MATSUS

Materials for Sustainable Development Conference

MATSUS Fall 2023 Torremolinos, Spain
16th - 20th October, 2023 **#MATSUS23**

PROGRAM

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What is MATSUS and what to expect?

#MATSUS23 operates as part of a broader initiative under the name MATSUS (Materials for Sustainable Development Conference), which hosts two annual editions: Spring Meeting and Fall Meeting. Attendees can expect a diverse range of discussions, insights, and innovations aimed at advancing sustainable solutions for fostering collaboration among experts in the field of materials science and technology.

This conference offers a unique blend of symposia encompassing both fundamental and multidisciplinary scientific topics, as well as applied symposia with a specific focus on Sustainable Development. Delving into traditional topics, including Halide Perovskites, Organic Photovoltaics, Solar Fuels, Nanocrystals & 2D materials, Catalysis & Electrocatalysis, and Energy Storage. But also introducing exciting new subjects such as Organic Mixed Ionic Electronic Conductors, Bioelectronics, and Biobased Functional Materials.

Eleni Stavrinidou
Linköping University, SE

Sascha Feldmann
Harvard University, US

Ifan Stephens
Imperial College London, UK

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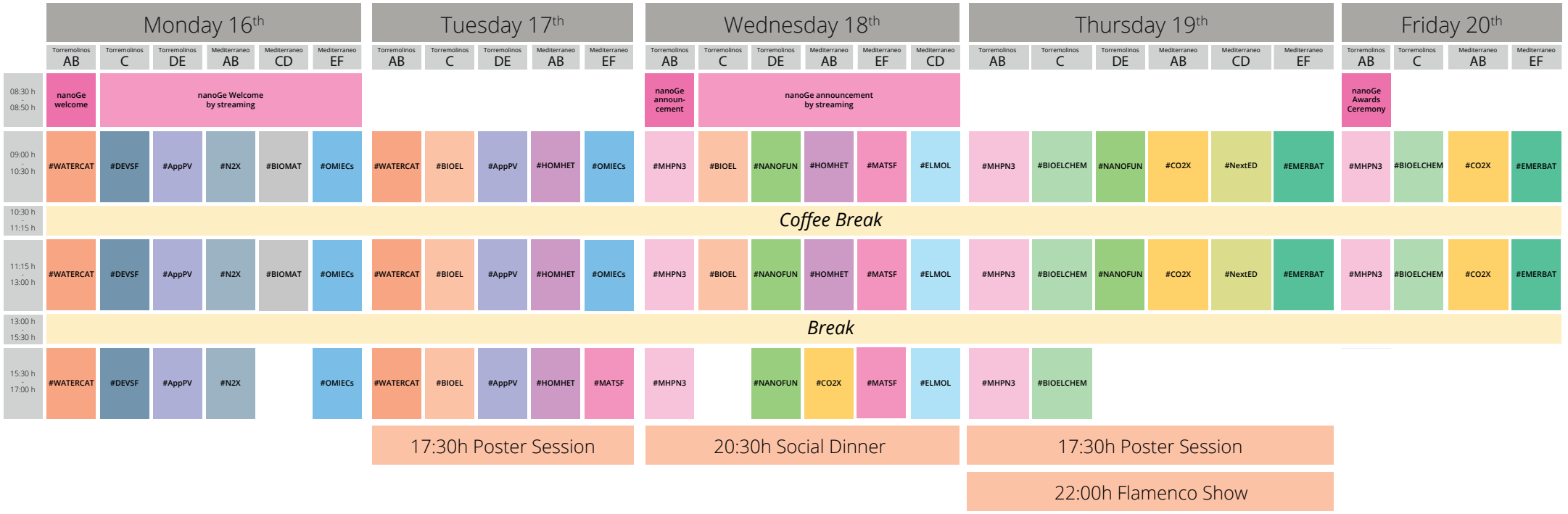
Schedule at a glance:

