EFCF 2020

FINAL ANNOUNCEMENT
20 – 23 October
KKL Lucerne, Switzerland

24th conference in series of the European Fuel Cell Forum in Lucerne

14th EUROPEAN SOFC & SOE FORUM

Chaired by
Prof. Anke Hägen
Prof. Peter Vang Hendriksen
DTU Technical University of Denmark

Fuel Cells, Electrolyzers & Membrane Reactors
CO₂ Emission Reduction & Reuse

Register with no Risk
in case of no show due to Covid restrictions
Reimbursement of the Fees

at www.EFCF.com
### Schedule of Events

**Motto 2020:** Enabling Solid Oxide Technologies - Developments & Achievements

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<th>Day</th>
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<td><strong>Monday, 19 October 2020</strong></td>
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<tr>
<td>09:00 – 09:30</td>
<td>Registration for <strong>Grid Service Markets</strong> symposium</td>
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<td>09:30 – 17:50</td>
<td><strong>GSM Sessions</strong> 19:30 <strong>GSM Network Dinner</strong></td>
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<td><strong>Tuesday, 20 October 2020</strong></td>
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<td>09:30 – 10:00</td>
<td>Registration for <strong>Tutorials</strong> – 2nd floor Club Rooms above Auditorium</td>
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<td>10:00 – 17:00</td>
<td><strong>FCH: Fuel Cells &amp; Hydrogen Tutorial</strong> Dr. G. G. Scherer &amp; Dr. J. Van herle</td>
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<td>10:00 – 17:00</td>
<td><strong>EIS: Electrochemical Impedance Spectroscopy Tutorial</strong> Dr. André Weber &amp; Dr. Dino Klotz</td>
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<td><strong>Wednesday, 21 October 2020</strong></td>
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<tr>
<td>08:00 – 16:00</td>
<td><strong>On-site Registration</strong>, Speakers Breakfast until 09:00, info at main desk</td>
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<td>09:00 – 18:00</td>
<td><strong>Conference Sessions 1 – 6, keynote, invited talks</strong>; presentations on projects &amp; activities in various countries, status of industry &amp; major groups, technical highlights; networking &amp; exhibition</td>
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<td><strong>Tuesday, 20 October 2020</strong></td>
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<td>09:00 – 16:55</td>
<td><strong>GSM Sessions</strong> 17:00 <strong>GSM Grid Apéro</strong></td>
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<td><strong>Thursday, 22 October 2020</strong></td>
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<td>08:00 – 16:00</td>
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<td>09:00 – 18:00</td>
<td><strong>Conference Sessions 7–13, keynote, invited talks</strong>, networking &amp; exhibition</td>
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<td><strong>Friday, 23 October 2020</strong></td>
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<td>08:00 – 10:00</td>
<td><strong>On-site Registration</strong>, Speakers Breakfast until 09:00, info at main desk</td>
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<td>09:00 – 16:15</td>
<td><strong>Conference Sessions 14–17, keynote, invited talks</strong>, individual poster presentation, exhibition &amp; networking</td>
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<td>09:00 – 12:00</td>
<td><strong>Exhibition &amp; Poster area open</strong></td>
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<td>12:00 – 14:00</td>
<td><strong>Poster removal</strong></td>
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<td>15:00 – 16:15</td>
<td><strong>Closing &amp; Award Ceremony:</strong> Best poster, best scientific contribution &amp; outstanding lifetime work; <strong>Keynote by the EFCF Gold Medal of Honour Winner</strong></td>
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<tr>
<td>16:15 – 17:00</td>
<td><strong>Goodbye</strong> coffee and travel refreshment in front of the Luzerner Saal</td>
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**www.EFCF.com/Events**
The sole purpose of the European Fuel Cell Forum is the promotion of fuel cell and hydrogen technologies through the EFCF conference, the Green Salon & Rondo event, literature and media. It is a high-level exchange platform, providing scientific sessions and tutorials, an exhibition, as well as international project meeting support and recreational networking events in the charming and inspirational area of Lucerne, the heart of Switzerland.

Every summer the European Fuel Cell Forum invites more than 10’000 stakeholders to participate in this internationally recognised event on the shores of the picturesque Lake Lucerne. More than 300 contributions and posters will be presented in 28 sessions over the course of 3.5 intensive and stimulating days. The high level scientific content is complemented with plenary a keynote presentations on country overviews, grid services based on fuel cells and electrolyzers, status of leading industry & major groups, and an overview on proton conducting ceramics. Two extended poster sessions recognise the excellence of the poster contributions that are also accessible throughout the entire conference. Closing with the award ceremony, the audience will be privileged to hear a keynote from the winner of the 2020 Gold Medal of Honour. Awarded is Prof. Ludger Blum from the Forschungszentrum Jülich in Germany for his outstanding contribution to the advancement of SOC systems. Based on the convincing number and quality of submissions, more than 500 participants from 35–40 countries are expected at this year’s conference.

The EFCF has a heritage of more than 20 years! As far back as 1994 the 1st EUROPEAN SOFC FORUM attracted leading international speakers as well as a global audience. Since then, a high-quality conference series has been established. The conference topics alternate annually. On even years the conference concentrates on „Solid Oxide Cells“ (SOC): Fuel Cells, Electrolyzers and Membrane Reactors. On odd years, the conference concentrates on „Direct Alcohol and Hydrogen Fuel Cells” as well as „Hydrogen Processing: Production, Storage and Infrastructure”. The 14th EUROPEAN SOFC & SOE FORUM 2020 is expected to be again world’s largest dedicated SOC event.

Over the years, many strong relationships and contacts have been established at these events. This is thanks to a caretaking organisation with dedicated advisors and conference chairs, who keep a watchful eye on scientific quality. Unlike many commercial conferences, this event is organised by fuel cell technologists and scientists. Active members of the European fuel cell and hydrogen community, they consider the recommendations of the EFCF International Board of Advisors and observe and anticipate the trends of the sector. The conference organisers ensure that the stakeholder’s needs are always the focus of the European Fuel Cell Forum.

We are dedicated to continuously grow the European Fuel Cell Forum as one of the most prominent meeting places for the comprehensive exchange of scientific and technical information and for high-level networking. This creates an environment that enables scientific breakthroughs and their subsequent transfer into industry.

A very special thank you for this year’s conference goes to Prof. Dr. Anke Hagen and Prof. Dr. Peter Vang Hendriksen from the Technical University of Denmark DTU. Both present a very strong scientific experience and cooperate closely with industrial partners on fundamental aspects of understanding. In this way, they reflect well the ambition of the EFCF: Building a bridge from science to technology – from technology to products! Together we are proud to offer a sound scientific programme, unforgettable side events and invite you to the pleasant surroundings of Lucerne. Finally, we would like to thank all the authors, exhibitors and suppliers for their excellent contributions, the Scientific Advisory and Organising Committees for their review work, and our staff members for fastidiously taking care of all the organizational details. Together with the numerous participants and exhibitors, the stage has been set for an exuberant 14th EUROPEAN SOFC & SOE FORUM 2020.

Thank you and we look forward to seeing you in Lucerne in July

Olivier Bucheli & Michael Spirig
European Fuel Cell Forum – www.EFCF.com
The 2020 EFCF theme is Solid Oxide Technologies broadly; including Fuel Cells, Electrolysers & Membrane Reactors and puts in focus concepts for CO₂ Emission Reduction & Reuse.

The Paris Agreement from 2015 formulates ambitious emission reduction targets to mitigate the adverse climate effects of anthropogenic CO₂ emissions. More and more countries have formulated policies in line with this agreement; Europe aims to be “climate neutral” by 2050 and launched the European Climate law to transform this political promise into law. Realising this transition to a climate neutral society over the next 30 years represents a tremendous societal challenge and calls for improved energy conversion technologies, huge energy infrastructure investments, development of large scale energy storage and complete re-shaping of the transport sectors, including road-transport, shipping as well as aviation.

Solid oxide fuel cells and perhaps even more so solid oxide electrolysis technologies have the potential to play a key role in this transition, due to high efficiencies and fuel flexibilities. Now is the window of opportunity. However, improvements in terms of overall economic competitiveness and lifetime are still called for as well as an up-scale in module size and manufacturing capacity.

Hence, contributions from academia on basic understanding of performance and lifetime limiting processes are still in high demand as are identification of improved materials and manufacturing routes enabling fabrication of desired microstructures and components. Design and process optimisation by advanced modelling approaches and clever engineering to improve products, their reliability, and performance remain important challenges for the industrial as well as academic stakeholders in this field.

We are glad to chair the 14th European SOFC & SOE Forum and appreciate the worldwide contributions by the research groups from academia and research institutions and from industries as well to this event. The Forum will present a comprehensive overview of the current state of the art in solid oxide technology, covering both fuel cells and electrolysers. This year a special emphasis is put on solid oxide technology based on proton conducting ceramics and use of CO₂. The technical program spans from basic science at the materials- and cell level right up to stacks, products and industrial achievements.

The Scientific Advisory Committee has provided a serious and unbiased evaluation of all contributions leading to a high quality of the technical program. All papers presented as lectures or posters will be collated in the electronic proceedings which will be distributed to all participants and later to libraries, research institutions and universities.

The European SOFC & SOE Forum has always provided an excellent opportunity to present the worldwide recent technical progress, establish new contacts, and to exchange technical, industrial and business information. The covid-19 pandemic has forced us to postpone the conference. We are looking forward to fulfilling the expectations for a constructive and productive atmosphere with intense discussions and hope to meet you in Lucerne in October 20-23 for a great EFCF 2020.

Anke Hagen and Peter Vang Hendriksen
DTU Energy, Technical University of Denmark

Conference language is English
Prof. Dr. Dr. Anke Hagen is professor at the Department of Energy Conversion and Storage at the Technical University of Denmark. She holds a Dr. rer. nat. degree in the field of heterogeneous catalysis from the University of Leipzig 1994 and a Dr. techn. degree in the field of solid oxide fuel cells from the Technical University of Denmark 2018.

Anke held research positions at the University of Leipzig, Germany, Yale University, USA, University of Oldenburg, Germany, and Technical University of Denmark. Her research focused on heterogeneous catalysis, before she joined the research staff at the former Risø National Laboratory to work on electrochemistry and solid oxide cells in 2003, since 2007 part of the Technical University of Denmark. Her current research interests include electro chemistry and catalysis, diagnostics and lifetime.

In her current position, she is responsible for the coordination of the solid oxide fuel cell program at DTU Energy. She has actively engaged in the Hydrogen Europe partnership and in the International Energy Agency Annex 32: Solid Oxide Fuel Cells. Anke is author/co-author of 97 publications in reviewed scientific journals (155 in total), several book chapters and two patents. She has been project manager of a number of national (German and Danish) and international projects (mainly European projects in the area of SOFC and SOE).

Prof. Peter Vang Hendriksen heads the section „Solid State Chemistry“ at the Department of Energy Conversion and Storage at the Technical University of Denmark (DTU) which currently counts ca. 20 employees. Peter did his Ph.D. at the Laboratory of Technical Physics, DTU, from where he graduated in 1993 with a dissertation on magnetic properties of nanoparticles. Immediately after, he joined the research group at the former Risø National Laboratory in Denmark working on development of solid oxide fuel cells. Initially he worked on modelling of stacks but soon got involved in materials development and testing activities. He became a member of the management team in 2003.

Peter has led numerous projects on materials and component development both in the area of SOFC and SOEC, and has served as work package leader/coordinator in European projects in the related area of oxygen transport membranes.

His current research involves synthesis and characterization of functional oxides (charge transport and catalytic properties), high temperature corrosion, mechanical and fracture mechanical issues in functional ceramics and various aspects of SOEC development. He is the author/co-author of more than 140 papers in reviewed scientific journals, 75 conference papers, 18 patents and several book chapters.
The Tutorial will provide the basic concepts required to address the general but also more specialised field of fuel cells. Fuel cell technology is interdisciplinary par excellence, and requires knowledge in electrochemistry, materials science, mechanical and electrical engineering, catalysis, corrosion, thermal management, systems engineering etc. The course will cover these different aspects as broadly as possible, illustrated by many examples. All fuel cell families will be addressed i.e. Hydrogen Fuel Cells (H₂FC) and High Temperature Fuel Cells (HTFC) as well as Hydrogen Production, Storage and Infrastructure (H₂PSI). Applications and examples will be mostly surrounding the two most popular fuel cell types, PEFC (G. G. Scherer = GGS) and SOFC (J. Vanherle = JVh), this is due to the expertise of both lecturers in their respective specialties.

The Tutorial will be targeted to newcomers as well as those who have been working in the area of fuel cells for some time. Participants will gain, or revise, current understanding of the operation and key challenges of fuel cell technology, where considerable progress in recent years has been achieved and new insights gathered. The requirements for fuel cell market introduction will be discussed.

The Tutorial lecture topics are fuel cell operating principles, thermodynamics, kinetics, efficiencies, central notions such as electrolyte ionic conductivity, electrode overpotential, triple phase boundary, Nernst equation, fuel reforming, cell and stack architectures and design, fuels (both fossil and renewable) for different fuel cells including their treatment, all fuel cell families (SOFC, MCFC, PAFC, PEFC/DMFC, AFC).

Tutorial Schedule:
09:30 Registration, welcome refreshments
10:00 Lecture 1: Fundamentals of Electrochemical Energy Conversion (GGS)
10:45 Lecture 2: Characteristics of the Important Fuel Cell Technologies (GGS)
11:30 Coffee break
11:45 Lecture 3: Fuels for fuel cells, fuel processing (JVh)
12:30 Lunch break
14:00 Lecture 4: Applications of Polymer Electrolyte Fuel Cells PEFC (GGS)
14:45 Lecture 5: System aspects, applications of High Temperature Fuel Cells SOFC,…(JVh)
15:30 Coffee break
15:45 Lecture 6: State-of-the-art, challenges, summary (JVh)
17:00 End of Tutorial, Possibility to visit the exhibition

The Tutorial language is English. Register online at - www.EFCF.com/TutReg
Each participant will receive a copy of all of the Tutorial lectures. The tutorial registration fee for all participants is CHF 500.–.
Electrochemical Impedance Spectroscopy (EIS) has become an important tool in Solid State Ionics for studying mass and charge transport in electrochemical systems. It is not only of importance for fundamental research, but also for characterizing batteries, fuel cells, sensors, etc. The EIS Tutorial is focused on medium to experienced level users, who are already familiar with the principles of the SOCs (Solid Oxide Cells).

The EIS Tutorial will support you with new findings and relevant experiences. During the EIS Tutorial you will receive answers to questions before you have to ask them, as well as the chance to ask questions you may not dare to voice in front of a general audience. You will come into contact with the specialists and other experienced users. You enlarge your exchange and discussion network within the EIS community. Opportunity for discussion and exchange are provided, especially during the ‘EIS challenge’.

The EIS Tutorial is an excellent extension of your current know-how. It contains 5 lectures and an ‘EIS challenge’: The lectures will range from the basic principles, that makes EIS one of the most powerful analysing instruments available today, to more advanced applications of EIS, to very sophisticated cases and many practical experiences. Many results will be presented, and the right interpretation discussed. The lectures are followed by an ‘EIS challenge’, where all kinds of impedance questions, problems, and latest experiences can be discussed and exchanged with other participants.

**Tutorial Schedule:**

09:30  Registration, welcome refreshments
10:00  Lecture 1: Fundamentals of Electrochemical Impedance Spectroscopy
10.45  Lecture 2: Applications I - Analysis of SOC - Materials and (Model-) Electrodes
11:30  Coffee break
11.45  Lecture 3: Applications II - Analysis of SOC - Single Cells and Stacks
12:30  Lunch break
14:00  Lecture 4: Evaluation of Impedance Spectra - Kramers-Kronig Test, DRT-Analysis & CNLS Fit
14:45  Lecture 5: Impedance Modelling and Simulation
15.30  Coffee break
15:45  Lecture 6: ‘EIS challenge’ -Summary
17:00  End of EIS Tutorial, opportunity to visit the exhibition

**The Tutorial language is English.**

Register with no Risk in case of no show due to Covid restrictions

Reimbursement of the Fees

www.EFCF.com/Reg

Each participant will receive a copy of all the Tutorial lectures. The EIS tutorial registration fees are as follows: CHF 500.–, for EFCF & GSM 2020 participants CHF 350.–.
The 14th European SOFC & SOE Forum 2020 will be held from 20 – 23 October in the renowned Kultur- und Kongresszentrum Luzern (KKL) in Lucerne, Switzerland. The parallel lectures will be presented in the „Luzerner Saal“ and the „Auditorium“, while all posters will be permanently exhibited in the „Auditorium Foyer“. The KKL is located next to the Railway Station on the shore of Lake Lucerne. Boat traffic, waterfront activities, as well as spectacular views of the old town and snow-capped mountains add to the charm of the venue. View Video on www.EFCF.com/Lucerne.

The EFCF 2020 is the 14th European SOFC & SOE Forum and will focus on Solid Oxide Technologies: Fuel Cells (SOFC), Electrolysers (SOE) & Membrane Reactors (SOMR) and concepts for CO2 Emission Reduction & Reuse. The forum will be the world’s largest dedicated event, allowing industry and major groups an unparalleled opportunity to present their status and outlook. The technical program will range from fundamental science and new materials, through cell, stack, and system design, performance and BoP, to the latest results on commercial deployment. The topics also cover manufacturing, lifetime, characterisation, modelling and optimization. Also product and novel concepts, SOC integration and P2X as well as CO2 capture and chemical processing applications are addressed. In the plenary sessions overviews of the progresses in the EU, US, Japan and China are given. Representatives of the leading industry players and the major groups will present and summarise their current technology status. Keynote presentations are given on energy systems, grid flexibility and business models as well as latest findings for proton conducting SOCs. The surprise presentation from this years Gold Medal of Honour winner, Prof. Ludger Blum from FZJ, will be the final high light of EFCF 2020.

Including the GSM 2020 (Grid Service Market symposium on Monday and Tuesday, featuring grid flexibility and business, see next page) and the two tutorials, a highly attractive five-day program results. It offers product presentations, scientific lectures, demonstrations, posters, exhibits... a lot of knowhow and contacts. EFCF alone provides about 300 scientific contributions i.e. 120 oral presentations in 26 sessions and up to 180 posters in two large dedicated poster sessions, with extended time for technical discussions and fruitful exchange. The posters are permanently accessible throughout the entire event. All events are held in the same building.

Registration covers unrestricted admission to both conference and exhibition. European global developers present innovative high temperature fuel cell and electrolysis solutions, as well as materials, development equipment, fuel cell components and supplies. The technical programme is designed to inform representatives from industry, trade, finance, utilities and users as well as planners, engineers, technology brokers and members of the scientific research community. Product and application information are available from the exhibitors.

The EFCF 2020, the 14th European SOFC & SOE Forum will be the major international event on these subjects this year.
The Electricity Market is changing, opening opportunities for more flexibility in generation, storage and consumption. The integration of a large amount of new renewable energy sources poses great challenges for the European electricity grids & markets. Network reinforcement, market harmonisation and integration are both solutions and challenges for the various players in the electricity industry.

The GSM 2020 is the 4th Symposium. It will outline recent developments in European grid service markets, highlight advancements and challenges in international cooperation, and discuss technological progress. In addition, it will report on experiences and success stories, supporting a rating of the performance and future potential of new technologies.

The two-day symposium will feature sessions with invited and contributed talks and posters. The International Advisory Board (IAB) ensures that all presentations are of high quality. The technical program will include: Development in GSM, international collaboration, enabling & advanced technologies to grid service operation, and impacts of trends to real world case studies. In the field of Virtual Power Plant (VPP), special panels with high level keynotes and deepening discussions are planned in collaboration with the FCH JU project www.PACE-energy.eu.

The GSM 2020 symposium is chaired by Prof. Dr. Christoph Imboden from HSLU, Switzerland. It takes place at the Culture & Convention Centre Lucerne (KKL) before and in conjunction with EFCF 2020. For EFCF 2020 participants it is possible to join the GSM 2020 sessions for a reduced fee. Book on-line on www.EFCF.com/Registration.

You like to add a poster contribution? Download the template and inform info@GridServiceMarket.com

GRID FLEXIBILITY & BUSINESS WITH NEW TECHNOLOGIES
Control reserves - Virtual power plant
Direct marketing - Dynamic load management
Exhibition  www.EFCF.com/ExReg

EFCF 2020 offers you a top chance to catch up on some exhibition opportunities, and share your products directly with potential new clients - possibly for the first time this year. The technical exhibition will be held in the splendid Foyer of the Lucerne Hall. This event offers industry, suppliers, test equipment providers and research laboratories the opportunity to showcase their latest products and services, as well as allowing important face-to-face contact with potential new clients.

Exhibitors from all over the world are invited to participate.

In addition to fuel cell, electrolyser and hydrogen technology developers showing systems, related hardware and applications, suppliers can present new materials, stack and system components, control devices, production technology, qualification and test benches and diagnostic tools alongside research and development services.

For further information please contact the European Fuel Cell Forum or visit www.EFCF.com/Exhibition. The details of confirmed exhibitors are listed in the rear of this booklet.

