

Report on Division 3 Activities from September 2019 to July 2020

There are currently 1506 active members of Division 3 from Europe, Asia, North and South Americas, Africa and Oceania. Division 3 is the second largest Division after Division 4 in the International Society of Electrochemistry (total 3466 members).

1) Division Officers for 2019-2020 term:

Chair: **Francesca Soavi** (Italy)

Past Chair: **Robert Kosteki** (USA) replaced by Stefano Passerini (Germany)

Chair Elect: **Andrea Balducci** (Germany)

Vice- Chairs: **Kiyoshi Kanamura** (Japan), **Clara Santato** (Canada)

As it concerns the next 2021-2023 term, D3 proposes the following D3 Chair Elect candidates

- Prof Clara Santato (Polytechnique Montreal, Canada)
- Prof. Thierry Brousse (University of Nantes, France)

and is appointing the Vice Chairs:

- Sonia Dsoke, Helmholtz Institute Ulm & Institute for Applied Materials – Energy Storage Systems, Germany
- Wataru Sugimoto, Shinshu University, Japan

2) Annual Meetings

71st ISE Annual Meeting – On line, Belgrade, Serbia, 31st August-4th September, 2020. Division 3 is sponsoring the following symposia:

Symposium 6: Advances in Microbial Electrochemistry for Energy Conversion, Biotransformation, Bioremediation and Electroanalysis

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

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 bio Ims
- 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 7: Electrochemical capacitors: beyond double-layer storage

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

The symposium covers 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 8

Next Generation Batteries – S&T Challenges and Opportunities

Organizers:

Dominic Bresser (Coordinator), Helmholtz Institute Ulm and Karlsruhe Institute of Technology, Germany (dominic.bresser@kit.edu)

Robert Kostecki, Lawrence Berkeley National Laboratory, USA

Miran Gaberšček, National Institute of Chemistry, Slovenia

Milica Vujković, University of Belgrade, Serbia

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 9: Fuel Cells and Electrolysis: Promising energy for the future

Organizers:

Nenad Marković (Coordinator), Argonne National Lab, USA (nmmarkovic@anl.gov)

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

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, electro-oxidation 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 13: Electrochemistry in the digital age: model-supported process analysis and design

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

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 18: Nanoelectrochemistry and electrocatalysis – from fundamentals to applications

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
Kristina Tschulik, Ruhr-University Bochum, Germany
James Rohan, Tyndall National Institute, Ireland
Kristina Tschulik, Ruhr-University Bochum, Germany

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 be 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 20: Cutting Edge Electrochemical Measurement Techniques

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

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 sub fields 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 21: Education and transmission of knowledge from the past to the new generations of electrochemists

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

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 electro- chemical 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 scientists- what is the difference?
- Combining Electrochemistry and Computational Chemistry
- Modeling Electrochemical Reactions Using Density Functional Calculations

Symposium 22(General Section, All Divisions) General Session

Organizers:

Jun Chen (Coordinator), Nankai University, China (chenabc@nankai.edu.cn)
 Woonup Shin, Sogang University, South Korea
 Jelena Lović, University of Belgrade, Serbia
 Vladislava Jovanović, University of Belgrade, Serbia

This Symposium covers all ISE areas not compatible with topical symposia

3) Topical Meetings

Division 3 supported and co-organized the 2020 ISE Topical Meeting **Electrochemical Deposition for Semiconductor and Green Energy** that was planned on 29 March -1 April 2020 Tainan, Taiwan but that has been cancelled due to the Covid-19 emergency.

Indeed, on 30th January 2020, the International Health Regulations Emergency Committee of the WHO agreed that the Novel Corona Virus (2019-NCOV) outbreak met the criteria for a 'Public Health Emergency of International Concern'. The WHO classified the Regional Risk level as 'High' (Situation Report 21, 10th February 2020*).

Therefore, the ISE had the duty of care towards its members and the wider electrochemistry community, and the ISE Executive Committee and the Local Organising Committee with deep regret, given the circumstances, collectively decided to cancel the 26th ISE Topical Meeting in Tainan, Taiwan,

The ISE Executive Committee did not take this decision lightly and decided to offer participants full refund of the registration fees, where applicable (this process can unfortunately take up a few weeks).

4) Sponsored Meetings:

ISE Division 3 supports academic events, which are aligned with ISE mission and relevant to Division 3 science and technology areas of interest in electrochemical energy conversion and storage. Financial support is primarily dedicated to the sponsorship of Student Poster Awards.

In 2019, since the last 70th AM in Durban, Division 3 sponsored the following meetings:

- **Waste-Water-Energy as Resource for a Sustainable Future**, 07-09 August 2019, Durban South-Africa (Patronage)
- **Advanced Batteries, Accumulators and Fuel Cells (ABAF-20)**, 25-28 August 2019, Brno, Czech Republic
- **6th International Conference on Advanced Capacitors**, 8-12 September 2019, Ueda, Japan
- **Electrolysis and Fuel Cell Discussions – Towards Catalysts free of Critical Raw Materials for Fuel Cells and Electrolysers**, 15-18 September 2019, La Grande Motte, France
- **Symposium on Insights into Gas Diffusion Electrodes: From Fundamentals to Industrial Applications**, 23-25 September 2019, Magdeburg, Germany
- **12th International Symposium of Advanced Lithium Batteries for Automobile Applications (ABAA 12)**, 6-9 October 2019, Ulm, Germany

In 2020 Division 3 has sponsored the following meetings:

- **BioFuel20. Bio-hybrid approaches to solar energy conversion: the bio-material interface**, 19-23 October 2020, Barcelona, Spain
- **Current Trends in Electrochemistry**, 30 June - 03 July 2020, Paris, France
- **Hydrogen Days 2020**, 24-26 March 2021, Prague, Czech Republic.

5) Division Poster Awards

The Division sponsored Student Poster Awards at the ISE-sponsored conferences listed above.

7) Scientific Meetings Committee

The annual SMC in Lausanne was cancelled due to the Covid-19 emergency. Francesca Soavi will attend the On-line SMC meeting on next 27th August 2020

8) Contribution to *Electrochimica Acta* Special Issues

Electrochimica Acta Special Issue containing selected papers presented at the 71st ISE Annual Meeting, Belgrade, Serbia is planned. Suggested Guest Editors for Division 3 sponsored symposia (7, 8, and 9) are:

Symposium 7: Sonia Dsoke

Symposium 8: Dominic Bresser

Symposium 9: Nenad Marković

Francesca Soavi
(on behalf of ISE Division 3)
09/07/2020