nanoge.org/MATSUS23



- **WATERCAT** - Experiment and Theory in the Catalysis of Water Electrolysis and Hydrogen Fuel Cells
- **DEVSF** - Solar Fuels: Moving from Materials to Devices
- **AppPV** - Application Targets for Next Generation Photovoltaics
- **N2X** - Recent Advances on Nitrogen Activation and Conversion
- **BIOMAT** Next Generation Bio-hybrid, Bio-inspired and Bio-enabled Materials
- **OMIECs** Fundamentals of Mixed Ionic-electronic Transport in Polymers
- **BIOEL** Bioelectronics
- **HOMHET** - Bridging The Gap Between Homogeneous and Heterogeneous (Photo)-Electrocatalysis
- **MATSF** Advanced Materials for the Production of Direct Solar driven Fuels and Chemicals
- **MHPN3** Fundamental Advances in Metal Halide Perovskites and Beyond: New Materials, New Mechanisms, and New Challenges
- **NANOFUN** - Functional Nanomaterials: from Optoelectronics to bio - and Quantum Applications
- **CO2X** - Frontier Developments in Electrochemical CO2 Reduction and the Utilization
- **ELMOL** - The Future of Molecular Electronics
- **BIOELCHEM** - Bioelectrochemical Systems from Sustainable Electrode Materials
- **EMERBAT** - Emerging Battery Technologies

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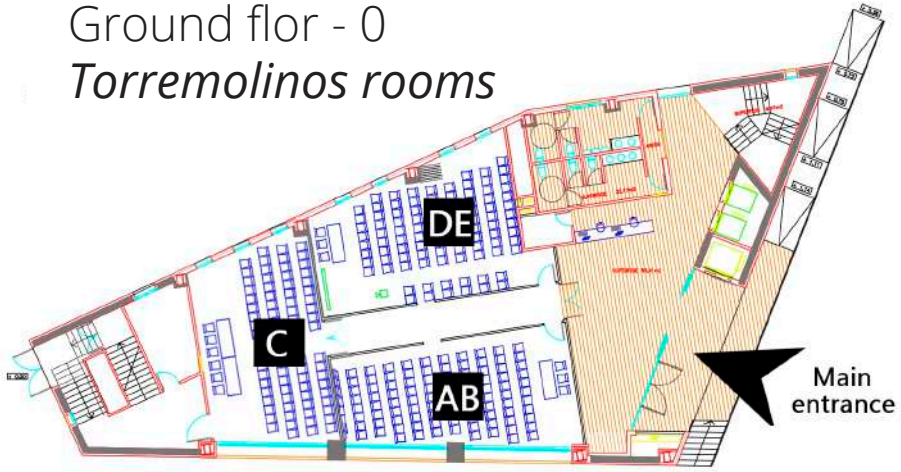
Venue. Where can I find my session?

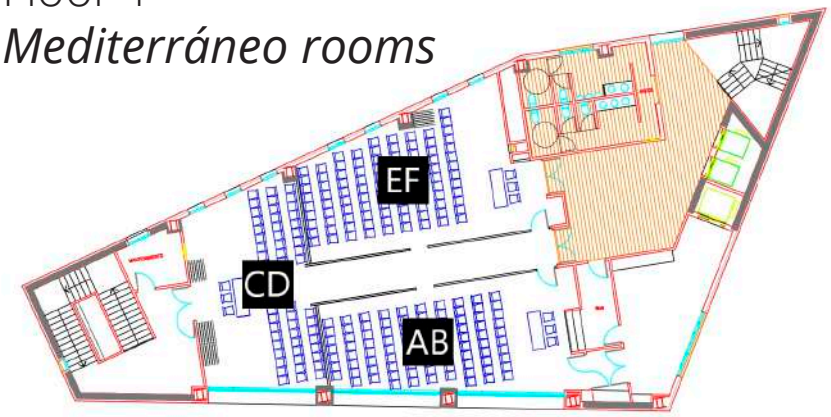
Ground flor - 0

Torremolinos rooms



Floor 1

Mediterráneo rooms



#WATERCAT - Experiment and Theory in the Catalysis of Water Electrolysis and Hydrogen Fuel Cells

Days: Monday Oct 16th & Tuesday Oct 17th.

Click here to view the program

Symposium Organizers: Serhiy Cherevko, Nejc Hodnik.