International Project Meetings  www.EFCF.com/FPM

As many international experts participate in the European Fuel Cell Forum, Monday and Tuesday of the conference week offer an ideal opportunity for international project meetings. Please feel free to use this time to schedule your meetings for your ongoing projects, setting-up of new projects, or for other topic related events such as the GSM symposium on „European Grid Service Markets” related to FCH JU projects QualyGridS & PACE.

To simplify project initiators’ and organizers’ life, the organisation of such events for registered participants and exhibitors is supported by our organization. Get more information at www.EFCF.com/FPM or send an e-mail to forum@efcf.com

Scientific Organizing Committee  www.EFCF.com/SOC

from DTU Technical University of Denmark

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**EFCF Online Library**  
www.EFCF.com/O-Lib

The EFCF online library offers fast and easy access to both free and purchased information. The library is constantly being updated, and currently contains Proceedings with ISBN dating back to 2011, with files from as far back as 1994 gradually being converted and uploaded.

In addition, the library offers access to the Programmes of the EFCF Conferences Presentation slides (see below), direct Links to the EFCF Special Issue Series and Impressions of all EFCFs. For all information on this valuable know-how resource go to www.EFCF.com/Lib

www.EFCF.com/PP

The complete proceedings will be available in electronic format and distributed to all conference participants for an optimal scientific exchange. In addition, EFCF offers three possibilities for publication of the works:

1.a. Authors may benefit from a publication of their contribution in the web-accessible proceedings, under the 2020 ISBN: 978-3-905592-25-2 (see www.EFCF.com/PROCEEDINGS).
1.b. Authors can apply for inclusion of their contribution in a Special Issue of „FUEL CELLS – From Fundamentals to Systems” (Impact Factor 2018: 2.33, 2014: 2.08, www.fuelcells.wiley-vch.de). Selected papers will need to comply with the journal’s guidelines, and go through a peer-review process.
2. Authors are also free to publish their work ELSEWHERE.

In the case of 1.b. and 2. only the title, contact and one page abstract will appear in the ISBN proceedings to prevent a clash of copyrights.

**Presentation available with approved participant login**  
www.EFCF.com/Presentations

At the EFCF conferences, participants are not permitted to take pictures of the presentations (literary property). This allows presenters to show their latest results, which are, for example, intended for publication in a scientific paper at a later date. However, presenters usually indicate their willingness to share their presented and eventually copyedited slides to the conference registrants. Upon receiving the authors permission, presentations of the current and previous years will be made available in the online library www.EFCF.com/PRESENTATIONS for all registered participants of the European Fuel Cell Forum with an approved login. To obtain download rights after the conference, post-registration is possible by „filing Contact Data” on the www.EFCF.com/Lib on-line form.
Who should attend?

The conference with exhibition offers an attractive programme for potential users of fuel cells, decision makers, researchers and engineers in industry, laboratories, academic institutions, governments, investors, consultants and electric power engineers. The event provides many opportunities for informal exchanges between industry, market and academia, a platform for technology transfer and recruitment of qualified students and trainees. The European Fuel Cell Forum combines the personal atmosphere of a workshop with the format of a scientific conference. This is the time and the place where decision makers meet politicians, inventors meet investors, engineers meet scientists, power & transport industry meet OEMs and users meet providers. Participants from all continents are invited and welcome to attend this prestigious event.

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Prof. Wei Guo Wang NIMTE, PR China
Prof. Jianbo Zhang, Tsinghua University, China
Assoc. Prof. Zhichuan Jason Xu, NTU, Singapore
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<td>09:30</td>
<td><strong>A02:</strong> Keynotes by FCH JU - EU Programs, US, Japan, China</td>
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<td>11:15</td>
<td><strong>A03:</strong> Technology status at industry &amp; major groups I</td>
<td><strong>B03:</strong> Manufacturing Processes</td>
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<td><strong>A04:</strong> Poster Session I covering All Session Topics</td>
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<td>15:00</td>
<td><strong>A05:</strong> Technology status at industry &amp; major groups II</td>
<td><strong>B05:</strong> Fuel electrodes</td>
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<tr>
<td>16:30</td>
<td><strong>A06:</strong> Products &amp; demonstrations</td>
<td><strong>B06:</strong> Advanced characterization I</td>
</tr>
<tr>
<td><strong>Tu 09:00</strong></td>
<td><strong>A07:</strong> Keynote Grid Flexibility - Business Models</td>
<td><strong>B07:</strong> Keynote about proton conducting SOC</td>
</tr>
<tr>
<td>09:30</td>
<td><strong>A08:</strong> System design &amp; performance</td>
<td><strong>B08:</strong> Advanced characterization II</td>
</tr>
<tr>
<td>11:00</td>
<td><strong>A09:</strong> Emerging SO technology electrode investigation &amp; modelling</td>
<td><strong>B09:</strong> Lifetime: Stacks &amp; Cells</td>
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<tr>
<td>13:15</td>
<td><strong>A10:</strong> Poster Session II covering All Session Topics</td>
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<tr>
<td>15:00</td>
<td><strong>A11:</strong> Keynote Energy systems</td>
<td><strong>B12:</strong> Oxygen electrodes I</td>
</tr>
<tr>
<td>15:30</td>
<td><strong>A12:</strong> SOC integration, Power-to-X, CO2 capture etc.</td>
<td><strong>B13:</strong> Cells, stacks &amp; interconnects</td>
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<tr>
<td>16:30</td>
<td><strong>A13:</strong> Products, demonstrations, novel concepts &amp; BoP</td>
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</tr>
<tr>
<td><strong>Tu 09:00</strong></td>
<td><strong>A14:</strong> Proton Conducting Cells, Stacks &amp; materials</td>
<td><strong>B14:</strong> Oxygen electrodes II</td>
</tr>
<tr>
<td>11:00</td>
<td><strong>A15:</strong> Cell, stack &amp; system modelling &amp; optimization</td>
<td><strong>B15:</strong> Lifetime: Cells, components &amp; interfaces</td>
</tr>
<tr>
<td>13:30</td>
<td><strong>A16:</strong> System design, performance &amp; BoP</td>
<td><strong>B16:</strong> Lifetime: Interconnects &amp; contact layers</td>
</tr>
<tr>
<td>15:05</td>
<td><strong>A17:</strong> P4: Closing Ceremony, Keynote by the EFCF 2020 Gold Medal of Honour Winner</td>
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</tbody>
</table>

Legend: **Px:** = Plenary with Keynotes
09:00 A01: P1: Opening Session
S-Chairs: Anke Hagen, Peter Vang Hendriksen, M. Spirig, O. Bucheli

09:00 Welcome by the Organizers (A0101)
Olivier Bucheli, Michael Spirig; European Fuel Cell Forum, Luzern/Switzerland

09:05 Welcome by the Chairs (A0102)
Anke Hagen, Peter Vang Hendriksen; Technical University of Denmark, Lyngby/Denmark

09:15 Welcome to Switzerland (A0103)
Stefan Oberholzer, Rolf Schmitz, Benoît Revaz; Swiss Federal Office of Energy, Bern/Switzerland

09:30 A02: P2: Keynotes by FCH JU - EU Programs, US, Japan, China
S-Chairs: Anke Hagen, Peter Vang Hendriksen

09:30 The Status of SOFC and SOEC R&D
In the European Fuel Cell and Hydrogen Joint Undertaking Programme (A0201)
A. Aguilo-Rullan, M. Atanasiu, B. Biebuyck, D. Dirmiki, N. Lymeropoulos, D. Tsimis
FCH JU - Fuel Cells and Hydrogen Joint Undertaking, Bussels/Belgium

09:50 High Temperature Electrolysis for Hydrogen Production: US Research Highlights (A0202)
Olga Marina
Pacific Northwest National Laboratory, Richland/WA-USA

10:10 Current status of NEDO project on durability and reliability of SOFC cell-stacks (A0203)
Teruhisa Horita
National Inst. of Advanced Industrial Science and Technology (AIST), Ibaraki/Japan

10:30 Solid Oxide Cells Development in China (A0204)
Minfang Han
(1) State Key Lab. of Power Systems, Dept. of Energy and Power Engineering, Tsinghua University, Beijing/P.R. China,
(2) Beijing Key Lab. of CO2 Utilization and Reduction Technology, Dept. of Energy and Power Engineering, Tsinghua University, Beijing/P.R. China

10:50 Break - Ground Floor in the Exhibition
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
<th>Chair(s)</th>
<th>Location</th>
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<tbody>
<tr>
<td>11:15</td>
<td>A03: Technology status at industry and major groups I</td>
<td>Mihails Kusnezoff, Jongsup Hong</td>
<td>Luzerner Saal</td>
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<td></td>
<td>Status of Stack &amp; System Development at Sunfire (A0301)</td>
<td>Christian Walter, Robert Blumentritt, Oliver Posdziech, Matthias Boltze</td>
<td>Auditorium - Morning</td>
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<td></td>
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<td>Sunfire GmbH, Dresden/Germany</td>
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<td>Commercialization of the SteelCell® technology: Latest Update (A0302)</td>
<td>Robert Leah, Adam Bone, Ahmet Selcuk, Mike Lankin, Mahfuur Rahman, Andy Clare, Gavin Reade, Florence Felix, Jeffrey De Vero, Xin Wang, Subhasish Mukerjee, Mark Selby</td>
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<td>Ceres Power Ltd., Horsham/UK</td>
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<td>Status of HEXIS' SOFC Module Development (A0303)</td>
<td>Andreas Mai, Jan Grolig, Venkatesh Sarda, Michael Dold, Bernhard Schindler, Alexander Schuler</td>
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<td>Hexis AG, Winterthur/Switzerland</td>
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<tr>
<td>11:45</td>
<td>A03: Technology status at industry and major groups I</td>
<td>Robert Leah, Adam Bone, Ahmet Selcuk, Mike Lankin, Mahfuur Rahman, Andy Clare, Gavin Reade, Florence Felix, Jeffrey De Vero, Xin Wang, Subhasish Mukerjee, Mark Selby</td>
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<td>Hexis AG, Winterthur/Switzerland</td>
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<td>Power-to-X activities at Haldor Topsoe: Our approach for electrification of the chemicals industry (A0305)</td>
<td>Rainer Küngas, Peter Blennow, Thomas Heiredal-Clausen, Tobias Holt Norby, Jeppe Rass-Hansen, John Baglidl Hansen, Poul Georg Moses</td>
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<td>Haldor Topsoe A/S, Lyngby/Denmark</td>
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<td>Lunch - 2nd Floor on the Terrace / Coffee - Ground Floor in the Exhibition &amp; in the Poster Session</td>
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### 13:15 A04: Poster Session I covering All Session Topics
S-Chairs: Peter Vang Hendriksen, Anke Hagen

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<tr>
<th>15:00</th>
<th>A05: Technology status at industry and major groups II</th>
<th>B05: Fuel electrodes</th>
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<tbody>
<tr>
<td></td>
<td>S-Chairs: Andreas Mai, Jari Kiviaho</td>
<td>S-Chairs: Paola Costamagna, Jong-Ho Lee</td>
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<tr>
<td>15:00</td>
<td>Progress in SOC Development at the Forschungszentrum Jülich (A0501)</td>
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<td></td>
<td>Ludger Blum (1), Qiuping Fang (1), L.G.J. (Bert) de Haart (1), Jürgen Malzbender (1), Nikolaos Margaritis (2), Norbert H. Menzler (1), Roland Peters (1)</td>
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</tr>
<tr>
<td></td>
<td>Forschungszentrum Jülich GmbH: (1) Inst. of Energy and Climate Research, Jülich/Germany, (2) Central Inst. of Engineering, Electronics and Analytics, Jülich/Germany</td>
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<tr>
<td>15:15</td>
<td>Commercialization of Solid Oxide Fuel Cell Technology at SOFCMAN (A0502)</td>
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<td></td>
<td>Weiguo Wang, Changrong He, Tao Chen, Jun Peng</td>
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<td></td>
<td>Ningbo SOFCMAN Energy Technology Co., Ltd., Ningbo/PR China</td>
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<td>15:30</td>
<td>Reversible SOC System Development and Testing: Status at AVL and Outlook (A0503)</td>
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<td>David Reichholf, Franz Koberg, Richard Schauperl, Martin Hauth</td>
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<td>AVL List GmbH, Graz/Austria</td>
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<tr>
<td>15:45</td>
<td>Solid Oxide Cell Technology for Space Applications (A0504)</td>
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<td></td>
<td>Brandon Buergler</td>
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<td>ESTEC, Noordwijk/The Netherlands</td>
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<tr>
<td>16:00</td>
<td>Break - Ground Floor in the Exhibition &amp; in the Poster Session</td>
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</table>
### A06: Products and demonstrations

**S-Chairs:** Jürgen Rechberger, Annabelle Brisse

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speakers</th>
<th>Affiliations</th>
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<tbody>
<tr>
<td>16:30</td>
<td><strong>Demonstration of 200kW SOFC power generation using cleaned bio-methane gas from waste water treatment (A0601)</strong></td>
<td>Kimito Kawamura (1,2), Kenichiro Takeda (1), Toshihiro Oshima (2), Tsutomu Kawabata (2), Shunsuke Taniguchi (2), Tomomasa Kanda (1), Kazunari Sasaki (2)</td>
<td>(1) Asahi Quality and Innovations Ltd. Research &amp; Development Center, Moriya-shi/Ibaraki/JAPAN, (2) Kyushu Uni Next-Generation Fuel Cell Research Center, Fukuoka-shi/Fukuoka/JAPAN</td>
</tr>
<tr>
<td>16:30</td>
<td><strong>Product development and experiences of a new Convion SOFC system (A0602)</strong></td>
<td>Tuomas Hakala, Kim Åström, Erkko Fontell</td>
<td>Convion Oy, Espoo/Finland</td>
</tr>
<tr>
<td>16:45</td>
<td><strong>Development and testing of a 25 kWe Large Stack Module for SOFC and SOE applications (A0603)</strong></td>
<td>Z. Wuillemin (1), E. Varkaraki (1), C. Beetschen1, Y. Antonetti (1), O. Bucheli (1), S.Diethelm (1), A. Nesci (1), M. Bertoldi (2), Srikanth S. (3), D. Ullmer (3)</td>
<td>(1) SOLIDpower SA, Yverdon-les-Bains/Switzerland, (2) SOLIDpower S.p.A., Mezzolombardo/Italy, (3) German Aerospace Center (DLR), Inst. of Engineering Thermodynamics, Stuttgart/Germany</td>
</tr>
<tr>
<td>17:00</td>
<td><strong>Practical evaluation of Solid Oxide Fuel Cell (SOFC) – Micro Gas Turbine (MGT) Hybrid Power Generation System (A0604)</strong></td>
<td>Yasuyaru Kawabata (1,3), Daishiro Takeda (4), Kazuyoshi Ochi (4), Hiroshi Fujiki (4), Toshihiro Oshima (2), Yuya Tachikawa (1), Shunsuke Taniguchi (1,2)</td>
<td>(1,3) Digital Innovation Division, Tokyo Gas Co., Ltd., Yokohama/Japan, (2) Center for Coevolutionary Research for Sustainable Communities, Kyushu University, Fukuoka/Japan, (4) Next-Generation Fuel Cell Research Center(NEXT-FC), Kyushu University, Fukuoka/Japan, (5) Next-Generation Fuel Cell Research Center, Fukuoka/Japan, (6) Next-Generation Fuel Cell Research Center, Fukuoka/Japan</td>
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### B06: Advanced characterization I

**S-Chairs:** Nigel Brandon, Jan Van herle

<table>
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<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>16:30</td>
<td><strong>Fuel Flexibility of SOFCs (B0601)</strong></td>
<td>André Weber</td>
<td>Inst. of Applied Materials (IAM), Karlsruhe/Deutschland</td>
</tr>
<tr>
<td>16:45</td>
<td><strong>Equivalent circuit model of a triple-carrier conductor with partially blocking electrodes (B0602)</strong></td>
<td>Kotaro Okuyama (1), Keiji Yashiro (1), Yoshitaka Aoki (2), Tatsuya Kawada (1)</td>
<td>(1) Graduate School of Environmental Studies, Tohoku University, Sendai/Japan, (2) Graduate School of Engineering, Hokkaido University, Sapporo/Japan</td>
</tr>
<tr>
<td>17:00</td>
<td><strong>Impedance study of ceria-based electrodes reveals an excellent fuel electrode material for solid oxide cells (B0603)</strong></td>
<td>Andreas Nenning (1), Cornelia Bischof (2), Matthias Gerstl (1), Jürgen Fleig (1), Martin Bram (2), Alexander K. Opitz (1)</td>
<td>(1) TU Wien, Inst. of Chemical Technologies and Analytics, Vienna/Austria, (2) Forschungszentrum Jülich GmbH, Inst. of Energy and Climate Research, Materials Synthesis and Processing (IEK-1), Jülich/Germany</td>
</tr>
</tbody>
</table>
Experimental study of large Solid Oxide Cell (SOC) reactor module in co-generation operation mode producing hydrogen and power (A0605)
Srikanth S (1), M. P. Heddrich (1), D. Ullmer (1), S. Asif Ansar (1), Z. Wuillemin(2), E. Varkaraki (2), C. Beetschen (2), Y. Antonetti (2)
(1) German Aerospace Center (DLR), Inst. of Engineering Thermodynamics, Stuttgart/Germany,
(2) SOLIDPower SA, Yverdon/Switzerland

Grain Boundary Diffusivity in LSCF (B0605)
Mathew Niania (1), Samuel Cooper (2), Daniele Pergolesi (3), Thomas Lippert (3), John Kilner (1)
(1) Dept. of Materials, Imperial College London, Royal School of Mines, London/UK,
(2) Dyson School of Design Engineering, Imperial College London, Royal School of Mines, London/UK,
(3) Paul Scherrer Institut, Villigen PSI/Switzerland

La_{0.65}Sr_{0.3}Cr_{0.85}Ni_{0.15}O_{3-δ} perovskite electrocatalyst for high temperature steam and dry CO₂ electrolysis (A0606)
Diana M. Amaya-Dueñas (1), Matthias Riegraf (1), Andreas Nenning (2), Alexander K. Opitz (2), Rémi Costa (1), K. Andreas Friedrich (1)
(1) German Aerospace Center (DLR), Inst. of Engineering Thermodynamics, Stuttgart/Deutschland,
(2) Inst. of Chemical Technologies and Analytics, Vienna Uni of Technology, Vienna/Austria

Exploitation of the surface chemistry of La_{0.6}Sr_{0.4}CoO_{3-δ} thin-film solid-oxide electrodes for the improvement of solid/gas interfaces (B0606)
Ozden Celikbilek (1), Andrea Cavallaro (1), Gwilherme Kerherve (1), Aina Aguadero (1), John A. Kilner (1,2), Stephen J. Skinner (1)
(1) Dept. of Materials, Imperial College London, London/UK,
(2) International Inst. for Carbon-Neutral Energy Research (I2CNER), Kyushu University, Fukuoka/Japan

Morning - Luzerner Saal
09:00 A07: Keynote Grid Flexibility - Business Models
S-Chairs: Olivier Bucheli, Robert Braun

09:00 Where flexibility might save your case, and at what cost (A0701)
Christoph Imboden
Lucerne Uni of Applied Sciences & Arts, Lucerne/Switzerland

09:25 5 Min to change to Luzerner Saal for A08 Session or to Auditorium for B08 Session

Thursday, 22 October 2020
Auditorium - Morning
09:00 B07: Keynote about proton conducting SOC
S-Chairs: Olivier Bucheli, Robert Braun

Proton ceramics – applications, status and prospect (B0701)
Christian Kjølseth, Harald Malerød-Fjeld, Dustin Beeaff, Camilla Vigen, Selene H. Morejudo, Simen Aamodt, Per Vestre, Daniel Clark, Michael Budd
CoorsTek Membrane Sciences, Oslo/Norway

09:00 Where flexibility might save your case, and at what cost (A0701)
Christoph Imboden
Lucerne Uni of Applied Sciences & Arts, Lucerne/Switzerland

