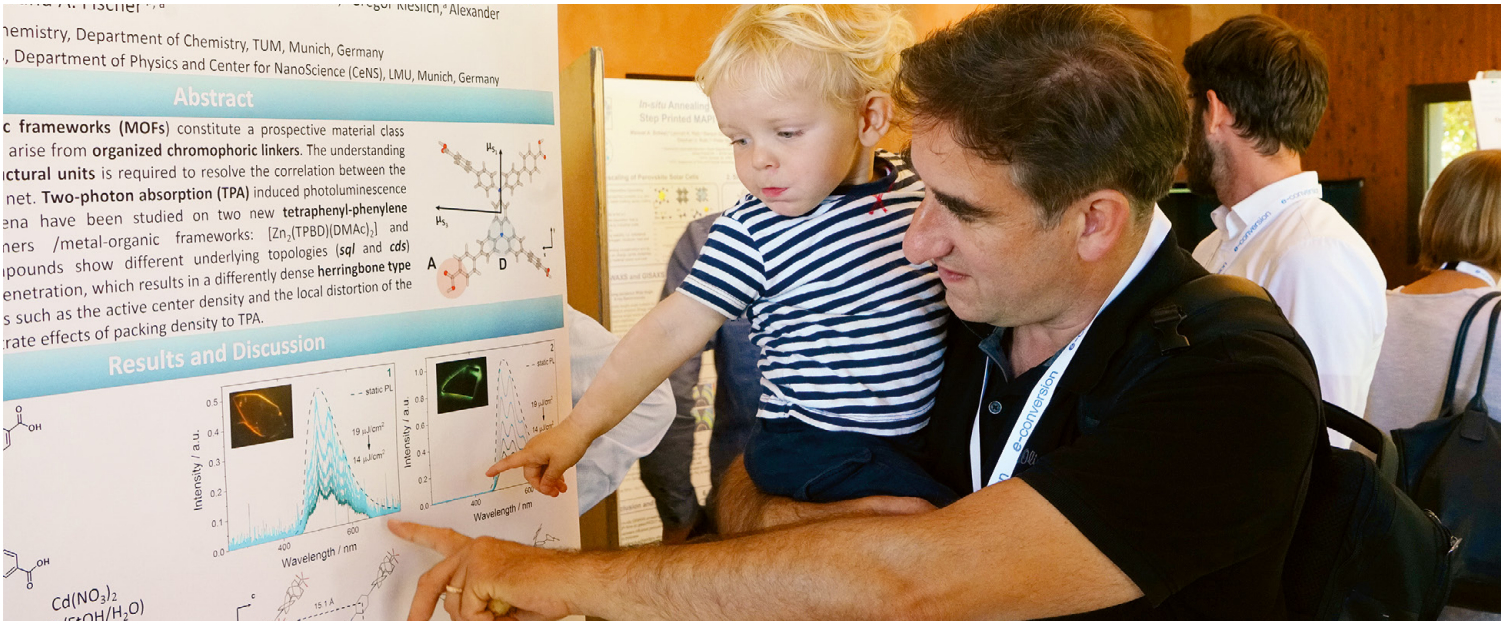


Early talent recruitment

energy conversion news

What's happening in the Cluster of Excellence

Editorial

Dear readers,

Welcome to the first edition of energy conversion news, the newsletter of the research cluster *e*-conversion. Funded within the German Excellence Strategy, *e*-conversion started in the beginning of 2019 and unites more than 40 research groups primarily located in Munich and working in the field of renewable energies.

Even in the most difficult times of COVID-19, the topics of climate change and the transition towards a sustainable energy system remain key challenges of this century. Public discussion on this matter is often concentrated on technological implementation, societal acceptance and economic implications. However, there is a layer "underneath". Materials need to be found or designed that actually enable the conversion of different forms of energy in our future energy system, like sunlight to electricity in solar cells or electricity to chemical energy in batteries. Such materials need to be abundant to enable global scale-up and they need to be non-toxic. They also need to efficiently work together in a final energy conversion device, as most shortcomings of current solutions arise at the interfaces between different materials. Tackling these scientific challenges is the mission of our research cluster.

The problems and advances in this hidden layer "underneath" are typically not so accessible to the broader public. With our newsletter we invite you to enter into this world! We aim to provide comprehensible information on topics and developments within *e*-conversion, like the reduction of platinum content in fuel cells described in this first edition. Yet, a research cluster is much more than just the science. We thus like you to meet the people behind the cluster and energy research in Munich. Dedicated students and scientists with passion for their research, with team spirit, creativity and curiosity! In this first edition, we start by introducing our network of young PhD students and David Egger as one of the new young professors attracted to Munich by our cluster.

We hope you enjoy exploring the layer "underneath"!