Invited Speakers: Virgil Andrei, Aliaksandr Bandarenka, Sara Cavaliere, Chang Hyuck Choi, Jakub Drnec, Max Garcia-Melchor, Felix Gunkel, Juan Herranz, Jasna Jankovic, Alex Martinez, Reshma Rao.

Description:

The transition to sustainable energy is a pressing challenge facing society, which can be addressed through the use of energy conversion technologies such as water electrolysis and hydrogen fuel cells. However, these technologies are limited by the lack of optimal electrocatalysts that are active, stable, selective, and abundant. To address this issue, several research directions have emerged in recent years: (i) fundamental research on well-defined systems combining advanced theoretical methods and operando experimental techniques, aiming at the knowledge-driven design of improved materials; (ii) automation of materials synthesis, characterization, and performance evaluation to identify promising candidates through fast screening of material libraries; (iii) electrochemical engineering ensuring optimized conditions for electrocatalysts utilization. This symposium brings together researchers working on these approaches to unite efforts and accelerate the discovery and implementation of heterogeneous electrocatalysts for energy conversion processes in the absence of light.

#DEVSF - Solar Fuels: Moving from Materials to Devices

Days: Monday Oct 16th.

Click here to view the program

Symposium Organizers: Franky Esteban Bedoya Lora, Anna Hankin, Camilo A. Mesa.

Invited Speakers: Fatwa Abdi, Anja Bieberle-Hütter, Serhiy Cherevko, Daniel Grave, Núria López, Flavio Leandro de Souza.

Description:

The abundance of solar energy on Earth and the natural photosynthesis in plants has motivated extensive worldwide research into photon capture by synthetic materials and conversion into storable fuels. This remains focused largely on the development of materials for solar fuel production that are: (i) efficient in converting photons to chemical product(s), (ii) inexpensive to fabricate and (iii) robust. However, despite substantial progress in material development, the question 'How might an industrial scale, efficient photoelectrochemical reactor system ultimately look?' still remains unanswered. This will remain so until the performance, durability and cost of scalable reactor demonstration units are understood from the atomic to the industrial scale, via modelling, design, fabrication and characterisation. Development of up-scaled reactors is a multidisciplinary challenge, involving material science, (photo)electrochemistry, electrochemical engineering and optics, supplemented by numerical modelling of the complete system to guide its design and optimisation. These many considerations need to be addressed simultaneously and will be the focus of this symposium.

#AppPV - Application Targets for Next Generation Photovoltaics

Days: Monday Oct 16th & Tuesday Oct 17th.

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Symposium Organizers: Ardalan Armin, Marina Freitag, Michael Saliba.

Invited Speakers: Harald W. Ade, Clara Aranda Alonso, Jonas Bergqvist, Gregory Burwell, Rene Janssen, Jenny Nelson, Monika Rai, Frédéric Sauvage, Tao Wang, Christian Wolff.

Description:

The research progress of the past ten years in the field of organic and hybrid photovoltaics is marked by important breakthroughs towards their use for a sustainable future. Relentless research endeavours helped to achieve high efficiencies in outdoor and indoor environments. This potential is now underpinned by impressive laboratory-scale efficiencies, for example 18% for organic solar cells and > 25% for perovskites, achieved by sophisticated molecular engineering and a deep understanding of charge generation and voltage loss mechanisms. Thus it is now time to drive these technologies into market adoption and to consider 'application targets' such as indoor light-harvesting for internet of things (IoT) or space solar cells, that are opportune platforms to enable adoption. This symposium endeavours to gather leading experts in academia and industries from around the world aiming to identify and describe application targets for next-generation photovoltaic devices. In this regard, the symposium will particularly focus on areas such as state-of-the-art materials for photoactive layers and ancillary components, new material processing and device fabrication techniques, device engineering, characterization and simulation, differences in device physics between standard solar illumination, and more bespoke conditions such as indoor lighting, and cost evaluation of technologically relevant 'whole systems'.

#N2X - Recent Advances on Nitrogen Activation and Conversion

Days: Monday Oct 16th.

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Symposium Organizers: Victor Mougel, Nella Vargas Barbosa, Ronald Marschall.