09:25 5 Min to change to Luzerner Saal for A08 Session or to Auditorium for B08 Session
<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>09:30</td>
<td>A08: System design &amp; performance</td>
<td>S-Chairs: Satet Raphaelle, Min-Fang Han</td>
</tr>
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<td></td>
<td>Evaluation of biaxial strength and fracture surface analysis of electrolyte-supported solid oxide fuel cells (B0801)</td>
<td>Ferdinand Dömling, Carolin Sitzmann, Nico Langhof, Walter Krenkel Ceramic Materials Engineering, Uni of Bayreuth, Bayreuth/Bavaria</td>
</tr>
<tr>
<td>09:45</td>
<td>Development of highly efficient SOFC system with CO₂ separation technology (A0802)</td>
<td>Tatsuki Dohkoh, Shunnosuke Akabane, Marie Tsuji, Tatsuya Nakajima, Yasusharu Kawabata, Takahiro Ide, Kazuo Nakamura, Toru Hatae Tokyo Gas Co., Ltd., Fundamental Technology Dept., Yokohama/Japan</td>
</tr>
<tr>
<td>10:00</td>
<td>Operating Experience with a 5kW-class Reversible Solid Oxide Cell System (A0803)</td>
<td>Roland Peters, Wilfried Tiedemann, Ingo Hoven, Robert Deja, Nicolas Kruse, Qingping Fang, Ludger Blum, Ralf Peters Forschungszentrum Jülich GmbH, Inst. of Energy and Climate Research (IEK), Jülich/Germany</td>
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<td>10:30</td>
<td>Break - Ground Floor in the Exhibition</td>
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<tr>
<td>Time</td>
<td>Session A09: Emerging SO technology electrode investigation and modelling</td>
<td>Session B09: Lifetime: Stacks and cells</td>
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<td>11:00</td>
<td>Mixed-Ionic Transport Properties of Acceptor Doped Ceria Systems (A0901)</td>
<td>Long-term stability of SOC stacks under realistic operating conditions (B0901)</td>
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<td>N. J Williams, S. J Skinner Dept. of Materials, Imperial College London, London/UK</td>
<td>Qingping Fang, Florian Thaler, Ute de Haart, Dominik Schäfer, Roland Peters, Ludger Blum Forschungszentrum Jülich GmbH, Inst. of Energy and Climate Research (IEK), Jülich/Germany</td>
</tr>
<tr>
<td>11:15</td>
<td>Effects of current density and H2/H2O ratio on the electrolytic performance of anode-supported and metal-supported solid oxide electrolysis cell stacks (A0902)</td>
<td>Post-test analysis of an SOFC after nearly 100,000h of stack operation (B0902)</td>
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<tr>
<td>11:30</td>
<td>High-resolution modelling of SOFC stack layers (A0903)</td>
<td>Test and characterization of reversible solid oxide cells and stacks for innovative renewable energy storage (B0903)</td>
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<tr>
<td>11:45</td>
<td>Solid oxide cells with infiltrated electrodes – Evaluation in reversible operation (A0904)</td>
<td>Long-term steam electrolysis with an SOC with thin (40 µm) 3YSZ electrolyte and Ni/GDC cathode (B0904)</td>
</tr>
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<td>Bhaskar Reddy Sudireddy (1), Xiufu Sun (1), Xiaofeng Tong (1), Ming Chen (1), Karen Brodersen (1), Anne Hauch (1), Giorgio Rinaldi (2), Priscilla Cialandro (2), Arata Nakajo (2), Suhas Sampathkumar (2), Mar Pérez-Fortes (2), Jan Van herle (2) (1) Dept. of Energy Conversion and Storage, Technical Uni of Denmark, Lyngby/Denmark, (2) École Polytechnique Fédérale de Lausanne, Sion/Switzerland</td>
<td>Annabelle Brisse (1), Josef Schefold (1), Christian Walter (2) (1) European Inst. for Energy Research (EIFFER), Karlsruhe/Germany, (2) Sunfire Gmbh, Dresden/Germany</td>
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<tr>
<td>12:00</td>
<td>Modeling of microstructure evolution in solid oxide cells (A0905)</td>
<td>In-operando monitoring and lifetime improvement of SOFCs on single-cell and stack level (B0905)</td>
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<td>Ming Chen (1), Kaiming Cheng (2), Huixia Xu (3), Lijun Zhang (3), Martina Trini (1), Salvatore De Angelis (1), Peter Vang Hendrikse (1) (1) Dept. of Energy Conversion and Storage, Technical Uni of Denmark, Lyngby/Denmark, (2) Shandong Provincial Key Lab. of High Strength Lightweight Metallic Materials, Advanced Materials Institute, Qilu Uni of Technology, Jinani/China, (3) State Key Lab. of Powder Metallurgy, Central South University, Changsha/China</td>
<td>Vanja Subotic (1), Mihails Kusnezoff (2), Stefan Pofahl (3), Vincent Lawlor (3), Benjamin Königshofer (2), Teko W. Napporn (4), Stefan Megel (2), Christoph Hochenauer (1) (1) Inst. of Thermal Engineering, Graz Uni of Technology, Graz/Austria, (2) Fraunhofer-Institut für Keramische Technologien und Systeme IKTS, Dresden/Germany, (3) AVL List Gmbh, Graz/Austria, (4) Uni of Poitiers, Institut de Chimie des Milieux et Matériaux de Poitiers (IC2MP), Poitiers/France</td>
</tr>
</tbody>
</table>
12:15  Solid oxide batteries for low-cost long-duration energy storage (A0906)
Christopher Graves (1,2,3)
(1) Technical Uni of Denmark, Dept. of Energy Conversion and Storage, Lyngby/Denmark,
(2) Cyclotron Road Fellow, Lawrence Berkeley National Laboratory, Berkeley/USA,
(3) Noon Energy Inc, Palo Alto/USA

12:30  Lunch - 2nd Floor on the Terrace / Coffee - Ground Floor in the Exhibition & in the Poster Session

13:15  A10: Poster Session II covering All Session Topics
S-Chairs: Anke Hagen, Peter Vang Hendriksen

15:00  A11: P3: Keynote Energy systems
S-Chairs: Anke Hagen, Peter Vang Hendriksen
Smart Energy Systems and Electrolysers in Renewable Energy Systems (A1101)
Brian Vad Mathiesen; Department of Planning, Aalborg University, København SV/Denmark

15:25  5 Min to change to Auditorium for B12 Session

Degradation analysis of CFY-stacks MK35x and Illusiveness of accuracy –
a guide for exact measurement (B0906)
Stefan Megel (1), Stefan Rothe (1), Viktar Sauchuk (1), Nikolai Trofimenko (1), Jochen Schilm (1),
Mihails Kusnezoff (1), Martin Hauth (2), Christoph Sallai (2)
(1) Fraunhofer IKTS, Dresden/Germany, (2) AVL GmbH, Graz/Austria
**Afternoon - Luzerner Saal**

**Thursday, 22 October 2020**

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<thead>
<tr>
<th>Time</th>
<th>Session A12: SOC integration, Power-to-X, CO2 capture etc.</th>
<th>Session B12: Oxygen electrodes I</th>
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<td>15:30</td>
<td>A12: SOC integration, Power-to-X, CO2 capture etc.</td>
<td>B12: Oxygen electrodes I</td>
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<tr>
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<td>S-Chairs: Anke Hagen, Peter Vang Hendriksen</td>
<td>S-Chairs: John Irvine, Truls Norby</td>
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<tr>
<td>15:30</td>
<td>Integration of carbonate looping and solid oxide electrolysis cell for CO2 capture and reduction (A1201)</td>
<td>Approaching Theoretical Current Density: A micro-/Nano-Honeycomb Solid Oxide Electrolysis Cell Anode (B1201)</td>
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<td>Chengzhi Guan (1,2), Yue Lu (1), Song Wan (1), Chunfeng Hong (1), Xianlong Du (1,2), Guoping Xiao (1,2), Zhongfeng Tang (1), Jian-Qiang Wang (1,2)</td>
<td>Bo Yu*, Wengiang Zhang, Jing Chen</td>
</tr>
<tr>
<td></td>
<td>(1) Shanghai Inst. of Applied Physics, Chinese Academy of Sciences, Jiading District/Shanghai, (2) Key Lab. of Interfacial Physics and Technology, Chinese Academy of Sciences, Jiading District/Shanghai</td>
<td>Inst. of Nuclear and New Energy Technology, Tsinghua University, Beijing/P. R. China</td>
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<tr>
<td>15:45</td>
<td>Experimental analysis of SOE stacks under pressurized co- and CO2 electrolysis operation (A1202)</td>
<td>Improved mesoporous scaffolds for composite electrodes in solid oxide devices for direct hydrogen production (B1202)</td>
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<td></td>
<td>Marc Riedel, Marc P. Hedrich, Asif Ansar, K. Andreas Friedrich</td>
<td>Simone Anelli (1), Federico Baiutti (1), Aitor Hornés (1), Lucile Bernardet (1), Marc Torrell (1), Albert Tarancón (1,2); (1) Catalonia Inst. for Energy Research (IREC), Dept. of Advanced Materials for Energy, Barcelona/Spain, (2) ICREA: Catalan Institute for Research and Advanced Studies, Barcelona/Spain</td>
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<td>16:00</td>
<td>Break - Ground Floor in the Exhibition &amp; in the Poster Session</td>
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**Afternoon - Luzerner Saal**

**Thursday, 22 October 2020**

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<tr>
<th>Time</th>
<th>Session A13: Products, demonstrations, novel concepts &amp; BoP</th>
<th>Session B13: Cells, stacks, and interconnects</th>
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<tr>
<td>16:30</td>
<td>A13: Products, demonstrations, novel concepts &amp; BoP</td>
<td>B13: Cells, stacks, and interconnects</td>
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<td>S-Chairs: Subhashish Mukerjee, Oliver Posdziech</td>
<td>S-Chairs: Eric Wachsman, Kazunari Sasaki</td>
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<tr>
<td>16:30</td>
<td>SOFC technology for heavy-duty vehicle propulsion (A1301)</td>
<td>Conditioning optimization in Sandvik Sanergy® HT 441 after the forming process (B1301)</td>
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<td></td>
<td>Marcus Taylor, Robert Steinberger-Wickens, Centre for Fuel Cell &amp; Hydrogen Research, School of Chemical Engineering, Uni of Birmingham, Birmingham/UK</td>
<td>Carlos Bernuy-López, Pablo Collantes-Jiménez, Ulf Bexell, Jürgen Westlinder</td>
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<td></td>
<td>Protonic Ceramic Electrochemical Hydrogen Compression with Planar Cell Geometries (A1302)</td>
<td>Surface Research, Strategic Research, AB Sandvik Materials Technology, Sandviken/Sweden</td>
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<td>Benjamin Kee (1), Sandrine Ricote (1), Robert J. Kee (1), W.G. Coors (2)</td>
<td>Material development for operation of solid oxide cells under specific conditions (B1302)</td>
</tr>
<tr>
<td></td>
<td>(1) Mechanical Engineering, Colorado School of Mines, Golden/USA, (2) Hydrogène Hélix, SAS, Cannes/France</td>
<td>David Udomsilp (1), Christian Lenser (1), Olivier Guillou (1,2), Norbert H. Menzler (1)</td>
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<td></td>
<td></td>
<td>(1) Forschungszenrum Jülich GmbH, Inst. of Energy and Climate Research, Materials Synthesis and Processing (IEK-1), Jülich/Germany, (2) Jülich Aachen Research Alliance: JARA-ENERGY, Jülich/Germany</td>
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</table>
Demonstration of High-Temperature (Co-)Electrolysis Systems and their Evolution towards Multi-MW Scale (A1303)
Konstantin Schwarze, Robert Blumentritt, Thomas Geißler, Hubertus Richter, Oliver Posdziech
Sunfire GmbH, Dresden/Germany

SOE stack deterioration caused by reactant contaminations in realistic operation conditions (A1304)
Dominik Schäfer, Larissa Queda, Qingping Fang, Ludger Blum
Forschungszentrum Jülich GmbH, Inst. of Energy and Climate Research (IEK), Jülich/Germany

Effect of Temperature and Water Content on the Oxidation Behavior and Cr Evaporation of High-Cr Steels for SOFC Cathode Air Preheater (A1305)
Kun Zhang, Ahmad El-kharouf, Robert Steinberger-Wilckens; Centre for Fuel Cell & Hydrogen Research, School of Chemical Engineering, Uni of Birmingham, Birmingham/UK

Summary of the RECOGEN project: SOFC System with Heat-Driven Recirculation and Cogeneration (A1306)
Patrick H. Wagner (1), Zacharie Wuillemin (2), David Constantin (3), Stefan Diethelm (2,3), Jan Van herle (3), Jürg Schöffmann (1)
(1) EPFL-LAMD, Neuchâtel/Suisse,
(2) SOLIDpower, Yverdon-les-Bains/Suisse,
(3) EPFL-GEM, Sion/Suisse

Oxygen-Electrode-Supported Solid Oxide Cells Utilizing Exsolution Fuel Electrodes (B1303)
Scott Barnett (1), Shanelin Zhang (1,2), Hongqian Wang (1), Tianrang Yang (1), Matthew Y. Lu (1), Cheng-Xin Li (2), Chang-Jiu Li (2)
(1) Northwestern University, Evanston/USA, (2) Xi’An Xiaotong University, Shaanxi/PR China

Fabrication and testing of MnCo2O4 based interconnect protective coatings by spray pyrolysis (B1304)
Sebastian Malin (1), Bartosz Kamecki (1,2), Jakub Karczewski (2), Piotr Jasiński (2)
(1) Faculty of Electronics, Telecommunications and Informatics, Gdańsk/Poland,
(2) Faculty of Applied Physics and Mathematics, Gdańsk Uni of Technology, Gdańsk/Poland

Can Solid Oxide Fuel Cell be Operated below the Temperature of Self-Ignition of Hydrogen and Oxygen? (B1305)
Ulf Bossel
ALMUS AG, Oberrohrdorf/Switzerland

Progress Report of Metal-supported SOFC (B1306)
Seung-Wook Baek (1), Jungi Hyun Kim (2), Jihoon Jeong (3), Joongmyeong Bae (4)
(1) Division of Industrial Metrology, Korea Research Inst. of Standards and Science, Daejeon/Republic of Korea,
(2) Dept. of Advanced Materials Science and Engineering, Hanbat National University, Daejeon/Republic of Korea,
(3) Walker Dept. of Mechanical Engineering, The Uni of Texas at Austin, Austin/USA,
(4) Dept. of Mechanical Engineering, Korea Advanced Inst. of Science and Technology, Daejeon/Republic of Korea

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<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
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<tr>
<td>09:00</td>
<td>A14</td>
<td>Proton Conducting Cells, Stacks and materials</td>
<td>S-Chairs: Jose M. Serra, Ellen Ivers-Tiffée</td>
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<td>09:15</td>
<td>B14</td>
<td>Oxygen electrodes II with fast oxygen exchange kinetics for SOEC and SOFC (B1401)</td>
<td>S-Chairs: Mogens Mogensen, Harumi Yokokawa</td>
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<td>09:15</td>
<td>B14</td>
<td>Ln₂Ni₁₋ₓCoxO₄₊δ (Ln = La, Pr or Nd, x= 0, 0.1, 0.2) as high performance and durable oxygen electrodes for solid oxide cells (B1402)</td>
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<td>09:30</td>
<td>B14</td>
<td>Performance of Ruddlesden-Popper-Type Oxides as Air Electrodes for Solid Oxide Cells (B1404)</td>
<td>Werner Sitte, Andreas Egger, Edith Bucher, Haruo Kishimoto, Katsuhiko Yamaji, Teruhisa Horita</td>
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<td>10:00</td>
<td>A14</td>
<td>Research Summary of Protonic Ceramic Electrochemical Cells (PCECs) at Idaho National Laboratory (A1405)</td>
<td>Dong Ding, Hanping Ding, Wei Wu; Idaho National Laboratory, Idaho Falls/USA</td>
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<td>Time</td>
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<td>Presenter and Affiliation</td>
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<td>Influence of the defect chemistry in calcium-doped lanthanum manganese perovskites on oxygen evolution reactions (OER) and oxygen reduction reactions (ORR) (B1406) Sabrina A. Heuer (1,2), Trutz Theuer (1,2), Roland Schierholz (1), Hermann Tempel (1), Izaak C. Vinke (1), Lambertus G.J. de Haart (1), (2), Gjorgji Nusev (2), Hartmut Schröttner (3), Christoph Hochmayer (1), Hans Kungl (1), Rüdiger-A. Eichel (1,2); (1) Forschungszentrum Juelich GmbH, Inst. of Energy and Climate Research, Juelich/Germany, (2) RWTH Aachen University, Inst. of Physical Chemistry, Aachen/Germany</td>
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<td>10:30</td>
<td>Break - Ground Floor in the Exhibition</td>
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<td>11:00</td>
<td>A15: Cell, stack &amp; system modelling and optimization</td>
<td>S-Chairs: John Bøgild Hansen, Yoshio Matsuzaki</td>
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<td>Fabrication of Porous Structure with 3D Printing Technology (A1501)</td>
<td>Kotaro Miyamoto (1), Hirotaka Koga (1), Masaaki Mizum (1), Hidekazu Nishiguchi (3)</td>
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<td>(1) The Uni of Kitakyushu, Fukuoka/Japan, (2) Kyushu Koriyama University, Fukuoka/Japan, (3) Meiryo Corporation, Fukuoka/Japan</td>
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<td>A methodology for the assessment of sealing joints in high-temperature SOFC stacks (A1502)</td>
<td>Sophia Bremm (1), Sebastian Dölling (1), Willfried Becker (1), Judger Blum (2), Roland Peters (2), Jürgen Malzbender (2), Detlef Stolten (2)</td>
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<td>(1) Technische Universität Darmstadt, Fachgebiet Strukturmechanik, Darmstadt/Germany, (2) Forschungszentrum Jülich GmbH, Jülich/Germany</td>
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<td>B15: Lifetime: Cells, components and interfaces</td>
<td>S-Chairs: Robert Steinberger-Wilckens, Koichi Eguchi</td>
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<td>Electrochemical analysis of Ni-YSZ anode in anode-supported cells: reaction mechanism and effective reaction zone (B1501)</td>
<td>Riyan Achmad Budiman, Katherine-Develos Bagarinao, Tomohiro Ishiyama, Haruo Kishimoto, Katsuhiko Yamaji, Teruhisa Horita (National Inst. of Advanced Industrial Science and Technology, Ibarakii/Japan)</td>
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<td>Repairing solid oxide cell electrodes during operation (B1502)</td>
<td>Theis L. Skafte (1,2,3), Frederik Schweer-Gori (1), Seren B. Simonsen (1), Marie L. Traulsen (1), Bhaskar R. Sudireddy (1), Michael C. Tucker (2), Christopher Graves (1,3,4)</td>
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<td>(1) Technical Uni of Denmark, Dept. of Energy Conversion and Storage, Lyngby/Denmark, (2) Lawrence Berkeley National Laboratory, Energy Storage and Distributed Resources Division, Berkeley/USA, (3) Noon Energy Inc, Alto/USA, (4) Cyclotron Road Fellow, Lawrence Berkeley National Laboratory, Berkeley/USA</td>
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11:30 Multi-scale model to describe the local degradation and mechanical failures in a SOCl stack (A1503)
Henrik Lund Frandsen, Omid Babaie Rizvandi, Xing-Yuan Miao, Aiswarya Krishnakumar Padinjarethil, Anke Hagen, Anne Hauch
Dept. of Energy Conversion and Storage, Technical Uni of Denmark (DTU), Lyngby/Denmark

11:45 Reaction mechanism analysis and microscopic modeling for co-electrolysis (A1504)
M. Nohl (1), L. Dittrich (1), E.E. Jaekel (1), I.C. Vinke (1), L.G.J. de Haart (1), R. A. Eichel (1,2)
(1) Inst. of Energy and Climate Research, Fundamental Electrochemistry (IEK-9), Forschungszentrum Jülich GmbH, Jülich/Germany,
(2) Inst. of Physical Chemistry, RWTH Aachen University, Aachen/Germany

12:00 Reaction mechanisms and durability of LSCF and LSCF-CGO electrodes: a coupled approach with elementary kinetic modelling and long-term testing under aggravated conditions (A1505)
E. Effori (1,2), E. Siebert (2), M. Petitjean (1), L. Dessemont (2), J. Laurencin (1)
(1) Univ. Grenoble Alpes – CEA/LITEN, Grenoble/FRance,
(2) Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble/France

12:15 Lifetime prediction of high temperature fuel cells using machine learning (A1506)
Aiswarya Krishnakumar Padinjarethil, Stefan Pollok, Anke Hagen
Dept. of Energy Conversion and Storage, Technical Uni of Denmark (DTU), Lyngby/Denmark
13:30  A16: System design & performance & BoP  
S-Chairs: Yasunobu Mizutani, Dario Montinaro

13:30  Results of 5 kW SOFC CHP system development in the SOFC5-60 project (A1601)  
Christopher Sallai, Stephan Weßensteiner, Michael Seidl, Stephan Pickelberger, Martin Hauth  
AVL List GmbH, Graz/Austria

13:45  xThermal Integration of a 150 kW SOEC System within a Nuclear Power Plant Facility (A1602)  
Joshua Merméstien, Tyler Westover, Richard Boardman  
Idaho National Laboratory, Idaho Falls/USA

14:00  Results from the operation of the first industrial size biogas-fed SOFC plant in Europe (A1603)  
M Acri, M. Gandiglio, T. Hakala, A. Hawkes, M. Rautanen, M. Santarelli  
Dept. Of Energy DENERG, Politecnico di Torino, Torino/Italy

14:15  SchIBZ® - experiences with liquid fuelled SOFC for ship applications (A1604)  
Keno Leites  
thyssenkrupp Marine Systems GmbH, Hamburg/Germany

14:30  A New Class of Materials for Desulfurization and Purification of Natural Gas, LPG and Biogas (A1605)  
Gokhan Alptekin, PhD  
SulfaTrap LLC, Arvada/USA

Jun Yong Kim, Luca Mastropasqua, Alireza Saeedmanesh, Jack Brouwer  
Advanced Power and Energy Program Engineering Lab. Facility, Uni of California, Irvine/USA

14:00  5 Min to change from B15 Session to Luzerner Saal for A16 Plenary Session
A17: P4: Closing Ceremony  
Keynote by the EFCF Gold Medal of Honour Winner 2020  
S-Chairs: Anke Hagen, Peter Vang Hendriksen, O. Bucheli, M. Spirig