Karsten Reuter, Ueli Heiz and Thomas Bein
Coordinators of *e*-conversion

Content

Cluster of Excellence *e*-conversion

Fundamentals of energy conversion processes

For experts the title and subtitle of our Cluster roll off the tongue. The others are allowed to stumble, and invited to read this article in order to learn what's it all about. Thereafter the way surely will be open for an easy "Fundamentals of energy conversion processes"…

We don't know yet how the supply with solely regenerative energy will look like in detail. However, this much is certain: all forms of energy have to be easily convertible into each other. The first process that generally comes to our mind is the direct conversion of sunlight and wind into electricity. However, generated electricity alone will not solve the problem. We need highly efficient storage devices such as batteries, energy carrier like hydrogen for mobility and synthetic fuels with high energy densities for industry and freight transport.

A huge problem is that during every conversion process a considerable proportion of the energy seeps away. Researchers could already reveal the most important "leak": In nearly every case, the crucial location seems to be at the interface between two materials. There, the potential of energy saving is enormous and a good reason to bring together the best researchers in this field into the *e*-conversion cluster. But not only the energetically inefficient conversion is worthy of improvement. Many systems lack in stability. Others contain rare and therefore expensive elements such as platinum or iridium, or toxic substances such as lead and cadmium. All these questions are part of the research at *e*-conversion. You will find an example on page 4.

The cluster's secret of success

The special feature of the DFG Clusters of Excellence is that experts from different areas come together to jointly address a certain question. The researchers at *e*-conversion are mostly physicists, chemists and biologists with expertise in the fundamentals of photovoltaics, photocatalysis, electrocatalysis, fuel cells, battery research and photosynthesis. The spectrum is supplemented by specialists in optoelectronics - a branch of research that deals with the conversion of light into electrical signals and vice versa. As different as their specific background may be, they all work with related materials and methods and tackle similar problems at the material boundaries.

The core issues for our scientists are the following: What happens at the atomic level and what goes wrong? What can we improve and what kind of alternatives can we develop? May self-designed materials be a key to success? Can one solution also solve challenges of other energy conversion processes? "The problems at the interface between materials lead to critical phenomena like overpotentials, recombination losses and increased resistance," explains Professor Thomas Bein, one of the three coordinators of *e*-conversion. "For making progress we first have to analyze the underlying excitation and energy conversion processes at the atomic level. The next step is their optimization."