Invited Speakers: Alexander Bagger, Ib Chorkendorff, Nicolay Kornienko, Sven Schneider, Alexandr Simonov.

Description:

The activation and conversion of nitrogen containing molecules (N2, NOx, NO3-) to valuable ammonia and other reduced products at temperatures and pressures lower than the benchmark Haber-Bosch process remains a challenge. However, the field of nitrogen compound reduction has made impressive strides over the last five years. Novel promising approaches, both homogeneous and heterogeneous, have been demonstrated and international collaborations are pushing the field towards standardization of data reporting and benchmarking protocols. As this research community continues to grow, it is imperative that we provide a forum to present and discuss the path forward. This symposium will bring experimentalists, theoreticians, and engineers together for in-depth discussions on state-of-the-art product quantification methods and catalytic systems. Moreover, we hope to include various perspectives of researchers that are now taking their N2X know-how and started their own companies (Atmonia & Nitricity) as part of a special panel discussion session. The Poster session will provide the younger generation of scientists the opportunity to network, exchange ideas and perhaps establish new collaborations that will increase the momentum in the field of nitrogen reduction.

#BIOMAT – Next Generation Bio-hybrid, Bio-inspired and Bio-enable Materials

Days: Monday Oct 16th.

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Symposium Organizers: Giuseppe Maria Paternò, Vito Vurro.

Invited Speakers: Herdeline Ardona, Ardemis Boghossian, Francesco Lodola, Alberto Scaccabarozzi, Lorenzo Vannozzi.

Description:

Nature has developed and optimized efficient process to promote energy generation, storage, motion and growth. Recently, scientific community from different fields are interested in exploiting and/or mimicking these naturally available structures and functionalities, for instance by interfacing them with exogenous materials. The realization of new biotic/abiotic interfaces enable several applications depending on the chosen abiotic counterpart, ranging from bioengineering, photonics, power generation and biological function restoration. The scope of this highly interdisciplinary symposium is to provide a venue for open discussion on the field of bio-hybrid, bio-inspired and bio-enabled materials. In particular, the symposium aims to cover the bridge between different scientific approaches, to overcome existing challenges, and to enable the development of next-generation materials, devices and applications.

#OMIECs - Fundamentals of mixed ionic-electronic transport in polymers

Days: Monday Oct 16th & Tuesday Oct 17th.

Click here to view the program

Symposium Organizers: Derya Baran, Simone Fabiano.

Invited Speakers: Natalie Banerji, David Beljonne, Gabriel Gomila, Laure Kayser, Scott Keene, Karl Leo, Wei Lin Leong, Sabine Ludwigs, Christian Müller, Jenny Nelson, Jonathan Rivnay.

Description:

Organic mixed ionic-electronic conductors can simultaneously transport ionic and electronic charges, thus enabling exciting new opportunities for energy harvesting and storage and bio-/opto-electronic applications. This symposium aims to provide a forum for discussing interdisciplinary research in organic ionic, electronic, and mixed ionic-electronic conductors. The emphasis of this symposium will be on the following:

1. Provide a theoretical framework for the wide range of ionic, electronic, and mixed ionic-electronic transport processes in organic conductors.
2. Understand the fundamental mechanisms of electrical (molecular) and electrochemical doping.
3. Explore the impact of chemical functionality, (macro)molecular structure, and film morphology on ionic, electronic, and mixed ionic-electronic transport.
4. Discuss the challenges and opportunities for in-operando characterization of organic mixed ionic-electronic conductors, including spectroscopy, scattering, microbalance, microprobe, and electron microscopy.

#BIOEL – Bioelectronics

Days: Tuesday Oct 17th & Wednesday Oct 18th.

Click here to view the program

Symposium Organizers: Christopher Proctor, Francesco Santoro, Achilleas Savva.

Invited Speakers: Husam Alshareef, Maria Rosa Antognazza, Maria Asplund, Tiago Costa, Shery Huang, Andreas Offenhäusser, Janire Saez, Rainer Schindl, Georgios Spyropoulos, Xenofon Strakosas, Christina Tringides, Bernhard Wolfrum.