15:05  
Summary by the Chairs (A1701)  
Anke Hagen, Peter Vang Hendriksen  
Technical University of Denmark, Lyngby/Denmark

15:20  
Information on Next EFCF:  
EFCF 2022 15th European SOFC & SOE Forum  
EFCF 2021 9th FC, Electrolyser & H2 Processing Forum (A1702)  
Olivier Bucheli (1), Thomas Schmidt (2), Michael Spirig (1)  
(1) European Fuel Cell Forum, Lucerne/Switzerland,  
(2) Paul Scherer Institut, Villigen PSI/Switzerland,

15:30  
Christian Friedrich Schönbein Award  
for the Best Poster, Best Science Contribution, Medal of Honour (A1703)  
Peter Vang Hendriksen, Anke Hagen  
Technical University of Denmark, Lyngby/Denmark

15:40  
Gold Medal Winner Keynote 2020  
History, status and prospects of SOC Systems (A1704)  
Ludger Blum, Forschungszentrum Jülich, Jülich/Germany

16:05  
Thank you and Closing by the Organizers (A1705)  
Olivier Bucheli, Michael Spirig  
European Fuel Cell Forum, Luzern/Switzerland

16:15 End of Sessions - End of Conference  
Good bye coffee and travel refreshment in front of the Luzerner Saal
A03 Poster Session I  covering All Session Topics

Wednesday, 21 October 2020  Afternoon 13.15 - 15:00

A03  + A05: Technology status at industry and major groups I + II

Evaluating the market attractiveness for Fuel Cell micro-Cogeneration units by applying a Multi-Criteria Evaluation (MCE) (A0307)
Tanaka Mbavarira, Marco Kunz; Lucerne University of Applied Sciences and Arts (HSLU), Horw/Lucerne

Development of 1 kW-class ammonia-fueled solid oxide fuel cell stack (A0308)
Masashi Kishimoto (1), Hiroki Muroyama (2), Shinsuke Suzuki (3), Masaki Saito (3), Takeshi Koido (3), Yoosuke Takahashi (3), Toshitaka Horiuchi (4), Hayahide Yamasaki (4), Shohei Matsumoto (5), Hidehito Kubo (5), Naoya Takahashi (6), Akihiro Okabe (6), Satoshi Ueguchi (7), Munsuk Jun (7), Akira Tateno (7), Takahiro Matsuo (7), Toshiaki Matsui (2), Hiroshi Iwai (1), Hideo Yoshida (1), Koichi Eguchi (2); (1) Dept. of Aeronautics and Astronautics, Kyoto University, Nishikyo-ku, Kyoto/Japan, (2) Dept. of Energy and Hydrocarbon Chemistry, Kyoto University, Nishikyo-ku, Kyoto/Japan, (3) Toyota Industries Corporation, Aichi/Japan, (4) Nippon Shokubai Co., Osaka/Japan, (5) Institute of Engineering Thermodynamics, German Aerospace Center (DLR), Stuttgart/Deutschland, (6) Mitsubishi Chemicals Inc., Chiba/Japan, (7) IHI Corporation, Kanagawa/Japan

The analysis of the status of industrial ecology system and technical level Korea’s fuel cell technology sector (A0309)
Yoo Ran, Seongkon Lee; Energy Policy Research Center, Korea Inst. of Energy Research, Daejeon/Republic of Korea

A06: Products and demonstrations

Development progress of a Residential SOFC CHP system “ENE-FARM type S” at Osaka Gas (A0607)
Naseruddin Khan, Youssif Al-Sagheer, Pietro Tricoli, Robert Steinberger-Wilkens; Osaka Gas Co. Ltd., Osaka/Japan

B03: Manufacturing Processes

Electrochemical performance improvement of solid oxide fuel cells by meso/nanostructure control (B0307)
Haewon Seo (1), Masashi Kishimoto (1), Hiroshi Iwai (2), Changsheng Ding (1), Motohiro Saito (1), Hideo Yoshida (1); (1) Dept. of Aeronautics and Astronautics, Kyoto University, Kyoto/Japan, (2) Dept. of Mechanical Engineering, Kyoto University, Kyoto/Japan

Characterization of femtosecond-laser-structured solid oxide electrolysis cell (B0308)
Tobias Marquardt (1), Andreas Gabler (2), Stephan Kabelac (1); (1) Inst. of Thermodynamics, Leibniz Uni Hannover, Hannover/Germany, (2) Forschungszentrum Energiespeichertechnologien, TU Clausthal, Goslar/Germany

Thin-film Gd-doped Ceria Diffusion Barrier Layers for Electrolyte Supported Solid Oxide Cells (B0309)
Feng Han (1), Matthias Riegraf (1), Christian Geipel (2), Christian Walter (2), Rémi Costa (1); (1) Inst. of Engineering Thermodynamics, German Aerospace Center (DLR), Stuttgart/Deutschland, (2) Sunfire GmbH, Dresden/Germany

Facile and durable TC film approach buffer layer design for suppressing chemical degradation of solid oxide fuel cell (B0310)
Amjad Hussain (1,2), Raek-Hyun Song (1,2), Jong-Eun Hong (1), Seung-Bok Lee (1,2), Tak-Hyoung Lim (1,2); (1) Fuel Cell Research Center, Korea Inst. of Energy Research, Daejeon/Korea, (2) Dept. of Advanced Energy and System Engineering, Uni of Science and Technology (UST), Daejeon/Korea

Highly effective diffusion-blocking layer to suppress the interfacial reaction between cathode and electrolyte of SOFCs (B0311)
Jong-Ho Lee, Kyung-Joong Yoon, Seungwan Lee, Sung-Young Yang, Ho-II Ji, Hyeongchul Kim, Ji-Won Son, Byung-Kook Kim, Hae-Woon Lee; Korea Inst. of Science and Technology, Seoul/Republic of Korea

Additive manufacturing-based 3D printed Solid Oxide Fuel Cells (B0312)
Shrikant S. Kawale, Chenyang Liao, Sivaprakash Sengodan, Stephen J. Skinner; Dept. of Material, Imperial College London, Royal School of Mines, London/UK
Development Of
A High-Efficiency, Low-Cost Hybrid SOFC/Internal Combustion Engine Power Generator (A0608)
(1) Colorado School of Mines, Golden/Colorado/U.S.A,
(2) Kohler Power Systems, Wisconsin/U.S.A. (3) Colorado State University, Collins/Colorado/U.S.A

SOFC Hybrid as Solution for Bus & Truck Electrification (A0609)
Bernd Reiter, Thomas Krauss, Raphael Neubauer, Martin Hauth, Jürgen Rechberger
AVL List GmbH, Graz/Austria

A08: System design & performance

Experimental analysis of a pressurized 30 kW SOFC system with fuel gas recirculation at reaction temperature (A0807)
Marius Tomberg, Matthias Metten, Christian Schniegelberger, Marc P. Hedrich, S. Asif Ansar, K. Andreas Friedrich; German Aerospace Center (DLR), Inst. of Engineering Thermodynamics, Stuttgart/Deutschland

Osaze Omoregbe, Ahmad El-kharouf, Robert Steinberger-Wilckens
Centre for Fuel Cell & Hydrogen Research, School of Chemical Engineering. Uni of Birmingham, Birmingham/UK

Integration and Operation of 20kW-HTSE Using SOC Technology to Produce Green Hydrogen (A0809)
Guoping Xiao, Xianlong Du, Chunfeng Hong, Huijuan Yan, Jian-Qiang Wang; Center for Thorium Molten Salt Reactor System, Shanghai Inst. of Applied Physics, Chinese Academy of Sciences, Shanghai/China

Teaching FCH Technologies in a Masters’ Course across Europe (A0810)

Large cell, short-term stability testing of Au-Mo-modified Ni/GDC for solid oxide co-electrolysis (B0313)

Fabrication of SOFC Stacks with Metal-Brazed Separator for Enhanced Durability under Thermal Cycling (B0314)
Hyeon-Jin Kim, Kyong Sik Yun, Ji Heang Yu; Korea Inst. of Energy Research, Daejeon/Republic of Korea

Performances and durability of solid oxide cells manufactured with graded electrodes (B0316)
Pierre Coddet (1), Daniela Neacsu (2), Cecile Autret (2), Jérôme Laurencin (3), Julian Vulliet (1)
(1) CEA Le Ripault, Monts/ France, (2) Université de Tours, CNRS, GREMAN UMR7347, Tours/ France, (3) Univ. Grenoble Alpes – CEAT/ Grenoble/ France

Novel Co- and Ni-free oxygen electrode architecture with a patterned electrode/electrolyte interface (B0317)
Claire Ferchaud, Loek Berkveld, Miranda Heijink-Smith, Frans van Berkel, Yvonne von Delft
ECN part of TNO, ZG Petten/The Netherlands

Characteristics of solid oxide fuel cell components fabricated by ultrasonic spray coating process (B0318)
Seokhee, Youngwook Lee, Taeho Shin; Energy & Environmental Division, Korea Inst. of Ceramic Engineering and Technology, Gyeongsangnam-do/Republic of Korea

Engineering and optimization of electrode/electrolyte interfaces to increase solid oxide fuel cell (SOFC) performances (B0319)
Rosen Tchakalov (1), A. Chesnau (1), A. Thorel (1); (1) MINES PARISTECH, PSL Research University, Evry/ France,

CENTRALESUPELEC, Université Paris-Saclay, Gif-sur-Yvette/ France
A08: System simulation and experimental investigation of Ammonia reforming and its application to SOFC power generation system (A0811)
Dong Keun Lee (1), Sang Ho Lee (1), Young Sang Kim (1), Young Duk Lee (1,2), Kook Young Ahn (1,2); (1) Korea Institute of Machinery & Materials (KIMM), (2) University of Science and Technology (UST), Daejeon/South Korea,
On-line diagnosis of a solid oxide fuel cell stack by means of uncertain equivalent circuit models (A0812)
Luka Žnidarič (1), Gorijgi Nusev (1), Bertrand Morel (2), Julie Mougin (2), Dani Jurčič (1), Pavle Božkoski (1); (1) Jožef Stefan Institute, Ljubljana/Slovenia, (2) Univ. Grenoble Alpes – CEA/LITEN, Grenoble CEDEX 9/France
Operation Characteristics according to Steam Temperature of External Steam-related SOEC System (A0813)
Young Sang Kim (1), Young Duk Lee (1,2), Kook Young Ahn (1,2); (1) Dept. of Clean Fuel and Power Generation, Korea Inst. of Machinery & Materials (KIMM), Daejeon/South Korea, (2) Uni. of Science and Technology (UST), Daejeon/South Korea
Syngas fueled Solid Oxide Fuel Cells – Experiments and thermodynamic equilibrium analysis (A0814)
Rakesh N, Anand M S, S Dasappa; Centre for Sustainable Technologies, Indian Institute of Science, Bangalore/Karnataka/India
A09: Emerging SO technology electrode investigation and modelling
Complex transport phenomena inside a planar SOFC stack at high fuel utilization (A0907)
Sanghyeok Lee (1), Younggyun Bae (2), Kyung Joong Yoon (1), Jong-Ho Lee (1), Jongsup Hong (2); (1) Center for Energy Materials Research, Korea Inst. of Science and Technology, Seoul/South Korea, (2) Dept. of Mechanical Engineering, Yonsei University, Seoul/South Korea
Three-dimensional Microstructure Reconstructions of Solid Oxide Fuel Cell Electrodes with Large Volume Size using Generative Adversarial Networks (A0908)
Zilin Yan (1,2), Zhenjun Jiao (1), Naoki Shikazono (2), Shotaro Hara (3); (1) School of Science, Harbin Inst. of Technology, Uni Town, Shenzhen/China, (2) Inst. of Industrial Sciences, The Uni of Tokyo, Tokyo/Japan, (3) Faculty of Engineering, Chiba Inst. of Technology, Chiba/Japan
B05: Fuel electrodes
Digital Materials Design (DMD) of SOFC electrodes (B0507)
Cation-swapped homogeneous nanoparticles in perovskite oxides for solid oxide fuel cell anodes (B0508)
Sivaprakash Sengodan; Dept. of Materials, Imperial College London, London/UK
Electrochemical performance and carbon resistance comparison between Sn, Cu, Ag, and Rh-doped Ni/ScCeSZ anode SOFCs operated by biogas (B0509)
Zeyu Jiang, Abigail Snowdon, Ahmad El-kharouf, Robert Steinberger-Wilckens; Centre for Fuel Cell & Hydrogen Research, School of Chemical Engineering, Uni of Birmingham, Birmingham/UK
Microstructure, performance and stability of thin film Ni-YSZ anodes (B0510)
Buse Bilbey (1), Meldrem Sezen (2), Cleva Ow-Yang (3), Aligül Büyükaksoy (1,4); (1) Dept. of Materials Science and Engineering, Kocaeli/Turkey, (2) SUMUN Nanotechnology Research Center, Sabanci University, Tuzla/Istanbul, (3) Faculty of Engineering and Natural Sciences, Sabanci University, Tuzla/Istanbul, (4) Inst. of Nanotechnology, Gebze Technical University, Kocaeli/Turkey
Improving the performance of solid oxide electrolysis cell with GDC nanoparticles-modified Ni-YSZ cathode (B0511)
Xiao Lin, Linjuan Zhang, Guoping Xiao, Jing Zhou, Yu Wang, Jian-Qiang Wang*; Shanghai Inst. of Applied Physics, Chinese Academy of Sciences, Shanghai/P. R. China
Gd$_{0.1}$Ce$_{0.9}$O$_{2-δ}$ nanosol coating in porous metal support for development of high performance metal-supported solid oxide fuel cells (B0512)
Sang-Kuk Woo, Sun-dong Kim Energy Materials Laboratory, Korea Institute of Energy Research (KIER) Sang-Kuk Woo, Sun-dong Kim; Energy Materials Laboratory, Korea Inst. of Energy Research (KIER), Daejeon/Republic of Korea
Investigation on B-site exsolved titanates and its structure-property relationship as fuel electrode in solid oxide cells (B0513)
Shuai He; School of Chemistry, University of St Andrews, Fife/United Kingdom
Advancements in ceramic nanocomposite fuel cell research and challenges (A0909)
Muhammad Imran Asghar (1,2), Peter Lund (2)
(1) Faculty of Physics and Electronic Science, Hubei University, Wuhan Hubei/China,
(2) New Energy Technologies Group, Dept. of Applied Physics, Aalto Uni School of Science, Espoo/Finland

Thermal stress analysis of a planar SOFC stack under long-term operation (A0910)
Guang-Jhih Jheng (1), Chi-Huang Lin (1), Szu-Han Wu (2), Chien-Kuo Liu (2), Ruey-Yi Lee (2)
(1) Dept. of Mechanical Engineering, National Central University, Tao-Yuan/Taiwan,
(2) Nuclear Fuels and Materials Division, Inst. of Nuclear Energy Research, Tao-Yuan/Taiwan

Lifetime prediction of SteelCell® stacks using advanced multiphysics modelling (A0911)
Ameir Mahgoub, Robert Leah, Duncan Gawel, Gavin Reade, Jack Howlett,
Nick Lawrence, Subhasish Mukerjee, Mark Selby
Ceres Power Ltd., Horsham/UK

Model based engineering for improved SOFC system development (A0912)
Raphael Neubauer, Thomas Krauss, Bernd Reiter, Juergen Rechberger; AVL List GmbH, Graz/Austria

Transmission Line Modeling of Composite Electrodes (A0913)
Sebastian Dierickx, Florian Wankmüller, André Weber, Ellen Ivers-Tiffée
Inst. of Applied Materials (IAM), Karlsruhe/Deutschland

CFD simulation of SOC stack layer under fuel cell and electrolysis conditions (A0914)
Stephan Herrmann (1), Sebastian Wilhelm (1), Maximilian Hauck (1), Felix Fischer (1), Jeremias Weinrich (2),
Matthias Gaderer (2), Hartmut Spliethoff (1)
(1) Lehrstuhl für Energiesysteme, Technische Universität München (TUM), Garching/Germany,
(2) Professur für Regenerative Energiesysteme, Technische Universität München, Straubing/Germany

Interaction of BZCY with YSZ, NiO and sintering aids (A0915)
Xinge Zhang, Luigi Alde, Mark Robertson, Jason Fahlman
EME Research Center, National Research Council Canada, Vancouver/Canada

Effect of the Porosity of Cathode Layers on the Performance of Solid Oxide Fuel Cells (A0916)
N. Alhazmi (1), G.N.A. Almutairi (2), Ferial Ahenayez (2), B. AlOtaibi (2)
(1) Materials Science Research Institute, ,
(2) Energy Research Institute, King Abdul Aziz City for Science and Technology (KACST), Riyadh/Saudi Arabia

Nd and Ni co-doped BaFeO$_3$ cathode materials for intermediate-temperature solid oxide fuel cells (B0514)
You-Dong Kim, Ja-Yoon Yang, Kwangho Park, Jun-Young Park
Dept. of Nanotechnology and Advanced Materials Engineering, Sejong University, Seoul/Korea

Advanced Anodes for Direct Hydrocarbon Fueled-SOFCs with Improved Thermal Management (B0515)
Boxun Hu (1), Seraphim Belko (1), Michael Reisert (1), Junsung Hong (1), Ashish Aphale (1), Rabi Bhattacharya (2), Brian J. Koeppe (4), Prabhakar Singh (1); (1) Uni of Connecticut, Storrs CT/USA, (2) UES Inc., Dayton/USA, (3) Pacific Northwest National Lab, Richland/USA, (4) Lawrence Berkeley National Lab, Berkeley/USA

B06: Advanced characterization I

Determination of the RWGS and the CO$_2$ Electro-Catalytic reduction reactions on Ni/GDC during Solid Oxide H$_2$O/CO$_2$ Co-Electrolysis (B0607)
Evangelia Ioannidou (1,2), Mara Chavani (1,2), Stylianos G. Neophytides (1), Dimitrios K. Niakolas (1)
(1) Foundation for Research and Technology, Inst. of Chemical Engineering Sciences (FORTH/ICE-HT), Patras/Greece,
(2) Dept. of Chemical Engineering, Uni of Patras, Patras/Greece

Recent Process about the SOEC Materials by Synchrotron Radiation-based X-ray absorption Spectra (B0608)
Linjuan Zhang*, Ze Liu, Yuxuan Zhang, Xiao Lin, Jian-Qiang Wang
Dept. of Molten Salt Chemistry and Engineering, Shanghai Inst. of Applied Physics, Shanghai/China

SOFC In-Field Test of an Advanced Monitoring and Diagnostics Tool (B0609)
Jan Pieter Ouwelte (1), Francesco Galiano (2), Marco Gallo (3), Pavle Boškoski (4), Stefan Pofahl (5), Aki Niiminen (6), Bertrand Morel (7), Andrea Leonardi (8)
(1) SOLIDpower SA, Yverdon-les-Bains/Switzerland, (2) Bitron, Grugliasco/Italy,
(3) Uni of Salerno, Salerno/Italy, (4) Jožef Stefan Institute, Ljubljana/Slovenia,
(5) AVL List, Graz/Austria, (6) VTT, Espoo/Finland,
(7) CEA, Grenoble/France, (8) SOLIDpower SpA, Mezzolombardo/Italy,

Mechanical characterization of thin 3YSZ electrolyte-supported solid oxide fuel cells (SOFC) (B0610)
Tom Liensdorf, Ferdinand Dömling, Carolin Sitzmann, Nico Langhof, Walter Krenkel
Ceramic Materials Engineering, Uni of Bayreuth, Bayreuth/Bavaria
Multiphase-field simulations of nickel-coarsening in SOFC-anodes (A0917)
Paul W. Hoffrogge (1), Daniel Schneider (1,2), Florian Wankmüller (1), André Weber (1), Patricia Haremski (3), Anika Maruszczyn (3), Matthias Wieler (3), Piero Luponetti (3), Britta Nestler (1,2)
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Transient Analysis of the solid oxide fuel cell coupled absorption refrigeration system for refrigerated transportation (A0918)
Bhargav Pandya, Ahmad El-Kharouf, Robert Steinberger-Wilckens
Centre for Fuel Cell & Hydrogen Research, School of Chemical Engineering, Uni of Birmingham, Birmingham/UK

A study of Surface modified Ba(Sr)Co(Fe)O$_3$ perovskite electrocatalyst for Oxygen Electrode Reaction beyond Room Temperature Application (A0919)
Kim Han Seul, Lee Young Wook, Kwang Chul Roh, Shin Tae Ho
(1) Energy & Environmental Division, Korea Inst. of Ceramic Engineering & Technology (KICET), Jinju-si/South Korea,
(2) Dept. of Nanofusion Technology, Pusan National University, Busan/Republic of Korea,
(3) Dept. of Applied Science for Electronics and Materials, Kyushu University, Fukuoka/Japan

High performance BaZrO$_3$ based oxide ion electrolyte for Solid oxide fuel cells (A0920)
Akanksha Yadav, Preetam Singh; Department of Ceramic Engineering, Varanasi/India

Investigating Ruddlesden-Popper (n=1) oxide materials for hydrogen production via chemical looping water splitting (A0921)
George Wilson, Andrea Cavallaro, Ainara Aguadero
Dept. of Materials, Imperial College London, London/UK

