade, Serbia

Call for Papers

Authors are invited to submit a one page abstract in English. Abstracts must be submitted online through the ISE website. The site will be opened for abstract submission in **December 2019**. The closing date for abstract submission will be **20 March 2020**.

Electrochimica Acta

A special issue of the Society's journal, Electrochimica Acta, is planned based on selected original contributions made at the conference. Selection will be made by an international Editorial Committee comprising a Guest Editor for each Symposium, appointed and co-ordinated by the Special Issues Editor, Sergio Trasatti.

General Information

Venue

The Sava Conference Center has 16 meeting rooms and is one of the largest conference centers in the South East Europe region. Being conveniently located in the heart of the New Belgrade business district, just 15 minutes from Belgrade Airport and just 5 minutes from the city center, its prime location guarantees easy access to the city, in the beautiful area surrounded by two rivers. It is directly connected to Crowne Plaza Hotel, which enables comfortable accommodation for a large number of participants. Belgrade is one of the oldest cities in Europe. During its 7000 year long history, it has been at the crossroads between East and West. The city's most prominent landmark is the Belgrade Fortress-Kalemegdan, ovelooking the confluence of the Sava into the Danube. Other popular sights in Belgrade include Knez Mihailova Street, the House of the National Assembly of Serbia, Niikola Tesla's Museum, City Hall, "Beli Dvor" (former Royal Court), "Konak Kneza Miloša" and "Konak Kneginje Ljubice" (former Residences of Prince Miloš and Princess Ljubica), "Kapetan-Mišino Zdanje" - the Main Building of the University of Belgrade, the Church of St. Sava, the Bohemian guarter of Skadarlija, the Ada Ciganlija lake - recreational zone with beaches and sports facilities. Excellent food, good wine, and vibrant nightlife are all available in Belgrade.

Accommodation

Belgrade offers a wide range of different category hotels. A lot of 3* to 5* hotels are located within a 3 km radius from the meeting venue. High quality comfortable and reasonably priced accommodation, in several hundred private rental apartments and categorized hostels, is also available.

Climate

The climate in Serbia is moderate continental, with four seasons. Summer in Belgrade is very pleasant with sunny and warm periods. The average day time temperature during late August and September ranges from 17°C to 27°C. High temperatures (above 30°C) during this period are not uncommon.

Travel

Belgrade is easily accessible by plane, train or car. Nikola Tesla international airport represents the main gate to Serbia, located only 15 minutes from the meeting venue and the city center. It is directly connected to many European capitals and several intercontinental destinations. Serbia has one of the most liberal visa polices in Europe, enabling participants from EU and non-EU countries (including USA, China and Russia) to attend the ISE Annual Meeting without any visa procedures or additional costs.



https://annual71.ise-online.org e-mail: events@ise-online.org