Description:

Bioelectronic systems have recently shown unprecedented potential for developing therapies as well as new diagnostic tools for healthcare. These systems target to controlling cellular activity by delivering local electrical cues, or to sensing bioelectrical signals induced by biological events. Within this multi-disciplinary symposium, we aim to bridge the gap between biology, engineering, and materials science to promote a holistic overview on bioelectronic systems for therapeutic and diagnostics. We aim to bringing together researchers with diverse expertise across various fields, and from around the world, to share their knowledge on bioelectronic systems for a wide range of applications in biology, disease treatment and diagnosis. We hope that this symposium will serve as a comprehensive reference of the state-of-the-art of the field, while also paving the way for further advancements.

#HOMHET – Bridging The Gap Between Homogeneous and Heterogeneous (Photo)-Electrocatalysis

Days: Tuesday Oct 17th & Wednesday Oct 18th.

Click here to view the program

Symposium Organizers: Idan Hod, Elena Más Marza, Menny Shalom.

Invited Speakers: Josep Albero Sancho, Thomas Burdyny, Matthias Driess, Salvador Eslava, Joanna Kargul, Katharina Landfester, Antoni Llobet, Charles Machan, Greta Ricarda Patzke, Peter Strasser, Victor A. de la Peña Oshea.

Description:

In recent years there is a growing interest in designing new catalytic materials that could in principle benefit from the virtues of both molecular and bulk (photo)-electrocatalysts. An ideal catalyst material should in one hand exhibit the well-defined nature of a molecular active site, allowing easier understanding of operation mechanisms as well as high TOFs. On the other hand, the catalyst should also possess the robustness, high conductivity, and overall efficiency of a heterogeneous bulk catalyst. Possible strategies to achieve this goal: 1) imprinting of single-atom sites in carbon-based materials 2) using porous framework materials that contain molecular active sites 3) hybrid systems with immobilized molecular catalysts on inorganic heterogeneous catalysts 4) bulk materials with bio-inspired functionalities. The symposium will cover a wide range of (Photo)-electrochemical reaction for energy conversion as well as environmental remediation (e.g. organic transformations). This cross-disciplinary symposium will bring together experts in homogenous (molecular) and heterogeneous catalysis to discuss the latest developments in these fast-growing topics.

#MATSF – Advanced Materials for the Production of Direct Solar-driven Fuels and Chemicals

Days: Tuesday Oct 17th & Wednesday Oct 18th.

Click here to view the program

Symposium Organizers: Milena Arciniegas, Iwan Moreels, Gabriele Raino.

Invited Speakers: Yehonadav Bekenstein, Maryna Bodnarchuk, Francesco Carulli, Juan Ignacio Climente, Maria Ibáñez, Efrat Lifshitz, Dan Oron, Katherine Shulenberger, Alexander Urban, Daniel Vanmaekelbergh, Kaifeng Wu, Nuri Yazdani.

Description:

In the global energy context, the direct conversion of sunlight into fuels and high added-value chemicals is gaining momentum as a promising strategy to contribute to decarbonize the energy sector and the chemical industry. In this scenario, the development of novel efficient and durable photoactive and catalytic materials and architectures, as well as a deep understanding of the role of interfaces, plays a pivotal role to drive these technologies towards more mature technology readiness levels. The present symposium will focus on the development of novel materials and architectures for photocatalytic (PC) and photoelectrochemical (PEC) applications for energy conversion and the production of high added-value chemicals, particularly highlighting the synthesis, characterization and mechanistic insights.

#MHPN3 – Fundamental Advances in Metal Halide Perovskites and Beyond: New Materials, New Mechanisms, and New Challenges

Days: Wednesday Oct 18th, Thursday Oct 19th & Friday Oct 20th.

Click here to view the program

Symposium Organizers: Paola Vivo, Qiong Wang, Waifeng Wu.

Invited Speakers: Omar F. Mohammed, Teresa Gatti, Robert Hoye, Iván Mora Seró, Ana Belén Muñoz García, Wanyi Nie, Zhijun Ning, Michele Saba, Diego Solis Ibarra, Atsushi Wakamiya, Dmitri Yakovlev.