Effect of Ni-alloying on CO$_2$ electrolysis at Ni/YSZ fuel electrode (A0922)
Sungeun Yang, Min-Jun Oh, Ho-II Ji, Kyung Joong Yoon, Ji-Won Son, Jong-Ho Lee
Center for Energy Materials Research, Korea Inst. of Science and Technology (KIST), Seoul/South Korea

High-performance backbone-supported BaZr$_{0.8}$Ce$_{0.05}$Y$_{0.15}$O$_{3-d}$ systems for membrane reactors with multi-product streams (A0923)

B08: Advanced characterization II

A novel method to determine the transport coefficients of an YSZ electrolyte based on impedance spectroscopy (B0807)
Pablo Radici, Nele Geesmann, Gerardo Valadez Huerta, Stephan Kabelac
Inst. of Thermodynamics, Leibniz Uni Hannover, Hannover/Germany

Oxygen surface exchange in lanthanum nickelates (B0808)
Artur J. Majewski (1), Maxim Anyanve (2), Peter R. Slater (3), Robert Steinberger-Wilckens (1)
(1) School of Chemical Engineering, Uni of Birmingham, Birmingham/UK, (2) Inst. of High Temperature Electrochemistry, Yekaterinburg/Russia, (3) 2 School of Chemistry, Uni of Birmingham, Birmingham/UK

Towards in operando XAS investigation of CO$_2$ electrolysis in Solid Oxide Cells: Ca doping in La$_{1-x}$M$_x$CrFeO$_{3-δ}$ perovskites (B0809)
Oliver Calderon, Viola Ingrid Birss, Simon Trudel; Dept. of Chemistry, Uni of Calgary, Calgary AB/Canada

Residual stress evaluation of metal support solid oxide fuel cell (B0810)
Takumi Komaya (1), Ruhma Zaka (1), Satoshi Watanabe (1), Keigo Kumada (2), Itaru Oikawa (2), Kazuhisa Sato (2), Keki Yashiro (1), Hitoshi Takamura (2), Tatsuya Kawada (1)
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(2) Graduate School of Engineering Tohoku University, Sendai/Japan

B09: Lifetime: Stacks and cells

Quantitative evaluation of SOFC anode microstructure based on optical microscope (B0907)
Dong Yan, JiaJun Yang, Jian Pu, Bo Chi, Jian Li
Center for FuelCell Innovation, Huazhong Uni of Science and Technology, Wuhan/China

Anode fuel recirculation on solid oxide fuel cells (SOFCs) fueled with landfill gas (B0908)
Hendrik Langnickel, Daniele Reschiotto, Christopher Graves, Anke Hagen
DTU Energy, Technical Uni of Denmark, Lyngby/Denmark
Design of Multiple Repetitive Electrolyte Structure to Improve Thermal Durability of Solid Oxide Fuel Cell Using Thin Film Electrolyte (A0924)
Taehong Kim, Sungmin Kang, Minseok Bae, Jaeseok Lee, Joongmyeon Bae; Dept. of Mechanical Engineering, Korea Advanced Inst. of Science and Technology (KAIST), Daejeon/Republic of Korea

A12: SOC integration, Power-to-X, CO2 capture etc.
E-fuels for SOFC mobility – A Systematic Approach (A1207)
Robert Steinberger-Wilckens
Centre for Fuel Cell & Hydrogen Research, School of Chemical Engineering, Uni of Birmingham, Birmingham/UK

Waste2Grids:
Converting wastes efficiently and flexibly for grid balancing services and sector coupling (A1208)
Ligang Wang (1), Mar Perez-Fortes (1), Yi Zong (2), Vincenzo Motola (3), Stefan Diethelm (4), Alessandro Agostini (3), Olivier Bucheli (4), Jan Van herle (1)
(1) Swiss Federal Inst. of Technology, Lausanne/Switzerland,
(2) Technical Uni of Denmark, Lyngby/Denmark,
(3) ENEA, Rome/Italy,
(4) SOLIDpower SA, Switzerland

Sizing and market evaluation of building power storage systems based on a reversible SOEC / SOFC (A1209)
Meleika Hounsou, Chloé Duchayme, Stéphane Hody; ENGIE Lab CRIGEN, Stains/France

Nuclear Hydrogen Production Research by High Temperature Steam Electrolysis in SINAP (A1210)
Jian-Qiang Wang (1,2), Guoping Xiao (1,2), Chengzhi Guan (1,2), Linjuan Zhang (1,2), Xiao Lin (1,2)
(1) Key Lab. of Interfacial Physics and Technology, Chinese Academy of Sciences, Shanghai/China,
(2) Shanghai Inst. of Applied Physics, Chinese Academy of Sciences, Shanghai/China

Production of CO from CO2 using low-temperature, molten carbonate and solid oxide electrolysis (A1211)
Rainer Küngas, Peter Blennow, Thomas Heiredal-Clausen, Tobias Holt Narby, Jeppe Rass-Hansen, Poul Georg Moses;
Haldor Topsoe A/S, Lyngby/Denmark

Electro-chemo-mechanical Analysis System of Solid Oxide Fuel Cell Considering Gas and Heat Distributions (B0909)
Mayu Muramatsu, Masami Sato, Kenjiro Terada, Keiji Yashiro, Tatsuya Kawada, Fumitada Iguchi, Harumi Yokokawa
(1) Department of Mechanical Engineering, Keio University, Yokohama/Japan,
(2) Graduate School of Engineering, Tohoku University, Sendai/Japan,
(3) International Research Institute of Disaster Science, Sendai/Japan,
(4) Graduate School of Environmental Studies, Tohoku University, Sendai/Japan,
(5) Institute of Industrial Science, the University of Tokyo, Tokyo/Japan

Long term behaviour of solid oxide electrolyser (SOEC) stacks (B0910)
Tohru Yamamoto (1,2), Akifumi Ido (1), Koichi Asano (1), Hiroshi Morita (1,2), Yoshihiro Mugikura (1,2)
(1) Central Research Inst. of Electric Power Industry (CRIEPI), Kanagawa/Japan,
(2) Yokohama National University, Kanagawa/Japan

B12: Oxygen electrodes I
Proton Conductivity of BaCe0.2Zr0.7Y0.1O3 (B1207)
Izaak C. Vinke (1), Hans Kungl (1), L.G.J.(Bert) de Haart (1), Rüdiger-A Eichel (1,2)
(1) Inst. of Energy and Climate Research, Fundamental Electrochemistry (IEK-9), Forschungszentrum Jülich GmbH, Jülich/Germany,
(2) Inst. of Physical Chemistry, RWTH Aachen University, Aachen/Germany

Composite Cathodes of Ba4Sr2Sm2Co4O15–BaCe0.5Pr0.3Y0.2O3 for PCFCs (B1208)
Toshiaki Matsui, Kohei Manriki, Kazunari Miyazaki, Hiroki Muroyama, Koichi Eguchi
Graduate School of Engineering, Kyoto University, Kyoto/Japan

Nanofibrous LaCoO3 perovskite cathode for solid oxide fuel cells fabricated via chemically assisted electrodeposition (B1209)
Seung-Bok Lee (1,2), Saeed Ur Rehman (1), Tak-Hyong Lim (1,2), Jong-Eun Hong (1), Hye-Sung Kim (1), Dong Woo Joh (1), Seok-Joo Park (1,2), Rak-Hyun Song (1,2)
(1) Korea Inst. of Energy Research, Daejeon/Korea,
(2) Korea Uni of Science and Technology, Daejeon/Korea
Sn Electrodeposition on Gas Diffusion Electrodes for the Electrochemical CO₂ Reduction (A1212)
Mila Manolova (1), Renate Freudenberger (1), Joachim Hildebrand (2), Elias Klemm (2), Fabian Bienen (3), Denis Kopijar (3), Norbert Wagner (3)
(1) fem - Research Inst. for Precious Metals & Metals Chemistry, Schwäbisch Gmünd/Germany, (2) ITC - Inst. of Chemical Technology, Uni of Stuttgart, Stuttgart/Germany, (3) DLR – German Aerospace Center, Inst. of Engineering Thermodynamics, Stuttgart/Germany

CO₂ utilization in Power-to-liquid routes:
effect of SOEC pressure on the synthesis of Fischer-Tropsch products (A1213)
Marco Marchese, Massimo Santarelli, Andrea Lanzini; Dept. Of Energy DENERG, Politecnico di Torino, Torino/Italy

Operation and Scale-Up of a Lab. scale Power-to-Liquid plant (A1214)
Gregor Herz, Michael Gallwitz, Paul Adam, Erik Reichelt; Fraunhofer IKTS, Dresden/Germany

Experimental investigation of reversible Solid Oxide Cells for fast switching between co-electrolysis and natural gas-based fuel cell operation (A1215)
Luca Mastropasqua (1), Alireza Saeedmanesh (1), Derek McVey (2), Jack Brouwer (1); (1) Advanced Power and Energy ProgramEngineering Lab. Facility, Uni of California, Irvine/USA, (2) HydroLoop, Inc., Irvine/USA

Boundaries of High-Temperature Co-Electrolysis of H₂O and CO₂ towards pure CO₂ electrolysis (A1216)
L. Dittrich (1, 2), E. E. Jaekel (2), S. R. Foit (1), I.C. Vinke (1), R.-A. Eichel (1,2), L.G.J. de Haart (1)
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Model-based assessment of the integration of a high temperature electrolysis in green steelmaking routes (A1217)
Nils Müller, Gregor Herz, Erik Reichelt, Matthias Jahn; Fraunhofer IKTS, Dresden/Germany

System Assessment of Synthetic Fuel Production via CO₂/H₂O Co-Electrolysis (A1218)
Samuel Sobganes, Robert Steinberger-Wilckens; Centre for Fuel Cell & Hydrogen Research, School of Chemical Engineering, College of Engineering and Physical Sciences, Uni of Birmingham, Birmingham/UK

Utilization of Solid Wastes as H₂S Adsorbent for Biogas-fueled SOFC System (A1219)
Hendrik Setiawan (1), Mio Sakamoto (2), Yusuke Shiratori (2,3)
(1) Dept. of Hydrogen Energy Systems, Graduate School of Engineering, Kyushu University, Fukuoka/Japan, (2) International Research Center for Hydrogen Energy, Kyushu University, Fukuoka/Japan, (3) Dept. of Mechanical Engineering, Faculty of Engineering, Kyushu University, Fukuoka/Japan

Combined effects of A-site non-stoichiometry, crystal structure and microstructure for enhanced catalytic activity of (La,Sr)(Co,Fe)O₃₋δ cathodes for IT-SOFCs (B1210)
Ozden Celikbilek (1,2), Cam-Anh Thieu (3,4), Fabio Agnese (5), Eleonora Cali (2), Christian Lenser (6), Norbert H. Menzler (6), Ji-Won Son (3,4), Stephen J. Skinner (2), Elisabeth Djurado (1)

Fe nano particle-dispersed Ni-YSZ hydrogen electrode for high-temperature solid electrolyzer cells (B1211)
Kyoung-Jin Lee, Min-Jin Lee, Haejin Hwang; Inha University, Incheon/Korea

Ceramic Composite Fuel Electrode of La(Sr)Cr(Mn)O₃/ Ce(Mn, Fe)O₂ for CO₂ reduction in Solid Oxide Electrochemical Cells (B1212)
Min Kyu Kim, Young Wook Lee, Tae Ho Shin; Energy & Environmental Division, Korea Inst. of Ceramic Engineering & Technology (KICET), Jinju-si/South Korea

B13: Cells, stacks, and interconnects

Design and Optimization of Fiber Electrodes for Direct Carbon Fuel Cells (B1307)
Min Xu, John T.S. Irvine; School of Chemistry, Uni of St Andrews, Scotland/UK

New concepts for solid oxide cells manufacturing: The use of 3D printing technologies (B1308)
Arianna Pesce (1)*, Maritta Lira Dos Santos (1), Natalia Kostretsova (1), Aitor Hornes (1), Alex Morata (1), Marc Torrell (1), Albert Tarancón (1,2)
(1) IREC, Catalonia Inst. for Energy Research, Jardins de les Dones de Negre 1, Barcelona/Spain, (2) ICREA, Passeig Lluís Companys 23, Barcelona/Spain

Influence of spinel protective coating on Crofer interconnects conductivity (B1309)
Pierre Coquoz, Fabien Morand, Daniela Correa, Raphael Ihringer, Faxell Säfl, Lausanne/Switzerland
Development of a zero-dimensional transient model of reversible SOE integrated PV system under real-world operating conditions (A1220)
Alper Can Ince, Mustafa Fazil Serincan, Selim Sivrioglu
Gebze Technical University, Faculty of Engineering, Mechanical Engineering Department, Kocaeli/Turkey

Integrating SOEs with a methanation reactor for methane gas production using an MCFC for CO2 capture from biogas (A1221)
Mohammed Kaazem Ayodeji, Robert Steinberger-Wilckens
Centre for Fuel Cell & Hydrogen ResearchSchool of Chemical Engineering, College of Engineering and Physical Sciences, Uni of Birmingham, Birmingham/UK

Experimental Investigation of H2O and CO2 Electrolysis and H2O/CO2 Co-electrolysis (A1222)
Alireza Saeidmanesh (1), Luca Mastropasqua (1), Derek McVay (2), Jack Brouwer (1)
(1) Advanced Power and Energy ProgramEngineering Lab. Facility, Uni of California, Irvine/USA,
(2) HydroLoop, Inc., Irvine/California

Reversible solid oxide cell systems for integration with natural gas pipelines and grid energy management (A1223)
E. Reznicek, R.J. Braun; Colorado School of Mines, Dept. of Mechanical Engineering, Golden/Colorado/U.S.A

Evaluation of different CCUS systems based on the MCFC technology for decarbonising the power generation sector (A1224)
Stavros Michaillos; Uni. of Sheffield, Sheffield/UK

A13: Products, demonstrations, novel concepts & BoP

Biogas cleaning and integration with solid oxide fuel cells (A1307)
Jan Van herle (1), Nina Montport (2), Marta Gandiglio (3), Serge Biollaz (4), Stephen McPhail (5), Sander Reijkerkerk (6), Bertrand Morel (7), Frank Mittmann (8), Fabrizio Gualandris (11)

Analysis of gas phase transport effect in a planar SOFC (B1310)
Samuel Koomson, Arthur Ebenezer, Choong-Gon Lee
Dept. of Chemical & Biological Eng., Hanbat National University, Daejeon/Korea

Shaping of Mn1.5Co1.5O dense coating on flat and profiled metal surface (B1311)
Agnieszka Żurawska, Leszek Ajdys, Yevgeniy Naumovich
Inst. of Power Engineering, Dept. of High Temperature Electrochemical Processes, Warsaw/Poland

Comparison of different SOFC types running on bio-syngas at moderate working temperatures (B1312)
Benjamin Steinrücken (1), Michael Hauser (1), Stephan Herrmann (1), Christian Lenser (2), Sebastian Fendt (1), Hartmut Spleithoff (1)
(1) Technische Universität München, Inst. for Energy Systems, Garching/Germany,
(2) Forschungszentrum Jülich GmbH, IEK-1, Jülich/Germany

Electrochemical study of thin film perovskite electrodes for SOEC applications (B1313)
Mykhailo Pidburtnyi, Haris Ansari, Viola Birss
Department of Chemistry, University of Calgary, Calgary/Canada

In Situ Surface Modification of the Cathode for CO2 Electrochemical Reduction in SOEC (B1314)
Wenqiang Zhang, Bo Yu*, Jing Chen
Inst. of Nuclear and New Energy Technology, Tsinghua University, Beijing/P. R. China

B14: Oxygen electrodes II

Nanostructured La0.6Sr0.4Co0.2Fe0.8O3-δ/Gd0.2Ce0.8O1.9 Composite Cathode for High Performance IT-SOFC (B1407)
Kazuyoshi Sato (1), Chizuru Iwata (1), Naokatsu Kannari (1), Hiroya Abe (2), Yongtae Kim (3), Naoki Shikazono (3)
(1) Graduate School of Science and Engineering, Gunma University, Gunma/Japan,
(2) Joining and Welding Research Institute, Osaka University, Osaka/JAPAN,
(3) Inst. of Industrial Science, The Uni of Tokyo, Tokyo/JAPAN

Characterization of oxidized iron-copper coated 441-type ferritic stainless steel interconnect material (B1408)
Line Larby, Ulf Bexell, Carlos Bernuy-López, Niklas Norry, Mikael Stenström, Jörgen Westlinder
Surface Research, Strategic Research, AB Sandvik Materials Technology, Sandviken/Sweden
Solid oxide electrolyzer cells prototype based on self-produced electrode supported tape cast cells and powder metallurgy (PM) interconnects: The CoSin Project (A1308)
M. Carmen Monterde (1,2,3), L. Bernadet (2), A. Rodriguez (1), J. Arcos (1), F. Ramos (4), J. A. Calero (1), E. Jimenez-Piqué (3), M. Torrell (2)
(1) AMES PM Technical Center, Barcelona/Spain,
(2) IREC, Catalonia Inst. for Energy Research, Dept. Advanced Materials for Energy, Barcelona/Spain,
(3) Universitat Politècnica de Catalunya (UPC - EEBE), Barcelona/Spain,
(4) FAE, Barcelona/Spain

Energy and Exergy evaluation of a novel tri-generation system using Solid Oxide Fuel Cell (SOFC) and Humidification - dehumidification (HDH) desalination unit (A1309)
Hamid Reza Abbasi (2), Hossein Pourrahmani (1), Nazanin Chitgar (2), Jan Van herle (1)
(1) Group of Energy Materials (GEM), Ecole Polytechnique Federale de Lausanne (EPFL), Sion/Switzerland,
(2) School of Mechanical Engineering, Iran Uni of Science and Technology, Tehran/Iran

Biogas-powered reversible SOC system (A1310)
Stephan Herrmann, Hartmut Splitspoff
Lehrstuhl für Energiesysteme, Technische Universität München (TUM), Garching/Germany

Modeling a residential SOFC –
hybrid desiccant cooling system and system analysis priority on cooling ability and CO₂ emission (A1311)
Yulho Lee (1,2), Sungjin Park (1), Sanggyu Kang (2)
(1) Dept. of Mechanical and System Design Engineering, Seoul/Korea,
(2) Mechanical Engineering, Gwangju Inst. of Science and Technology, Gwangju/Korea

Experimental and CFD analysis of hotbox heat management using extended pipes (A1312)
Israel Torres Pineda (1), Van-Tien Giap (2), Young Duk Lee (1,2), Young Sang Kim (1), Dong Keun Lee (1), Kook Young Ahn (1,2)
(1) Center for Clean Fuel and Power Generation, Korea Inst. of Machinery & Materials (KIMM),
(2) Dept. of Environmental and Energy Mechanical Engineering, Uni of Science and Technology (UST), Daejeon/South Korea

Extension of catalyst lifetime for application of diesel-fueled pre-reforming in a commercial SOFC system (B1409)
Tobias Schiekel, Elmar Pohl; OWI Oel-Waerme-Institut gGmbH, Herzogenrath/Germany

Nanocrystalline La₆Sr₆CoO₁₉ oxygen electrodes fabricated by spray pyrolysis for solid oxide cells operating at intermediate temperatures (B1410)
Bartosz Kamecki (1,2), Jakub Karzewska (2), Piotr Jasiński (1), Sebastian Molin (1)
(1) Faculty of Electronics, Telecommunications and Informatics, Gdansk/Poland,
(2) Faculty of Applied Physics and Mathematics, Gdansk Uni of Technology, Gdansk/Poland

Water effect on the overpotential at low currents in a SOFC (B1411)
Samuel Koomson, Arthur Ebenezer, Choong-Gon Lee
Dept. of Chemical & Biological Eng., Hanbat National University, Daejeon/Korea

B15: Lifetime: Cells, components and interfaces

Analysis of H₂S related performance degradation and regeneration of Ni/YSZ and Ni/GDC SOFCs fueled with biomass gasifier product gas (B1507)
Gernot Pongratz (1), Vanja Subotic (1), Christoph Hochenauer (1), André Anca-Couce (1), Robert Scharler (2)
(1) Inst. of Thermal Engineering, Graz Uni of Technology, Graz/Austria,
(2) BEST – Bioenergy and Sustainable Technologies GmbH, Graz/Austria

Direct Usage of real biogas in SOFC (B1508)
S. R. Folt (1), H. Abbas (1,2), I.C. Vinke (1), R. - A. Eichel (1,2), L. G. J. de Haart (1)
(1) Inst. of Energy and Climate Research, Fundamental Electrochemistry (IEK-9), Forschungszentrum Jülich GmbH, Jülich/Germany,
(2) Inst. of Physical Chemistry, RWTH Aachen University, Aachen/Germany

Towards stable SOEC operation: identification of degradation-inducing operating parameters and degradation minimization by interlayer variation (B1509)
Vanja Subotic (1,2), Shotoar Futamura (2), George F. Harrington (3,4), Junko Matsuda (3), Katsuya Natsukoshi (2), Kazunari Sasaki (2,3,4)
(1) Inst. of Thermal Engineering, Graz Uni of Technology, Graz/Austria,
(2) Dept. of Hydrogen Energy Systems, Faculty of Engineering, Kyushu University, Fukuoka/Japan,
(3) Center for Co-Evolutionary Social Systems (CESS), Kyushu Uni Fukuoka/Japan,
(4) Next-Generation Fuel Cell Research Center (NEXT-FC), Kyushu University, Fukuoka/Japan
A14: Proton Conducting Cells, Stacks and materials