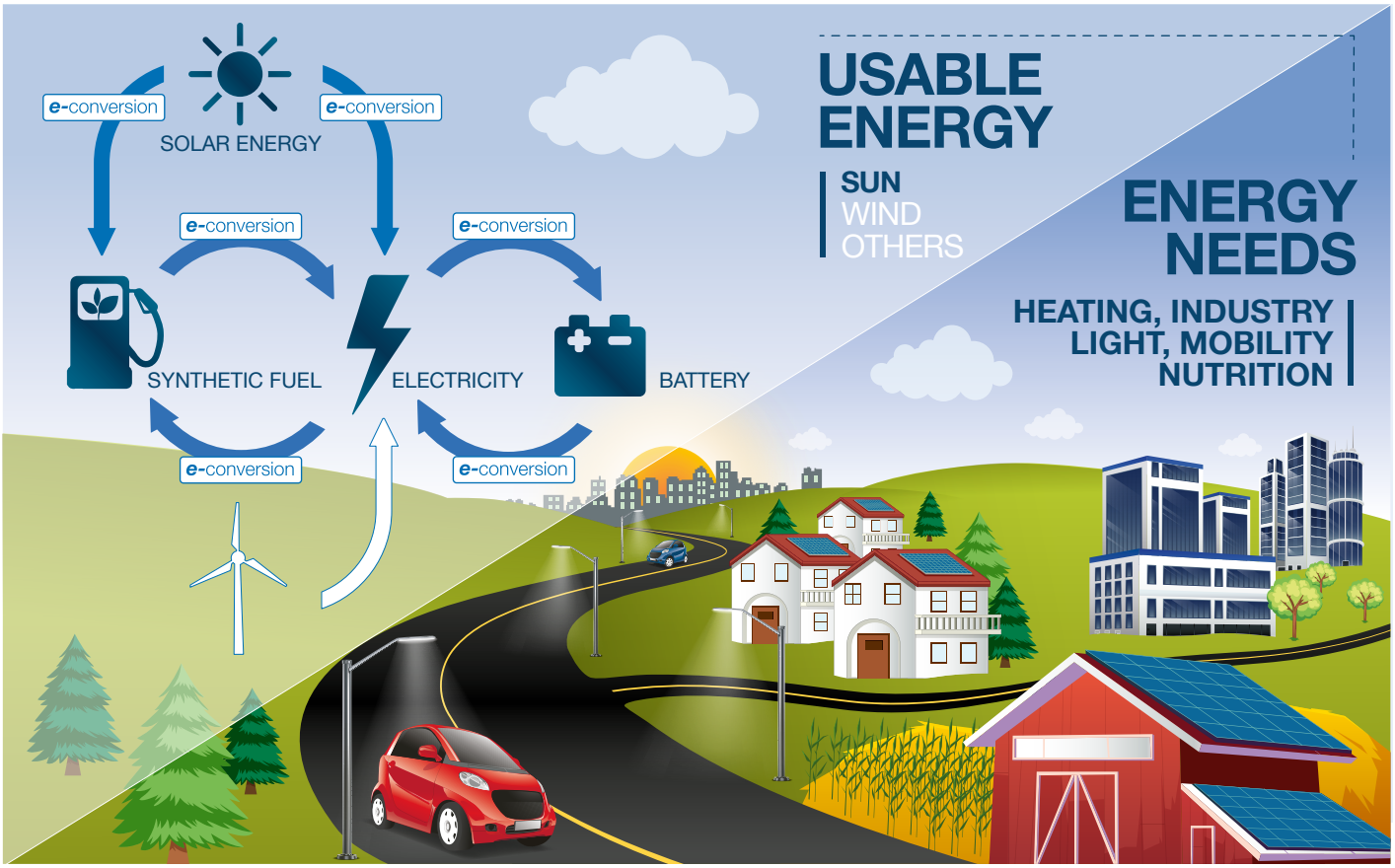
Back to basics

As one of the first steps, the scientists construct simplified interface models – in the lab as well as in computer simulations. These models help to understand basic operations in detail and to identify the factors disturbing the conversion process. Thanks to the cluster's excellent technical facilities the members are able to define the model set-up down to the atomic level and to precisely modify single parameters. Afterwards they test what has to be optimized in the model and later in the more complex working devices.

"The resistance in solid-state batteries often is quite high and results from degradation processes at the interfaces," says cluster coordinator Professor Karsten Reuter. "With simplified models we investigate the atomic processes behind this degradation and analyze how to stop it. As soon as we get valuable results we apply the scheme to real systems."

"And the 2019 Nobel Prize in chemistry goes to..."

...the developers of the lithium-ion battery John Goodenough (USA), Stanley Whittingham (UK) and Akira Yoshino (Japan). With its awarding, the Nobel Committee emphasizes the importance of the topic of energy storage for all mankind. At *e*-conversion, numerous scientists are working on new storage media, inspired by the great legacy of the three Nobel laureates.



e-conversion investigates the fundamental processes for converting the usable forms of renewable energy into those forms of energy that cover our energy needs.

Perfectly equipped

In addition to the high-tech instruments in the individual research groups, all members have access to many and partly unique devices and to services of external institutes. This includes the Leibniz Supercomputing Centre and the Research Neutron Source Heinz Maier-Leibnitz at the campus Garching. A close cooperation exists with the soft X-ray synchrotron BESSY II in Berlin. In addition, the TU München is about to build its own Operando Electron Microscopy Center, further invigorating the Cluster. Those microscopes will be able to produce outstanding live records of energy conversion processes in operation at near atomic resolution.

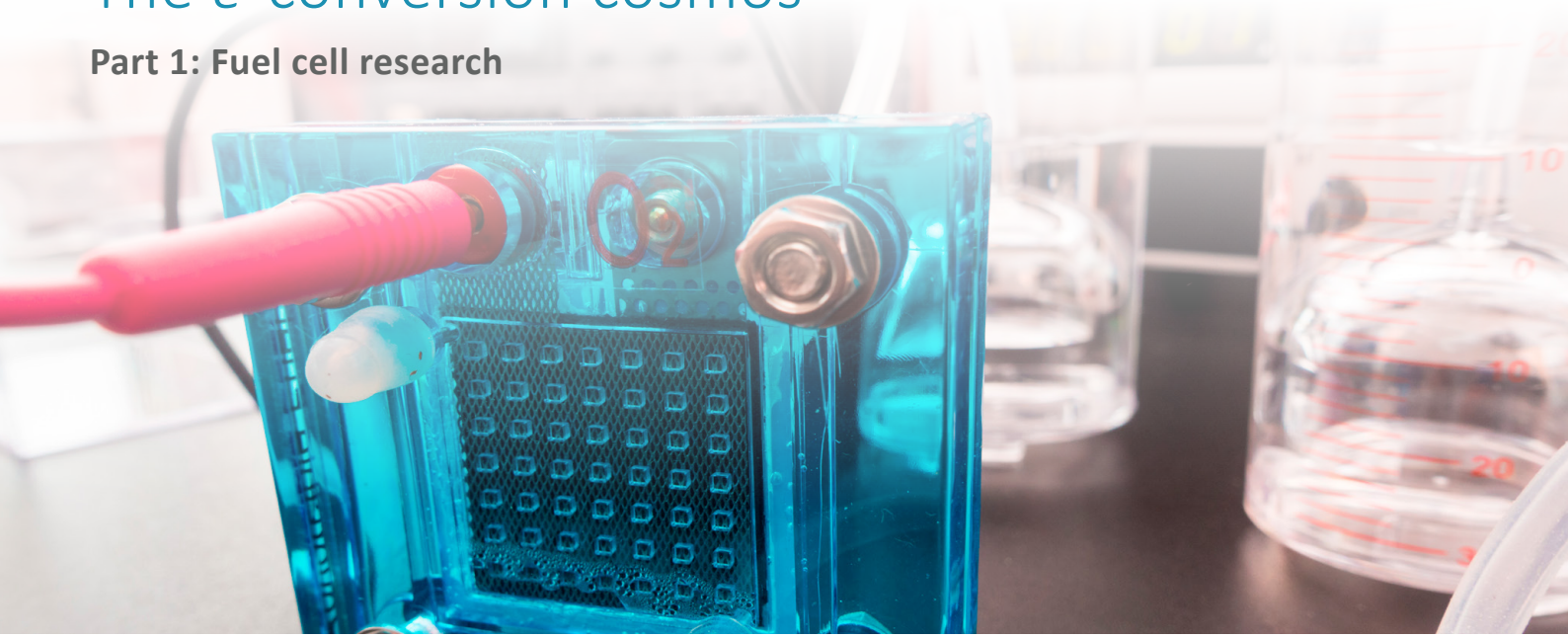
Nevertheless, all these innovative technologies would be nothing without the bright minds behind. The scientists of *e*-conversion bring in all their knowledge, skills and enthusiasm to help build the sustainable energy supply of the future.