Description:

Lead halide perovskites have become a game changer for solar cells and light-emitting devices. In spite of intense, worldwide studies in recent years, there are still challenges to overcome, and also, new opportunities to explore. One of the major challenges is the toxicity of lead-halide perovskites. Researchers have been searching for a lead-free perovskite compound alternative, in the hope of developing a cost-effective, highly efficient and environment-friendly PV technology. In terms of new opportunities, the fundamental aspects of halide perovskites (hot carriers, polarons, excitons, defects, anharmonicity, self-trapping) continues to fascinate the community, and understanding these fundamentals may help design future, super-high efficiency devices. Further opportunities exist in the field of quantum information and quantum optics, which stimulate nascent research into spins and chirality, exciton fine structures and exciton-polaritons in halide perovskite. Thus, it is necessary and timely to hold a symposium on new materials, new mechanisms, and new opportunities to collect the most recent, cutting-edge progress and insights into these related fields.

#NANOFUN – Functional Nanomaterials: from Optoelectronics to bio- and Quantum Applications

Days: Wednesday Oct 18th & Thursday Oct 19th.

Click here to view the program

Symposium Organizers: Milena Arciniegas, Iwan Moreels, Gabriele Raino.

Invited Speakers: Yehonadav Bekenstein, Maryna Bodnarchuk, Francesco Carulli, Juan Ignacio Climente, Maria Ibáñez, Efrat Lifshitz, Katherine Shulenberger, Alexander Urban, Daniel Vanmaekelbergh, Kaifeng Wu, Nuri Yazdani, Dan Oron.

Description:

Colloidal quantum dots (QDs) have become essential building blocks of many different optoelectronic devices, e.g. efficient photodetectors and vivid color screen displays, and are playing a pivotal role for the development of future quantum technologies, photocatalysis and bio-applications. This symposium aims at bringing together experimentalists and theoreticians who are investigating various fundamental processes in nanomaterials, from the synthesis, surface chemistry and optical characterization to theoretical modelling and device applications. It provides a forum for discussing the latest scientific discoveries in these exciting new research areas bridging material science with optoelectronics and quantum technologies.

#ELMOL - The Future of Molecular Electronics

Days: Tuesday Oct 17th.

Click here to view the program

Symposium Organizers: Sandrine Heutz, Rachel Kilbride, Jess Wade.

Invited Speakers: Max Attwood, Hugo Bronstein, Jeanne Crassous, Rachel Evans, Rachel Kilbride, Daphne Lubert-Perquel, Robert Oliver, Julianna Panidi.

Description:

From transistors to solar cells, light-emitting diodes to sensors, the unique optical, electronic and magnetic properties of molecular materials have been harnessed in a wide range of technologies. Alongside their application in devices, molecular electronic materials provide the ideal playground to explore fundamental physical phenomena. A plethora of new molecular designs has been met by a newfound ability to probe, understand and manipulate the quantum world.

This symposium will consider emerging molecular materials in which the quantum properties can be leveraged to improve device efficiency and sustainability. We will highlight how consideration of shape, symmetry and packing will play an important role in the next revolution of quantum devices. We will discuss the challenges facing our disciplines, and identify the future developments needed to advance the field. We will showcase how multi-disciplinary research that combines molecular design, synthesis, characterisation and theory is critical in the pursuit of molecular materials that benefit society.

#BIOELCHEM- Recent Advances on Nitrogen Activation and Conversion

Days: Thursday Oct 19th & Friday Oct 20th.

Click here to view the program

Symposium Organizers: Ioanna Mela, Anna Maria Pappa, Kyriaki Polychronopoulou.

Invited Speakers: Ardemis Boghossian, Susan Daniel, Guglielmo Lanzani, Roisin Owens, Onur Parlak, Giuseppe Maria Paternò, Charalampos Pitsalidis, Agneta Richter Dahlfors, Francesca Santoro, Eleni Stavrinidou.