Numerical analysis of current density distributions in a tubular protonic ceramic fuel cell (PCFC) considering gas partial pressures and temperature influences (A1407)
Kunpeng Li (1), Toshiaki Kawamura (1), Atsuhito Ota (1), Takuto Araki (2), Yuji Okuyama (3)
(1) Graduate School of Engineering, Yokohama National University, Kanagawa/Japan,
(2) Faculty of Engineering, Yokohama National University, Kanagawa/Japan,
(3) Dept. of Environmental Robotics, Faculty of Engineering, UNi of Miyazaki, Miyazaki/Japan
Cycle analysis of a PCFC system for CH$_4$-H$_2$O fuel considering hole conduction and temperature dependence (A1408)
Atsuhito Ota (1), Kunpeng Li (1), Toshiaki Kawamura (1), Masashi Mori (2), Takuto Araki (3)
(1) Graduate School of Engineering Science, Yokohama National University, Kanagawa/Japan,
(2) Central Research Inst. of Electric Power Industry, Kanagawa/Japan,
(3) Faculty of Engineering, Yokohama National University, Kanagawa/Japan

A15: Cell, stack & system modelling and optimization

Fault identification in the solid oxide fuel cell stack: Classification based and hybrid approaches (A1507)
Periasamy Vijay, M. O. Tade, Zongping Shao; Dept. of Chemical Engineering, Curtin Uni, Western Australia/Australia
Part-load Operations of Water-Cooled Solid Oxide Fuel Cell Stack (A1508)
Mungmuang Promson (1), Yoshuke Komatsu (1), Anna Scialzko (1,2), Shozo Kaneko (1), Naoki Shikazono (1)
(1) Inst. of Industrial Science, The Uni of Tokyo, Tokyo/Japan,
(2) Dept. of Fundamental Research in Energy Engineering, AGH Uni of Science and Technology, 30095 Krakow/Poland
Modeling and characterization of an intermediate temperature solid oxide fuel cell stack (A1509)
J. Lesmayoux (1), A. Jaafar (1), C. Turpin (1), J. B. Jollys (2), J. Göös (3), M. Noponen (3)
(1) LAPLACE, Uni of Toulouse, CNRS, Toulouse/France,
(2) Safran Power Unit, Toulouse/France,
(3) Elcogen, Vantaa/Finland
Optimum Electrode Design for Nanostructured Infiltration of Solid Oxide Fuel Cells (A1510)
Shiwoo Lee (1,2), Tao Yang (1,2), Bo Guan (1), Beomtak Na (1), Jian Liu (1,2), Harry Abernathy (1,2), Thomas Kalapos (1,2), Gregory Hackett (1)
(1) U.S. DOE National Energy Technology Laboratory, (2) Leidos Research Support Team, Morgantown/USA

Degradation monitoring and performance optimization of rSOC (B1510)
Benjamin Königshofer (1), Gernot Pongratz (1), Pavle Boškoski (2), Dani Jurčič (1), Vanja Subotić (1)
(1) Inst. of Thermal Engineering, Graz Uni of Technology, Graz/Austria,
(2) Jožef Stefan Institute, Ljubljana/Slovenia,
Effect of Strontium Segregation on Electrochemical Impedance Spectra for La$_{0.6}$Sr$_{0.4}$Co$_{0.2}$Fe$_{0.8}$O$_3$ Cathodes (B1511)
Hirofumi Sumi (1), Hongqian Wang (2), Scott A. Barnett (2)
(1) National Inst. of Advanced Industrial Science and Technology (AIST), Nagoya/Japan,
(2) Northwestern University, Illinois/USA
SOFC directly fed with ammonia: performance and durability for two anode microstructures (B1512)
Bertrand Morel (1), Nunzia Coppola (2), Thibault de Sorbier (3), Cesare Pianese (2), Luigi Maritato (2), Julie Mougin (1)
(1) Univ. Grenoble Alpes – CEA/LITEN, Grenoble Cedex 9/France,
(2) Dept. of Industrial Engineering, Uni of Salerno, Fisciano (SA)/Italy,
(3) TechnipFMC - Technip France, Courbevoie/France

B16: Lifetime: Interconnects and contact layers

Application of composite coatings as protection/contacting layers for metallic high-chromium-content SOFC interconnect material (B1607)
Viktar Sauchuk (1), Nikolai Trofimenko (1), Stefan Megel (1), Stefan Rothe (1), Jochen Schilm (1), Martin Andritschky (2), Michael Hiller (2), Mihails Kusnezoff (1)
(1) Fraunhofer IKTS, Dresden/Germany,
(2) High Tech Coatings GmbH - a Milba Group company, Vorchdorf/Austria
Computational analysis of mass transfer limitation in porous electrodes of solid oxide electrochemical cell (A1511)
Marcin Blesznowski (1), Monika Jalowiecka (1,2), Wojciech Orciuch (2), Lukasz Makowski (2), Jakub Kupecki (1); (1) Dept. of High Temperature Electrochemical Processes (HiTEP), Inst. of Power Engineering, Warsaw/Poland, (2) Warsaw Uni of Technology, Faculty of Chemical & Process Engineering, Warsaw/Poland

Analysing the Impact of Electrode Materials and Microstructures on SOFC Stack and System Level Performance (A1512)
Lukas Wehrle (1), Yuqing Wang (1,2), Aayan Banerjee (3), Paul Boldrin (3), Nigel P. Brandon (3), Olaf Deutschmann (1); (1) Karlsruhe Inst. of Technology (KIT), Karlsruhe/Germany, (2) National Key Lab. on Electromechanical Dynamic Control, Beijing Inst. of Technology, Beijing/China, (3) Imperial College London, Dept. of Earth Science and Engineering, London/UK

Towards model-based optimization of CGO/Ni anodes (A1513)
Philip Marmet (1), Lorenz Holzer (1), Thomas Hocker (1), Jan G. Grolig (2), Andreas Mai (2), Joseph M. Brader (3); (1) Zurich Uni of Applied Sciences, Inst. of Computational Physics, Winterthur/Switzerland, (2) Hexis AG, Winterthur/Switzerland, (3) Uni of Fribourg, Dept. of Physics, Fribourg/Switzerland

Estimation of triple-phase boundary activity in LSCF-GDC cathode of solid oxide fuel cells (A1514)
Masashi Kishimoto (1), Shunya Hanai (1), Tomoki Kimura (1), Yuya Tanimura (1), Hiroshi Iwai (2), Hideo Yoshida (1); (1) Dept. of Aeronautics and Astronautics, Kyoto University, Nishikyo-ku Kyoto/Japan, (2) Dept. of Mechanical Engineering and Science, Kyoto University, Kyoto/Japan

Characteristics of a Planar SOFC With Load Variation (A1515)
Hiroyuki MISE (1), Masahiro Nakamura (2), Yuya Tachikawa (1,3), Hironori Nakajima (1,3), Kohei Ito (1,3); (1) Dept. of Hydrogen Energy Systems, Graduate School of Engineering, Kyushu University, Fukuoka/Japan, (2) International Research Center for Hydrogen Energy, Kyushu University, Fukuoka/Japan, (3) Dept. of Mechanical Engineering and Science, Kyushu University, Kyoto/Japan

Anode and electrolyte supported Solid Oxide Fuel Cells: experimentation and modelling (A1516)
Aiswarya Krishnakumar Padinjarethil (1), Fiammetta Rita Bianchi (2), Barbara Bosio (2), Anke Hagen (1); (1) Dept. of Energy Conversion and Storage, Technical Uni of Denmark (DTU), Lyngby/Denmark, (2) PERT- Dept. of Civil, Chemical and Environmental Engineering, Uni of Genoa, Genoa/Italy

Modeling and simulation of an H2 production system based on solid oxide electrolysis (A1517)
S. Byun, S. Kim, T. Kim, Y. Choi, D. Seo, H. Hwang, S. Woo; Energy Materials Laboratory, Korea Inst. of Energy Research (KIER), Daejeon/Republic of Korea

A16: System design & performance & BoP

High efficient SOFC system with CFY-stack module perated with gasified biomass - HieffBioPower - (A1607)
Stefan Megel (1), Jens Schnettler (1), Mihails Kusnezzoff (1), Martin Hauth (2), Stefan Weissensteiner (2), Michael Seidl (2), Christopher Sallai (2), Gerhard Weiß (3), Thomas Brunner (3), Ingwald Obenberger (3); (1) Fraunhofer IKTS, Dresden/Germany, (2) AVL List GmbH, Graz/Austria, (3) BIO S BIOENERGIESYSTEME GmbH, Graz/Austria

Design of a 10-kW SOFC Hot Box Module with Recirculation (A1608)
Maximilian Hauck (1), Sebastian Wilhelm (1), Stephan Herrmann (1), Felix Fischer (1), Jeremias Weinrich (2), M. Gaderer (2), Sebastian Fendt (1), Hartmut Spliethoff (1); (1) Technical Uni of Munich, Chair of Energy Systems, Garching/Deutschland, (2) Technical Uni of Munich, Regenerative Energy Systems, Straubing/Deutschland

Consistent modeling and testing theory of high effectiveness heat exchange performance by means of Shannon 1948 entropy (A1609)
Jean-Paul Janssens (1), Michel Dubuisson (2); (1) R&D BOSAL Energy Conversion Industry, Lumenen/Belgium, (2) BOSAL Energy Conversion Industry, Vianen/The Netherlands

Experimental and CFD analysis of hotbox heat management using extended pipes (A1610)
Israel Torres Pineda (1), Tien Giap Van (2), Young Sang Kim (1), Young Duk Lee (1,2); (1) Environmental Systems Research Division, Korea Institute of Machinery & Materials, Daejeon/South Korea, (2) Department of Environmental and Energy Mechanical Engineering, University of Science and Technology (UST), Daejeon/South Korea

Online characterization of operational parameters in a SOFC-system with anode-exhaust gas recirculation by oxygen sensors (A1611)
Felix Schaefer (1), Sebastian Egger (1), Dietmar Steiner (1), Rüdiger-A. Eichel (2); (1) Robert Bosch GmbH, Renningen/Germany, (2) Institut für Energie- und Klimaforschung (IEK-9), Forschungszentrum Jülich, Jülich/Germany

Development of Reversible Electrolysis-Fuel Cell Stacks using 100 cm² Anode-supported Flat-tubular cells (A1612)
Segi Byun, Sun-dong Kim, Tae Woo Kim, Yoonseok Choi, Doo Won Seo, Hyo Jung Hwang, Sang-Kuk Woo; Energy Materials Laboratory, Korea Inst. of Energy Research (KIER), Daejeon/Republic of Korea
At the time of print of this Final Announcement the following developers, material, measurement tool and component supplies as well as research institution had registered for the exhibition.

<table>
<thead>
<tr>
<th>Company</th>
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<td>Bosal Energy Conversion Industry</td>
<td><a href="http://www.eci.bosal.com">www.eci.bosal.com</a></td>
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<td>16130 Wood-Red Road, Suite 7, 98072 Woodinville, WA</td>
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Welcome Gathering  
Tuesday, 20 October: 18:00, in the exhibition, ground floor: Meet old friends, find new contacts, and enjoy the splendid view of lake and historic town — a perfect start to the conference.

Swiss Surprise (optional, limited to 80 participants)  
Wednesday, 21 October: 18:30, place to be announced. A special surprise is offered in an unusual place close to Lucerne: An enjoyable evening with Swissness, music, drinks, and dinner. Tickets are sold on a first-come-first-serve-basis for CHF 120 per person. During your on-line registration (www.EFCF.com/Registration) please select the option to purchase tickets in advance for you and your guests.

Dinner on the Lake  
Thursday, 22 October: 19:30 Pier 6 (“Brücke 6”) next to Congress Center: A very special pleasure-boat (flagship of the fleet) will take us on a tour of the lake past a magnificent landscape to the „Rutli” glade, birthplace of Switzerland (1291). Enjoy the unique blend of music, drinks, and a candle-light dinner while gliding past beautiful scenery. Live music contributes to this unforgettable evening. This event is included in the registration fee. Please choose this option during your on-line registration on www.EFCF.com/Registration or use the registration form at www.EFCF.com/Download to purchase additional tickets for your guests (CHF 120 per person).

Entertainment for Accompanying Persons  
During the European Full Cell Forum your guests and yourself have the possibility to explore the beautiful region of Lucerne together with an experienced local guide. Bucher Travel Inc. and the Lucerne Tourist Office are able to organize for you and your guests entertaining trips around local attractions. It is possible to take a tour of Lucerne visiting the medieval part of the city, followed by a tour of the picturesque surrounding area e.g. Mount Pilatus, the Glass Factory & Mount Stanserhorn, etc. The excursions are arranged locally on a daily basis depending on weather conditions and requests. To get more information about the programs and to book an activity, please visit www.EFCF.com — Registration — Spouse Programs or contact in advance Bucher Travel Inc., booking@buchertravel.ch, +41 41 418 55 46 and/or visit www.luzern.com. The EFCF team can support you on-site at the registration desk in finding further offers and opportunities, except during the main registration time (Tuesday afternoon, Wednesday morning). Accompanying persons may participate in the „Swiss Surprise” and „Dinner on the Lake” for CHF 120.– per person as well as in the lunches on the terrace of the KKL. Please purchase guest tickets as long as they are available during your on-line registration. Additional lunch tickets are only sold on site until fully booked. The exhibitions can always be visited for free.

Tutorial Registration  
The registration fee for either Tutorial (FC & H₂ or EIS) includes the lectures with documentation, business lunch, snacks, coffee, refreshments, and access to the exhibition and poster area. You can also register for a Tutorial without participating at the Scientific Conference. Please indicate your choice during the easy on-line registration at www.EFCF.com/Registration or download the registration form at www.EFCF.com/Download.

The tutorial fees are as follows:  
FC & H₂ – Fuel Cells and Hydrogen Tutorial CHF 500.–  
EIS – Electrochemical Impedance Spectroscopy Tutorial CHF 500.–  
EIS Tutorial for EFCF 2020 Registered Participants CHF 350.–
All participants enjoy full conference privileges. Accompanying persons and guests are kindly asked to buy tickets for meals and social events at the registration desk. The following conference privileges are included in the conference package:

- Participation in the conferences, access to the poster and exhibition areas
- Access to on-line electronic proceedings, agenda and bag inserts
- Download rights after the conference at www.EFCF.com/Lib of
  - presentations accessible with author permission
  - proceedings from this year and former years
- Participation in all networking events:
  - Tuesday: Welcome Gathering with drinks and snacks
  - Thursday: Dinner on the Lake on the historical paddle wheel steamers
- Three business lunches (Wednesday to Friday)
- Refreshments during intermissions, breaks and goodbye close.

Not included:
Tutorials (can be booked separately), Swiss Surprise on Wednesday night (tickets to be ordered when registering for the conference www.EFCF.com/Registration), GSM 2020 symposium on European grid service Markets (21–22 October 2020, www/GridServiceMarkets.com, reduced fee for EFCF 2020 participants, to be booked during www.EFCF.com/Registration)
The following admission fees* apply: www.EFCF.com/Fee

Students, Trainees, Unemployed
Full-time students (age 26 or younger with valid identification) CHF 700.–

Academic Staff, Government, Consultants
CHF 1400.–

Industry, Trade and Commerce
Fuel cell developers, manufacturers and distributors pay an extra CHF 600.– to support the participation of students and trainees. This event provides an excellent platform for recruitment. Participants from industry and commerce benefit from the student support. CHF 2000.–

Rebates
Interesting rebates are possible for group reservation (one bill), for exhibitors (up to 55%) agreed long-term promotion activities and GSM 2020 attendees. Applications to be sent to forum@efcf.com

Surcharge on current fee* for Late Registration
Extra fee for late registration after 31 August 2020 CHF 100.–
Extra fee for on-site registration after 18 October 2020 CHF 250.–

One-Day Tickets
Registration includes full access to on-line conference proceedings and one Forum Agenda, as well as all conference privileges of the day, plus download of presentations accessible with author permission. Please register on-line at www.EFCF.com/Registration in advance, or at the registration desk (extra fees apply). CHF 700.–

Tutorials
FC & H₂ – Fuel Cells and Hydrogen Tutorial CHF 500.–
EIS – Electrochemical Impedance Spectroscopy Tutorial CHF 500.–
EIS Tutorial for EFCF & GSM 2020 Registered Participants CHF 350.–

Extra Ticket for Dinner on the Lake
Additional guests tickets for the „Dinner on the Lake” evening event on Thursday are sold on a first-come-first-serve basis. Please order your guests tickets on-line at www.EFCF.com/Registration during your registration or ask on-site. CHF 120.–

Swiss Surprise Night (optional)
Tickets for the entertaining evening event „Swiss Surprise” on Wednesday night are sold on a first-come-first-serve basis. Participation is limited to 80 persons and is not included in the conference fee. Please order your and your guests tickets on-line at www.EFCF.com/Registration during your registration or ask on-site. CHF 120.–

* Fees are incl. 7.7% VAT where applicable and valid from 1. July 2020. Early bird fees from before are then no longer valid.

Register with no Risk or participate VIRTUALLY
in case of no show due to Covid restrictions
Reimbursement of the Fees

Virtual Fees
Students, Trainees, Unemployed € 280.– / CHF 300.–
Academic Staff, Government, Consultants, € 550.– / CHF 600.–
Industry, Trade and Commerce
FC & H₂ – Fuel Cells and Hydrogen Tutorial € 200.– / CHF 220.–
EIS – Electrochemical Impedance Spectroscopy Tutorial € 200.– / CHF 220.–
EIS Tutorial for EFCF & GSM 2020 Registered Participants € 140.– / CHF 150.–

Payment of the Registration Fee
Bucher Travel Inc. handles all On-line conference registrations and hotel reservations. The registration fee can be paid by credit card or via bank transfer if sufficiently ahead of time. Payments are confirmed in writing, institutions and companies may request invoices for
registration of employees on company stationery. Please accept all bank charges related to
the transfer expenses to your payment. All payments must be made in Swiss Francs (CHF).
Foreign currency exchange rates for March 2020: 1 CHF ≈ 0.94 EUR ≈ 1.00 USD ≈ 112 JPY ≈ 0.79 GBP. Registrations are accepted as long as space is available.

Cancellation of Registration www.EFCF.com/TaC

Written cancellations of confirmed registrations should reach Bucher Travel Inc. before
20 September 2020. Fees already paid will be refunded, however a charge of CHF 300.– is ap-
plicable to cover administration expenses and the cost of the Electronic Proceedings that will
be mailed to the registrant after the event. No refunds can be made for cancellations recei-
vied after 20 September 2020. Withdrawing registrants will receive the Electronic Proceedings
of the 2020 conference. Register with no risk: in case of no show due to Covid restrictions.
Reimbursement of the Onsite-Fees.

Free Project Meeting Support Enquiry www.EFCF.com/FPM

Stakeholders interested in the free Organisational Support Service for their project, set-up,
or other issue-meetings can get more information at www.EFCF.com/FPM or via email to
forum@efcf.com.

Hotel Reservation www.EFCF.com/Hotel

The hotel can also be booked On-line: www.EFCF.com/Registration Button „Hotels“.
Bucher Travel Inc. handles all hotel bookings and will confirm the hotel reservations by email and
send you information about Lucerne. Hotel expenses can be paid at the hotel to the hotel
management.

If there are further needs contact Bucher Travel, booking@buchertravel.ch, Phone: +41 41 418 55 46
and/or visit alternative common hotel booking portals. The European Fuel Cell Forum is not
responsible for hotel accommodations. Please make sure to book and register ONLY ONCE!

Lucerne (view video clip) www.EFCF.com/Lucerne

Lucerne is located in the heart of Switzerland on the Lake of Lucerne admired for its beauty
and tranquillity. Nostalgic paddle wheel steamers connect the romantic town to charming
sites. From there you may ascend picturesque „Mount Rigi“ and steep „Mount Pilatus“, or
reach the high regions in the Alps of Switzerland. Cogwheel mountain trains, cable cars or
aerial tramways take you past alpine scenery to breath-taking panoramic views of the Top of
Switzerland. Most of the places can be reached between 1 – 3 hours travel.

Lucerne itself is built along the „Lake of Lucerne“ and the „Reuss River“, outflow of the
lake. The medieval part is closest to the waterfront. Bridges connect both banks. The famous
wooden „Kapellbrucke“ has been perfectly rebuilt by local artisan after total destruction by
a catastrophic fire in 1993. Lucerne is located in the heart of Western Europe and is an ideal
start location for further travels around the continent before or after the conference.
The event is endorsed by

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COGEN Europe
Cogeneration Sector Association
Avenue des Arts 3-4-5
1210 Brussels, Belgium

EURESEARCH Head Office
Effingerstrasse 19
3001 Bern/Switzerland

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Congress Fares are valid on the entire SWISS route network for flights to Switzerland, including flights operated by partner airlines under an LX flight number. These fares are now bookable for the travel period 14 days prior to and 14 days after the event.

Only registered congress participants and exhibitors can take advantage of this offer. After successful on-line registration at www.EFCF.com/Registration your EVENTCODE will be provided for an easy and convenient booking through SWISS.com via the following link www.swiss.com/event Please enter your email address and the given EVENTCODE.

The special SWISS congress fares are marked with a white triangle. They may not necessarily be the lowest fare, but they offer greater flexibility in the event of rebooking or cancellation.
The FCH Tutorial will provide a basic understanding of chemical, physical and technical principles that make fuel cells and electrolysers work simply, reliably and affordably. Application requirements and practical examples of current developments will be discussed.

The FCH Tutorial addresses newcomers as well as medium to experienced level users. You will gain basic knowledge or add expert know-how and practical experience to already existing understanding. Receive answers to questions before you have to ask them, and get a strong base to exchange with your partners & clients. Profit from an excellent kick start into the EFCF conference & exhibition.

Tutors:
Dr. Günther G. Scherer, formerly PSI, Switzerland
MER Dr. Jan Van Herle, EPFL, Switzerland

KKL, Lucerne, Switzerland
NEW DATE 20 October 2020

Registration required:
www.EFCF.com/TutReg open now
forum@EFCF.com by email

Organised & supported by the European Fuel Cell Forum

Kick-start into EFCF 2020
14th European SOFC & SOE Forum
SOFC & SOE Technology and Applications
24th Conference in Series, with Tutorials, Exhibition & Application Market
PROGRAM  The tutorial language is English

09:30  Registration, welcome refreshments
10:00  Lecture 1  Fundamentals of Electrochemical Energy Conversion
10.45  Lecture 2  Characteristics of the important Fuel Cell & Electrolyser Technologies
11:30  Coffee break
11.45  Lecture 3  Fuels for fuel cells, fuel processing
12:30  Lunch break
14:00  Lecture 4  Applications of Polymer Electrolyte Technologies such as PEFC, DMFC, H2FC, ...
14:45  Lecture 5  System aspects, applications of Solid Oxide Technologies such as SOFC, SOE, SOMR
15.30  Coffee break
15:45  Lecture 6  State-of-the-art, challenges, summary - Summary
17:00  End of FCH Tutorial, Visit the exhibition of the 14th European SOFC & SOE Forum

NEW DATE  20 October 2020

www.EFCF.com/FCH

Registration & Fees  from Oct 2019
On-line Registration:  www.EFCF.com/TutReg

Registration includes: Complete documentation of the tutorial lectures, exchange with FCH experts & users, a certificate of attendance, welcome refreshments, a fine business lunch, snacks & drinks during breaks, admission to the EFCF exhibition, VAT.

➤ CHF 500 for Regular Registration
Group registrations are entitled to rebates.

➤ CHF 350 Special Offer for High School Teachers
The EIS Tutorial will consist of 5 lectures and an ‘EIS challenge’: The lectures will range from the basic principles of EIS, to more advanced applications, addressing very sophisticated cases and practical experiences. The EIS Tutorial will provide a basic understanding of the technical and physical principles that makes EIS one of the most powerful analysing instruments available today. It is aimed at medium to experienced level users, who are already familiar with the principles of Electrochemical Reactor Technologies like Fuel Cells and Electrolysers. Opportunity for discussion and exchange are provided throughout the day, especially during the ‘EIS challenge’.
The tutorial language is English

NEW DATE: 20 October 2020

09:30 Registration, welcome refreshments
10:00 Lecture 1 Fundamentals of Electrochemical Impedance Spectroscopy
10.45 Lecture 2 Applications I - Analysis of SOC - Materials and (Model-) Electrodes
11:30 Coffee break
11:45 Lecture 3 Applications II - Analysis of SOC - Single Cells and Stacks
12:30 Lunch break
14:00 Lecture 4 Evaluation of Impedance Spectra - Kramers-Kronig Test, DRT-Analysis & CNLS Fit
14:45 Lecture 5 Impedance Modelling and Simulation
15.30 Coffee break
15:45 Lecture 6 "EIS challenge" - Summary
17:00 End of EIS Tutorial, Visit EFCF 2020 exhibition

Registration & Fees
Registration includes: Complete documentation of the tutorial lectures, exchange with EIS experts & users, a certificate of attendance, welcome refreshments, a full business lunch, snacks & drinks during breaks, admission to the EFCF exhibition, VAT.

On-line Registration: www.EFCF.com/TutReg
CHF 500.- for Regular Registration
Exhibitors and Groups are entitled to rebates.
CHF 350.- for EFCF & GSM 2020 Participants

www.EFCF.com/EIS
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GRID SERVICE MARKET SYMPOSIUM
GSM 2020
19-20 October
KKL Lucerne, Switzerland

GRID FLEXIBILITY & BUSINESS

Featuring
Operation & Enabling Technologies
Advanced Technologies providing Flexibility
Market Developments & International Collaborations

VPP Joint with

Extended Poster Sessions covering all topics

Networking
GSM Grid Apéro, GSM Network Dinner, EFCF Dinner on the Lake
EFCF - Electrolyser & Fuel Cell Forum conference, exhibition, tutorials

Participating among others

Register with no Risk to participate VIRTUALLY
In case of no show due to Covid restrictions
Reimbursement of the Fees
www.GridServiceMarket.com
GSM 2020
4th Grid Service Market Symposium featuring grid flexibility & business
Chaired by: Prof. Christoph Imboden HSLU, Lucerne/Switzerland

GSM SCOPE
The electricity market is changing, opening opportunities for more flexibility in generation, storage and consumption. The integration of a large amount of new renewable energy sources poses great challenges for the European electricity grids & markets. Network reinforcement, market harmonisation and integration are solutions and challenges for the various players in the electricity industry. New technologies such as Power to X, Batteries, Demand Side Response DSR, Water Electrolysers, Fuel Cells and others compete or complement each other in terms of technical capabilities and economic performance. The integration of such new technologies and methods, to provide grid services and optimise the use of existing infrastructure, is changing the face of the electricity industry in the long term.

GSM AIM
The 4th GSM-Symposium aims to outline recent developments in the European grid service markets, to highlight advancements and challenges in international cooperation and to reflect the technological progress. In addition, it reports on experiences and success stories, which support a rating of the performance, and future potential of new sustainable technologies.

GSM STAKEHOLDERS
The 4th GSM-Symposium addresses grid and technology experts, scouts and managers from the electricity industry, administration bodies and researchers interested in the commercial aspects of grid services and new technologies. Experts present their contributions to technological advances and propulsive business solutions. The international audience will exchange on market logic, regulations and harmonization activities, future trends, operations, technology capabilities, and long term business plans and other related business aspects of European grid service markets.

Session Program

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<th>Time</th>
<th>Session</th>
<th>Location</th>
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<tr>
<td>09:00</td>
<td>On-site GSM registration</td>
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<tr>
<td>09:30</td>
<td>G01 OPENING &amp; WELCOME</td>
<td>KKL auditorium</td>
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<tr>
<td>09:30</td>
<td>Welcome by the symposium chair</td>
<td>Christoph Imboden, Lucerne Uni of Applied Sciences &amp; Arts, Switzerland</td>
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<td>09:30</td>
<td>Welcome by SFOE</td>
<td>Stefan Oberhoder, Swiss Federal Office of Energy, Switzerland</td>
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<td>09:50</td>
<td>G02 Market developments and international collaborations I</td>
<td>KKL auditorium</td>
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<td>09:50</td>
<td>EU energy transition – the ETIP SNET roadmap for flexibility</td>
<td>Guido Guida, ETIP SNET and Entso-E, Belgium</td>
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<tr>
<td>09:50</td>
<td>Active demand, flexible generation, conversion and storage of energy carriers, network technologies</td>
<td>Guido Guida, ETIP SNET and Entso-E, Belgium</td>
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<tr>
<td>09:50</td>
<td>Keynote</td>
<td>Session-chair: Christoph Imboden</td>
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<td>09:50</td>
<td>DSO TSO cooperation: field report from the GOPACS project</td>
<td>Klaas Hommes, Tenet, Nederland</td>
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<td>10:40</td>
<td>Coffee break &amp; poster visit</td>
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<td>11:05</td>
<td>G03 Market developments and international collaborations II</td>
<td>KKL auditorium</td>
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<tr>
<td>11:05</td>
<td>Renewables and their financial risk landscape</td>
<td>Thomas Kammann, Energy Risk Solutions, Switzerland</td>
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<td>11:05</td>
<td>Future-proofing the EU energy system towards 2030</td>
<td>Johannes Henkel, 50Hertz Transmission, Germany</td>
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<td>11:05</td>
<td>Update on the implementation of the European balancing platforms</td>
<td>David Stieber, Amprion, Germany</td>
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<tr>
<td>11:05</td>
<td>Keynote</td>
<td>Session-chair: NN</td>
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<tr>
<td>11:05</td>
<td>Loop-flows, redispatch and bidding-zone splits: What's the part of German Energiewende in it?</td>
<td>Thaddaus Kraisig, Consentec, Germany</td>
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<tr>
<td>12:45</td>
<td>Lunch break and coffee in the poster area</td>
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<td>13:30</td>
<td>G04 POSTER SESSION - ALL TOPICS</td>
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<td>14:15</td>
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<td>14:15</td>
<td>Balancing markets and DEPs in the Italian regulatory framework: Insights on the UVAM case study</td>
<td>Arianna Rosai (1), F. Bovera (1), G. Rancilio (1), D. Falabretti (1), A. Galliani (2), M. Merlo (1)</td>
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<td>14:15</td>
<td>Flexibility aggregation for ancillary services in the Czech Republic</td>
<td>Stanislav Chvala, NANOenergies, Czechia</td>
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<td>14:15</td>
<td>Implementing better framework conditions for new players in the flexibility market</td>
<td>Hele Juhler-Verdoner, Danish Intelligent Energy Alliance, Denmark</td>
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<td>14:15</td>
<td>Impact of COVID-19 on the demand curves of Croatia and region</td>
<td>Igor Vidić, Matija Melež, Davo Bošnjak, HEP Trade, Croatia</td>
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<td>14:15</td>
<td>Integration of voluntary flexibility at Runtime</td>
<td>Philipp Graf, Jan Jurczyk, Klaus Nagl, Consolino Energy, Germany</td>
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<td>14:15</td>
<td>Integration of decentralized flexibility resources in the Austrian electricity market</td>
<td>Christian Pugil-Pichler, Vaaska Dimitrova, Markus Riegler, Christian Todor, Austrian Power Grid AG, Austria</td>
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<td>15:25</td>
<td>Coffee break &amp; poster visit</td>
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<td>15:50</td>
<td>G06 Operation and enabling technologies I</td>
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<td>15:50</td>
<td>Accelerating the European energy transition with digital</td>
<td>Mahir Chehbou, ETIP SNET, Belgium</td>
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<td>15:50</td>
<td>Impacts of peer-to-peer trading on wind energy curtailment in constrained distribution networks</td>
<td>Ivana Kockar, Mark Jenkins, University of Strathclyde, United Kingdom</td>
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<td>15:50</td>
<td>Active distribution grid management: A decentralized approach for the management of flexibility options</td>
<td>Michael Merz, PONTON, Germany</td>
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<td>15:50</td>
<td>Simple and efficient implementation of local energy markets</td>
<td>Thomas Walter, Easy Smart Grid, Germany</td>
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<td>17:20</td>
<td>G07 Operation and enabling technologies II</td>
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<td>17:20</td>
<td>Options for the implementation of fast control reserves in the Continental European power system</td>
<td>Alexander Stremer, Martin Lenz, Manuel Froschauer, M. Leonhardt (1), W. Gavlik, C. Alacs, C. Cornalbese, G. Lettner (2), A. Anta (3), K. Oberhauser (4)</td>
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<td>17:20</td>
<td>Improving grid networks operational decision support &amp; vegetation management practices using Hi-resolution weather models</td>
<td>Mark Stephens-Row, The Weather Company, an IBM business, United Kingdom</td>
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<td>17:20</td>
<td>Benefits of multi-voltage-level grid control in future distribution grids</td>
<td>Wolfgang Bienert (1), Thomas Erge (1), Thomas Kumm (2), Bernhard Wille-Haussmann (1)</td>
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<td>Forecasting and optimization approaches utilized for simulating a hybrid district heating network</td>
<td>Lukas Gram, Christian Pfeiffer, Markus Schnirder, Markus Puchagar, Forschung Burgenland, Austria</td>
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<td>Readiness of short-term load forecasting methods for their deployment on company level</td>
<td>Thilo Walter (1), Martin Ressinger (1), Niklas Hartmann (2), Christian Dierolf (1), Alexander Sauer (1)</td>
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<td>18:00</td>
<td>End of sessions</td>
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<td>19:30</td>
<td>GSM network dinner (included, guest tickets for 120,- CHF available)</td>
<td>KKL auditorium</td>
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Tuesday, 21 October

08:30 On-site Grid registration

09:00 G08 VPP and advanced technologies I

09:01 The European market monitor for demand side flexibility
Philippa Hardy
Delta-EE, Scotland

09:02 How virtual power plants enable renewable grid integration
Alessandra Radwanska, Felix Jedamzik, Felix Lober, Jan Aarninkvoort
Nept Kraftwerke, Germany

09:03 Trade with local flexibility to resolve transmission bottlenecks in Denmark
Thomas Dalgas Rasmussen
Energinet, Denmark

09:04 Quartierstrom: a local energy market in practice
Liliane Aebli-Schuhmann
Enatron, Switzerland

10:30 Coffee break & poster visit

11:05 G09 VPP and advanced technologies II

11:01 Converting wastes efficiently and flexibly for grid-balancing services and sector coupling
Ligang Wang (1), Mar Perez-Fortes (1), Yi Zong (2), Vincenzo Motola (3), Stefan Diedhiem (4), Alessandro Agostini (3), Oliver Buchel (4), Jan Van Herle (1)
(1) EPFL Swiss Federal Inst. of Technology Lausanne, Switzerland;
(2) Technical Uni of Denmark, Denmark;
(3) ENEA, Italy; (4) SOLIDpower, Italy

11:02 SOFCs, fuel flexible, easy to modulate, reversible and future proof
Jan-Willem Tollkamp
SOLIDpower, Italy

11:03 Opportunities and challenges for water electrolysers to participate in grid services
Stephanie Chevon, Valerie Seguin
CEA, France

11:04 Panel discussion: business-potentials & technology-challenges
Speakers & Audience, Moderator

11:05 Dispatchable renewable distributed power
Klaus Payrhuber
INNObet, Switzerland

12:30 Lunch break and coffee in the poster area

13:15 G10 POSTER SESSION - ALL TOPICS

14:00 G11 Advanced technologies providing flexibility

14:01 Perspectives for flexibility in the German electricity system
Stefan Mischerer
DENA, Germany

14:02 Water electrolysers for electricity grid services – dynamics, advantages and disadvantages of different types of electrolysers
K. Andreas Friedrich, Regine Reisanger, Syed Asif Ansar
German Aerospace Center, Inst. of Engineering Thermodynamics, Electrochemical Energy Technology, Germany

14:03 Frequency control by run-of-river hydropower: a case study on energetic and economic potentials
Baedan Hase (1), Christian Seidl (2)
(1) Technische Universität Braunschweig, Germany;
(2) AG Regenerative Energien, Institut für Statik, Denmark

14:04 Hydro storage as enabler of energy transition
Peter Bauhofer, Michael Ziegler
TITAG-Ticiter Wasserkraft, Austria

14:05 Opportunities for CHP plants providing flexibility
Filippo Bovera
Politecnico di Milano, Dipartimento di Energia, Italy

15:55 Closing

16:00 Fuel cells and hydrogen on the path to service market
Bart Biebuyck, Minel Aitanasov tbc
EU FCH Joint Undertaking, Belgium

16:01 Summary & GSM award “Audience Award”
Christoph Imboden (1), Michael Spring (2), Oliver Buchel (2)
(1) Lucerne Uni of Applied Sciences & Arts,
(2) European Fuel Cell Forum AG, Switzerland

17:00 End of sessions & end of official part of GSM Symposium

Networking possibilities on Tuesday evening
17:00 GSM grid apré in the EFCF exhibition area, optional booths free
18:00 EFCF welcome reception, free, offered by EFCF
19:30 GSM+EFCF joint dinner free, offered by EFCF with VPP Panel only (20 Oct, incl. Lunch)

Special offers** to join EFCF 2020 on Wednesday, 21 October

08:00 On-site registration open

09:00 EFCF 2020: first morning session block

A01 + A02: Opening, Overviews of EU, US, Japan, China, Networking coffee break

A03: Technology status at industry & major groups I

A04: Poster session & exhibition visit (free)

A05: Technology status at industry & major groups II

A06: Products & demonstrations

12:30 Lunch on KKL Terrace

13:15 EFCF 2020: afternoon session block

A07 + A08: Energy storage: technology and applications

A09: Technology status at industry & major groups I

A10: Panel discussion: business potentials & technology challenges

A11: Energy storage: technology and applications

18:30 EFCF Swiss surprise night (registered participants meet at station-side KKL entrance, to be booked by email in advance)
nall 3 days 21-23 October

08:00 On-site registration open

09:00 EFCF 2020: conference, poster area & exhibition incl. breaks, documentation, lunch, dinner on the lake

Find all program & event details in the final announcement on: www.GSM.com

**Only for GSM participants are special tickets available. Book them on-line or on-site (→ on-site fee applies)

www.GridServiceMarket.com

EFCF
The European Fuel Cell Forum is an international reference conference with exhibition & tutorials in the emerging field of “fuel cells, electrolyzers & H. processing”. Since 1994 it took 24th times place in Lucerne/Switzerland.

Figures Participants:
> GSM/VPP panel this year up to 200 participants expected;
> EFCF between 350-500 participants and 25-35 exhibitors
> EFCF tutorial 30-40 participants;
> FCH: fuel cells, electrolyzers & hydrogen (kick-start) 20
> EIS: electrochem. impedance spectroscopy (advanced) 25

The GSM symposium is supported by funds from the European FCH program, www.PACE-energy.eu and the Swiss Federal Office of Energy SFOE: www.bfe.admin.ch/
In order to ensure an affordable, secure, effective and cost-efficient transition of the European energy system, a System of Systems View of all sectors in the European economy must be applied and a strong coordination of policy initiatives both at EU and at Member States level is essential. Moreover, a sustainable energy transition requires renewed efficient energy markets that provide a level playing field for all stakeholders involved, non-discriminatory open access and preclude cross-subsidies.

In this framework, an increase of flexibility of the system should be ensured through policies, measures and regulations compatible with further market integration and increased competition in order to achieve climate and energy objectives. In order to rely on much higher balancing capacities, the future energy system will be coupled and optimised as one overall “Integrated Energy System”. In this new overall context, digitalization will play a key role as enabler.

The ETIP SNET R&I roadmap 2020-2030 is based on a consolidated and balanced stakeholders’ view for the future R&I needs of the Integrated Energy System with electricity as its backbone. It considers the encompassing interaction among the different energy vectors (i.e. electricity, gas, heating and cooling, transport, water, communication etc.), addressing the flexibility needs and the related conversion and storage technologies and solutions towards integration and decarbonisation.

Guido Guida is chairman of the European Technology and Innovation Platform for Smart Networks in Energy Transition (ETIP SNET). He is also Head of Terna Office in Brussels, the Italian Transmission System Operator (TSO) for electricity, is Member of ENTSO-E’s Board of Directors since July 2019 and Chair of the Digital committee. A prominent figure in the energy sector, with an experience of more than 25 years, he has been, till July 2018 the Head of Italian Dispatching Department of Terna, a company in which he has covered several key positions. During this period, he managed several projects aimed to contribute to the integration of Renewable Energy Source within the Italian electrical system, strength TSO-DSO cooperation and the development of Storage Systems. He has been involved in ENTSO-E activities since its creation. He was Member of the Market Committee representing Terna since the beginning of ENTSO-E and the Chair of the Research Development & Innovation Committee till July 2019.

GOPACS - Grid Operators Platform for Congestion Solutions - is a unique cooperation between Dutch TSO and DSO's to solve congestions in the electricity grid. GOPACS is an important step to mitigate capacity shortages in the electricity grid(congestion) and thus contribute to keeping the Dutch grid reliable and affordable. The energy transition and economic growth require capacity increase of the electricity grid. The grid operators are working hard on increasing this electricity grid capacity to be able to meet the growing demand. However, this cannot be realised overnight. Making use of flexible power from the market can contribute to solving (expected) congestion in the electricity grid. This is where the new GOPACS platform comes in.
GOPACS works in a way that is consistent with key European directives that relate to market-based mitigation of grid congestion and offers large and small market parties an easy way to generate revenues with their available flexibility and contribute to solving congestion situations. The collaboration among the grid operators also prevents congestion in one part of the electricity grid from causing problems elsewhere in the electricity grid at one of the other grid operators.

Klaas Hommes (1967) is an expert on the Dutch utility sector, he has over 25 years of experience in a broad variety of (management) functions. He has joined TenneT TSO B.V. twelve years ago and joined the System Operations Department (International Developments) as Business Developer. In 2008 he was one of the participants in developing the congestion management scheme in Westland, which has been used from December 2008 until July 2010. Since 2008 Klaas is working as Business Developer and has been involved in issues as Smart Grids, European Market Design, Data Exchange, Integration of Renewables, Electrical vehicles and more innovative issues. Currently Klaas is working on international projects on Frequency Products and data Governance in the Netherlands.