Description:

Bioelectrochemical systems combine biological and electrochemical processes to engineer sensors, novel sustainable catalysts and/or treat wastewater. By interfacing microorganisms, enzymes or plants with electrochemical methods/ materials novel technologies are introduced, aiming at improving the reducing or oxidizing metabolism. Research in this area focuses on the selection and design of novel (sustainable) electrode materials, the design of the electrochemical setup (including microfluidics for on chip integration) and subsequently the screening of electrochemically active or inactive model compounds/microorganisms. This symposium thus covers state-of-the-art technologies and fundamental studies related to electron transfer (efflux and consumption) for applications ranging from sensing and catalysis to wastewater treatment. We welcome abstracts/studies spanning from materials science and engineering to fundamental understanding of processes aiming to provide a holistic view/understanding of this emerging field.

#CO2X- Frontier Developments in Electrochemical CO2 Reduction and the Utilization

Days: Wednesday Oct 18th, Thursday Oct 19th & Friday Oct 20th.

Click here to view the program

Symposium Organizers: Alexander Bagger, Yu Katayama, Ana Sofia Varela.

Invited Speakers: Thomas Burdyny, Federico Calle Vallejo, Marta Costa Figueiredo, Kazuhide Kamiya, Magalí Lingenfelder, Núria López, Carlos Morales Guio, Beatriz Roldan Cuenya, Brian Seger, Peter Strasser.

Description:

For the future, CO2 Reduction (CO2R) is an attractive option for storing renewable energy and sustainable production of valuable chemicals and fuels. While most low-hanging fruits have been picked in understanding, development and application. This symposium invites frontier contributions that challenge the current state-of-the-art in CO2R, breaching scientific developments with atomistic level theory, fundamental electrochemistry, spectroscopy, materials synthesis and scaleup applied to push the frontier. The symposium also seeks possibilities in utilizing the product distribution from CO2R in various following process steps and in mixes with other reactants. Within these topics the symposium will discuss opportunities for new research activities that ultimately bring us a step closer towards establishing a low- or zero-emission carbon cycle.

#NextED - Next Generation of Electrochemical Devices

Days: Thursday Oct 19th.

Click here to view the program

Symposium Organizers: Moritz Futscher, Angus Mathieson.

Invited Speakers: Bruno Ehrler, Juan Carlos Gonzalez Rosillo, Antonia Guerrero, Raj Pandya, Francesca Santoro.

Description:

Electrochemical devices are beginning to provide platforms from which to launch new methods to manipulate and study material systems. For example, recent investigations have provided new insights into the interactions between mixed ionic-electronic conductors and light. The ability of influencing the properties of mixed conductors with light presents the possibility of new energy-related applications. Similar developments have led to new photo(electro)chemical devices such as light-rechargeable batteries and light-tuneable resistive switches.
Electrochemical methods have also found their way into semiconductor research, facilitating novel techniques such as doping for improved optoelectronic properties. To understand the complex phenomena inside an operating electrochemical device, non-invasive techniques based on the optical properties of battery materials are beginning to facilitate closer, real-time insights into the dynamic mechanisms of energy storage. This symposium invites contributions based on novel ways of characterising and using electrochemical materials, from both a perspective of the underlying phenomena and device applications.

#EMERBAT - Emerging Battery Technologies

Days: Thursday Oct 19th & Friday Oct 20th.

Click here to view the program

Symposium Organizers: Philipp Adelhelm, Maria Crespo, Guiomar Hernández.

Invited Speakers: Heather Au, Yair Ein Eli, Tim Patrick Fellinger, Gustav Graber, Emma Kendrick, Pedro López Aranguren, Katharina Märker, Emilia Olsson, Premkumar Senguttuvan, Ozlem Sel, Magda Titirici.

Description:

This symposium invites contributions on the broad topic of battery diversification as the cornerstone to achieve sustainable energy storage and enable the growing demands of our future electrified world. This includes beyond Li-ion research on other alkali- and multivalent-ion storage, dual and hybrid systems, solid state, metal-air, Li-S or anode-less batteries and their advanced fabrication methods. Related topics are cuttingedge operando characterisation techniques, advanced applications (e.g. structural or health-monitoring systems), tools to understand SEI formation and evolution, multiscale modelling, sustainability analysis (e.g. recyclability, LCA, circularity and future policy) and 'whole system' optimisation approaches (e.g. high throughput screening and data science for materials discovery).

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