Previously Klaas worked as a manager for Essent, RWE and NUON. Before joining TenneT Klaas worked for Capgemini as Managing Consultant.

RENEWABLES AND THEIR FINANCIAL RISK LANDSCAPE

Thomas Kammann, Managing Director, Energy Risk Solutions, Switzerland, www.ENERGY-RISK-SOLUTIONS.com

Financing renewable investments is often highly leveraged and thus depending on predictable cash flows. Cash flows are a product of energy price and produced volume. In the past price was a quite predictable component and volume could be hedged with weather derivatives. This stable constellation granted also investment security for grid infrastructure. Meanwhile on the price side mandatory auctioning systems, cannibalization effects and currently overloaded grids present a challenge for renewable investors whom however are required to reach ambitious European targets. A more stringent alignment of generation and grid investments is absolutely necessary.

Almost 30 years' experience in European and global energy industry. Covered segments:

- Founding Energy Risk Solutions in 2016
- Director of global financial power, gas and weather markets at Swiss Reinsurance with focus on renewables
- Head of European gas and coal markets trading at Alpiq
- German and Eastern European gas markets origination at Wintershall

Future-proofing the EU energy system towards 2030

Johannes Henkel, Head of Energy Market Development, 50Hertz Transmission, Germany www.50HERTZ.com

In the presentation, a new amendment for market design is presented. The development is based on market simulations for 2030. The simulation also allows for investigating the impacts of this new market design amendment.

Dr. Johannes Henkel had studied Energy & Process Engineering at Berlin University of Technology until 2006. He completed his PhD in Energy Economics also at Berlin University of Technology. He collected professional experience at Institute of Energy and Environmental Research, Heidelberg/Germany, Instituto de Planificación y Promoción de Soluciones Energeticas, Bogotá/Colombia as well as in the Analysis and Consulting Company Energy Brainpool, Berlin/Germany. In the later he worked as an advisor for companies, institutes & political institutions of the German & international Energy Sector.
UPDATE ON THE IMPLEMENTATION OF THE EUROPEAN BALANCING PLATFORMS ACC. TO THE ELECTRICITY BALANCING GUIDELINE

David Steber, Expert for Control Reserves and Balancing, Amprion, Germany

The presentation provides a detailed view of the target model for European balancing markets. In particular, it focuses on the different balancing processes and briefly describes the legal framework of the European balancing target model. The presentation gives an overview of the implementation of the EB Regulation with regard to the European Balancing Platforms and report on the progress made concerning the integration of balancing markets in Europe.

Dr. David Steber studied Business Administration & Engineering with specialization in electrical power engineering at the RWTH in Aachen. After that he started his doctorate in the field of simulation of energy systems at University Erlangen-Nürnberg. His dissertation was about the ‘Integration of Decentralized Battery Energy Storage Systems into the German Electrical Power System’ by aggregating residential PV-Storages and offering them on the FCR market. In late 2019 he started working as an Expert for Control Reserves and Balancing in the Transmission System Operation Department of Amprion GmbH.

LOOP-FLOWS, REDISPATCH AND BIDDING-ZONE SPLITS: WHAT’S THE PART OF GERMAN ENERGIEWENDE IN IT?

Thaddäus Kreisig, Consultant, Consentec, Germany

Germanys Energiewende increases necessary electricity transmission in the power system, which leads to additional loop flows through neighboring bidding zones. Loop flows also effect market-based and physical flows on neighboring interconnectors, thus, raising the question of which flows should be allocated. European regulation addresses the conflict of priority access of RES electricity on the one hand and non-discrimination of international trade on the other hand within the Clean Energy Package (CEP).

Mr. Kreisig will discuss instruments of the CEP relevant in this context, such as minRAM, cross-border redispatch and bidding zone configuration.

Thaddäus Kreisig joined Consentec in 2017. He holds a M.Sc. in Business Administration and Engineering from RWTH Aachen, with a particular emphasis on Electrical Energy Technology. At Consentec he was engaged with model-based studies regarding the European power market design including capacity allocation pursuant to the CEP as well as future system adequacy.

FLEXIBILITY AGGREGATION FOR ANCILLARY SERVICES IN THE CZECH REPUBLIC

Stanislav Chvala, CEO, Nanoenergies, Czechi

Nano Energies together with Czech TSO, Czech Technical University and municipality of Prague are building a framework for flexibility aggregation for ancillary services in the Czech Republic. The concept is tested on the demand-response type of flexibility providers, both industrial and public.

Stanislav Chvala is CEO of Czech company Nano Energies. Since 2018 he has directed the company towards accomplishing its vision of shared sustainable energy through creating new products for retail customers, expanding activities of the company to new markets and establishing partnerships across all industries. He has previously worked in the energy sector in Czechia and the UK and in banking.
IMPLEMENTING BETTER FRAMEWORK CONDITIONS FOR NEW PLAYERS IN THE FLEXIBILITY MARKET

Helle Juhler-Verdoner, Managing Director, Danish Intelligent Energy Alliance, Denmark  www.DANSKENERGI.dk

Implementing the EU Clean Energy Package (CEP) enhances the role of the independent aggregator. In the Danish context we have developed models for aggregators to improve framework conditions for commercial players including the independent aggregators, beginning before the CEP. The CEP is speeding up implementation of the Danish models which also includes other elements that will influence the value stream of demand side flexibility in the flexibility business case. Hence, the presentation will focus on implementing the independent aggregator in the Danish market models, but also address impact of Danish development of time-of-use tariffs and development of local flexibility markets.

Helle Juhler-Verdoner has more than 25 years' experience within advocacy towards policy-makers and other stakeholders, including public affairs activities. Since 1998 focussing on Energy and Climate change.

2014 – today: Managing the Danish Intelligent Energy Alliance. The main strategic focus of the Intelligent Energy Alliance is to improve framework conditions for business activities which activate flexibility /demand response in electricity consumption, and pave the way for optimal use of resources across the utilities providing power, heat, gas, Water and Waste/Waste Water treatment in Denmark

December 2008 – 2013: Vice President, Global Affairs, Alstom Power. Engaging pro-actively with stakeholders, thereby building a position for ALSTOM in different international fora with particular focus on UNFCCC negotiations, the annual climate summits (the COPs), incl. climate finance, carbon market development and technology transfer.

December 1998 – November 2008: Head of unit, Energy and Climate change, Confederation of Danish Industries. Managing the unit responsible for CDI's advocacy activities within climate change and energy policies on national and EU level.

ACCELERATING THE EUROPEAN ENERGY TRANSITION WITH DIGITAL

Maher Chebbo, Co-Chair, ETIP SNET, Belgium  www.CTECHNOLOGYS.com

- Role of the Digitalization in accelerating the Energy transition roadmap towards a decarbonized EU 2050
- Digital technologies required and use cases across the energy value chain, generation, grid, retail and customers.
- Role of Digital platforms in the democratic, simple & usable access to Energy for all customers.

- Co-Chair of the ETIP SNET Digital Energy Group
- Chair of the ETIP Batteries Europe Digital Task Force
- Chair of the Board of REEEP (Renewable Energy & Energy Efficiency Partnership)
- 30 years’ Digital Energy & Industries Senior Executive experience at Cap Gemini (6), SAP (21) & GE (3)

- Founder & President of Chebbo Technology Services, supported by GE & focusing on advising fast growth technology companies & Strategic Digital Energy Ventures
SIMPLE AND EFFICIENT IMPLEMENTATION OF LOCAL ENERGY MARKETS

Thomas Walter, Founder & Managing Director, Easy Smart Grid, Germany

Short Energy flexibility of prosumer equipment like CHP, heat pumps and electric vehicles can provide low cost storage (virtual batteries) to compensate for growing RE volatility and reduce grid congestion. Combining the well-known principles of the Walrasian Auctioneer (Economics) and Georg Kirchhoff (Physics) enables dynamic tariffs that are both economically efficient and reflect grid needs. We will report on first results of a pilot project and other areas of application.

Dr.-Ing. Thomas Walter studied Electrical Engineering (specialization Telecommunications) at TH Karlsruhe (now KIT) and the University of Essex (1982), later earned a PhD on automation from RWTH Aachen (1989). From 1983-89 he worked for Cambridge Consultants (Cambridge/UK and Offenburg/D) developing innovative technology for various sectors, followed by a role as product manager digital video recorders and assistant to the CEO at Philips BTS in Darmstadt (1989-93). 1994-2000 he managed a team at the in-house consulting company of Dresdner Bank (Frankfurt) on company restructuring in former Soviet Union and Bank support services. 2000-2011 he worked in Business Development at Altran Technologies (Frankfurt) developing business in high technology and the automotive industries with >25 direct reports and a role as Associate Director of the group. 2011-2014 he founded and led Wirsol Integrated PV Solutions (Wsghäusel/D) as a subsidiary of Wirsol Solar AG. Due to the PV crisis in 2014 he left Wirsol and founded Easy Smart Grid, which in 2014 was voted one of 3 Top smart Energy companies in Europa by EIT Digital, and has been running this company since.

QUARTIERSTROM: A LOCAL ENERGY MARKET IN PRACTICE

Liliane Ableitner, Co-Founder & CEO, Exnaton, Switzerland

Local energy markets are a widely-discussed approach to managing distributed energy supply. They allow households to buy renewable electricity directly from their neighbors' energy sources (e.g. solar panels) in times when these have surplus electricity available. The talk presents lessons learned from the real-world field test of Switzerland’s first local energy market. In the Quartierstrom research project, we designed, developed and deployed such a market in the town of Walenstadt, SG. We report on the technical infrastructure required, the market mechanism behind Quartierstrom and on the users’ readiness for local energy markets.

Dr. Liliane Ableitner studied information systems and holds a PhD from ETH Zurich. Her research focus was on consumer technology that promotes energy efficiency. She contributed to the success of the Quartierstrom project with the user experience design, front-end development, and user testing. Today, she is a co-founder of the startup Exnaton specialized on software for distributed energy.
The European Market Monitor for Demand Side Flexibility, published in 2019 in association with SmartEn, provides a holistic and independent view of the progress of Demand Side Flexibility across 21 European markets. The findings from our primary research in each market provides a high-level summary of the current market activity. This will enable industry to benchmark disparate markets against each other and track their progress on demand side flexibility.

Philippa has been working in the low carbon energy sector for over 10 years. She is passionate about demand-side flexibility as a key technology to enable the energy transition. This led to her creating the Flexibility Research Service at Delta-EE, which provides clients with primary research and advice on demand side flexibility markets, business models, technology, competitors and key issues impacting this space.

Philippa currently leads the development of Delta-EE’s Flexibility & Energy Storage Research Services, working with the team to develop our knowledge area, support our clients and continuously improve our services. She is responsible for managing current client relationships and leading business development for both services. Philippa holds a PhD in Engineering (specialising in Solar PV), and has a background in science and engineering with a MSc (Distinction) in Low Carbon Technologies, and a MSc (Distinction) in Energy and Environmental Engineering, from the University of Leeds.

Trade with local flexibility to resolve transmission bottlenecks in Denmark

G0803: The Danish TSO Energinet must be able to handle the expansion of new renewable capacity and electrification of consumption. In 2019 the wind-share of the total Danish electricity consumption was 47 %, while PV’s covered 3 %. In 2030 the RE-share of the electricity consumption must be 100 %. RE on market conditions makes it difficult to predict and plan the development of the energy system. Currently, grid enhancement is the basic solution as the Danish balancing markets don’t allow for efficient internal congestion management. Energinet is working towards enabling trade with local flexibility to enable short term congestion management to resolve local bottlenecks and give longer term incentives to invest in controllability and optimal grid locations for new production and consumption units. The concept for trade with local flexibility in Denmark is currently being tested in a pilot project.

G1103: The Danish TSO Energinet procures reserves to be able to handle significant outages and to balance the power system. To ensure balance and stability in the grid at reasonable cost, Energinet is investigating the possibility for RE to deliver capacity reserves on equal terms as i.e. power plants and consumption. In 2019 the wind-share of the total Danish electricity consumption was 47 %, while PV’s covered 3 %. In 2030 the RE-share of the electricity consumption must be 100 %. Hence, the capacity and hours of operation of the conventional providers, thermal power plants, are rapidly decreasing. Procurement for availability of reserves is performed the day before operation. If RE is to deliver reserves, it will require high quality forecasts to ensure available capacity to the reserve markets. Hence, Energinet is currently testing the regulating functionalities of RE and the certainty of forecasts and developing baselines for audit of the actual reserve delivery.

M.Sc. Energy Engineer at Energinet in the department of Flexibility & Ancillary Services since 2016.
- Developing technical requirements and markets for reserves based on the needs of the synchronous areas.
- Implementing EU requirements in national codes, testing, prequal. and monitoring of units.
- Leading Danish TSO-DSO collaboration to enable trade with local flexibility to resolve local bottlenecks.
- Enabling flexible consumption and RE to provide ancillary services.
Buildings account for 30% of total carbon emissions. Electrification is thought to be one of the best ways to tackle this, but will we have enough renewable power to pull this off? With about 1000 hours of sun and 3000 to 4000 hours of wind we can only cover half of the year’s real time electric demand in western European countries. The other half of the year, renewable power needs to come from storage. Batteries are a partial solution, but Hydrogen is likely to be the best answers to this large seasonal challenge and can be stored in our already available, slightly adapted, gas-infrastructure. To make this all happen, we will need the most efficient conversion technologies available. Solid Oxide Fuel cells will play a major role in this cycle of renewable storage in Hydrogen, and turning it back to power again the moment we need it. At the same time this will allow power grid-operators to manage congestion and imbalance issues, whilst gas-grid operators will keep their high value to society and their jobs. In this presentation all benefits of SOFC technology will be elaborated with practical examples taken from the challenges described above.

Jan Tolkamp is responsible for business development and sales in the UK, Benelux and potential new EU markets for SOLIDpower Fuel cells. He started to build up a distribution- and sales network there since June 2012. With his degree in automotive engineering and business-administration he has held several commercial positions at mostly high-tech OEM companies.

Renewable energy has always been a leading topic in his career, starting with engine-driven generator sets, automotive- alternative fuels CNG- and Hydrogen applications, via Solar-PV, back into Fuel cells again (now stationary SOFC and SOE).

After leading the international Sales team for Building integrated PV at the Dutch Solar-PV manufacturer Scheuten Solar, he decided to continue his renewable energy career with Ceramic Fuel cells, now SOLIDpower. With its offices in Heinsberg (G), Mezzolombardo (IT), Yverdon (Sz) and Melbourne (AU) it perfectly fit’s the international environment Jan likes to work in.

Perspectives for Flexibility in the German Electricity System

Stefan Mischinger is leading the electricity grids team of the German Energy Agency (dena) since 2017. In this context he is managing multi-stakeholder projects regarding grid planning, grid operation and regulation. Actual projects are the dena Grid Study III, the dena Ancillary Services Plattform and the Netzflex Initiative.

Before Stefan Mischinger started working as an expert at dena in 2013 he was working from 2010 to 2013 as an research associate at the Chair for Sustainable Energy Networks and Sources of Energy of TU Berlin.
WATER ELECTROLYSERS FOR ELECTRICITY GRID SERVICES – DYNAMICS, ADVANTAGES AND DISADVANTAGES OF DIFFERENT TYPES OF ELECTROLYSERS

K. Andreas Friedrich, Professor at Uni Stuttgart, Head of Electrochemical Energy Technology Department, German Aerospace Center (DLR), Germany

Water electrolysers are expected to play an important role in the strategy of EU for decarbonization. With an increasingly renewable-energy fed grid they can produce hydrogen for application in transport and industry replacing in these sectors CO2-emitting technologies. They can also help stabilizing the grid and provide energy storage via hydrogen production and electricity production from hydrogen.

The mature and robust technology of alkaline electrolysis, used up to megawatt size for decades, is often believed to be ill suited for fast dynamics. Just approaching systems commerciality in the megawatt size is the technique of PEM (polymer electrolyte membrane) water electrolysis which is characterized by its capability of dynamic operation. Still with the demonstration in 100s of kilowatt size is the technique of high temperature solid oxide electrolysis. It may reach very high electrical efficiency and has been demonstrated for reversible operation, i.e. the option of either consuming electricity and producing hydrogen (electrolysis) or consuming hydrogen and producing electricity (fuel cell).

Grid services as supplied to TSO (transmission system operators) and DSO (distribution system operators) were investigated in the project QualyGridS and transferred into testing protocols for electrolysers performing grid services. In this application the electrolyser offers its operational flexibility as a power consuming load to achieve improved revenues. The properties of the different electrolyser technologies are reviewed in this contribution. Modern alkaline electrolysers show their suitability even for fast grid services. They as well as PEM electrolysers need an update in their control system to adapt them to grid services requirements. Based on the lessons learned from QualyGridS this contribution will discuss also the suitability of high temperature SOEC technology for grid service based on present knowledge and technology.

Dr. K. Andreas Friedrich is a Professor of Mechanical Engineering at University of Stuttgart and the Head of the Electrochemical Energy Technology Department at the German Aerospace Center (DLR) in Stuttgart, Germany. His research areas are electrochemical energy conversion and storage, in particular polymer electrolyte fuel cells and electrolysis, solid oxide cells, system design and optimization.

Dr. Friedrich has authored and coauthored about 220 reviewed papers. He received the Fischer medal (Dechema) in 2009 and the Ertl prize 2014 for his scientific work. In 2004 he joined the DLR and University of Stuttgart heading the group at DLR focusing on electrolysis, fuel cells and advanced batteries. Priorities are polymer membrane and solid oxide technology as well as “beyond Li-ion” technology in batteries. The activities of the group have received the f-cell Award in Silver 2016 for electrolysis components, the Clean Tech Media Award 2012 (Aviation) and the f-cell Award in Silver 2008 (DLR with Airbus).

OPPORTUNITIES FOR CHP PLANTS PROVIDING FLEXIBILITY

Filippo Bovera, Politecnico di Milano, Dipartimento di Energia, Italy

Assessing the economic opportunities coming from the Ancillary Service Market (ASM) participation for Distributed Energy Resources (DERs) is a key aspect to orientate private investments in an economically and environmentally sustainable way within the future energy framework. The presentation will highlight the influence that the Italian dispatching reform currently in place could have on the sizing and operation phases of a Combined Cooling, Heat and Power plant in an industrial context. It will be shown how operators can give a value to flexibility services through market data analysis and which is the technical and economic impact on power plants operations.

Filippo Bovera is a Ph.D. student in Electrical Engineering at Politecnico di Milano, where he obtained a M.Sc. in Energy Engineering cum laude focusing on sustainability and distributed generation. His research activity involves optimization models for distributed energy resources management and statistical models for energy market simulation.
The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) is a unique public-private partnership supporting research, technological development and demonstration (RTD) activities in fuel cell and hydrogen energy technologies in Europe. Its aim is to accelerate the market introduction of these technologies, realising their potential as an instrument in achieving a carbon-clean energy system.

Fuel cells, as an efficient conversion technology, and hydrogen, as a clean energy carrier, have a great potential to help fight carbon dioxide emissions, to reduce dependence on hydrocarbons and to contribute to economic growth. The objective of the FCH JU is to bring these benefits to Europeans through a concentrated effort from all sectors.

Hydrogen can be produced from a broad range of renewable energy sources, acting as a unique energy hub providing low or zero emission energy to all energy consuming sectors. Technically and efficiently producing hydrogen from renewable sources is a key enabler for these developments.

The way how the electrical energy market is organised in Europe is changing, opening opportunities for more flexibility in generation and consumption. New sustainable technologies such as water electrolyzers, fuel cells, batteries and others meet the needs of the future transmission and distribution grid. Flexibility, virtual power plant, dynamic load management, direct marketing, control reserves, grid services are few of the key words addressing this challenge.

Bart Biebuyck is since 16th May 2016 the Executive Director of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), a public-private partnership aiming at facilitating the deployment of fuel cells and hydrogen technologies in Europe. Under his leadership, a strong emphasis on cooperation with cities and regions led to the creation of the European Hydrogen Valleys partnership with around 40 European regions. Dissemination of project results, building technology awareness and enhanced basic research became his key focusing points.

Before the FCH JU, Bart Biebuyck was at the Fuel Cell department of Toyota Motor Europe where he held the position of Technical Senior Manager. His expertise in the automotive industry includes extensive knowledge related to the deployment of new technologies in the European market. It is as part of the Clean Energy Partnership (CEP) program in Berlin that Bart worked at reinforcing European trials for the Toyota Fuel Cell Vehicle. He also had the opportunity to develop and expand his expertise in Japan, where for two years he worked on the development of Toyota and PSA’s small vehicle.

In addition to his industrial experience, Bart has been politically active in his local town since 2006. In 2013 he became the vice president of the City Council, responsible, among others, for the local economy and education. Bart's term as the Executive Director of the FCH - JU was extended for four years until 15 May 2023.
CHAIR of the GSM symposium

Prof. Christoph Imboden

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Christoph is professor for product innovation at the Lucerne University of Applied Sciences HSLU and Head of Research at the Institute for Innovation and Technology Management. He is engaged in several research projects focusing on power economy. He studied electrical engineering at the ETH Zurich, received his doctorate in 1995 and an executive MBA at the University of Zurich in 2006. He looks back to more than twenty years of industrial experience in different application areas of the energy, communication and information technologies.

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