FACTS AND FIGURES

Cluster of Excellence	Part of the Excellence Strategy of the federal and state governments. One research topic, various disciplines. In total 57 Clusters of Excellence from all scientific fields.
Duration (1st funding period)	January 1, 2019 to December 31, 2025
Members	44 professors and group leaders with their teams
Coordinators	Professor Karsten Reuter (TUM), Professor Ulrich Heiz (TUM), Professor Thomas Bein (LMU)
Research Areas	Solid-Solid Interfaces, Solid-Liquid Interfaces, Molecularly-Functionalized Interfaces, Foundry Organic, Foundry Inorganic
Participating institutions	TU Munich (managing university), LMU Munich, Max Planck Institute for Solid State Research (Stuttgart), Max-Planck-Institute for Chemical Energy Conversion and Max-Planck-Institute for Coal Research (both: Mülheim an der Ruhr)
Special measures	Graduate Program, family support, courses for students and teachers, public events,…

The *e*-conversion cosmos

Part 1: Fuel cell research



Small fuel cell in the lab

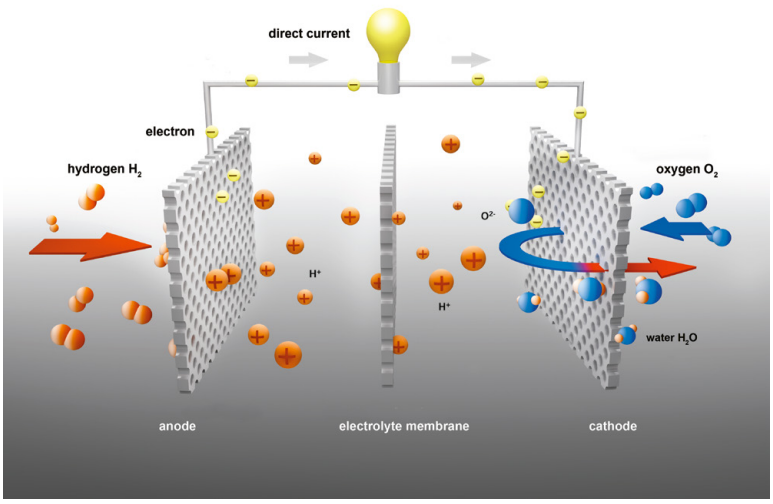
The *e*-conversion cosmos is full of exciting projects. In this series we present key topics of energy research on the basis of current publications from our cluster and give an insight into the daily work of our members.

One could call fuel cells frugal creatures. They are content with oxygen and hydrogen and willingly convert both into electricity and water. Usually, oxygen from the air is already sufficient. However, users may have to spend a lot of money on hydrogen, because its sustainable production by electrolysis is still rather expensive. In our first example we show how *e*-conversion scientists succeed in making the central chemical reaction of hydrogen production run much more efficiently. The second publication is all about platinum. This expensive precious metal sits in tiny particles on the cathode of the fuel cell and catalyses the reduction of oxygen. Thanks to the experts at *e*-conversion, the reaction with less platinum works even better than before.

With rough edges to more hydrogen

Molybdenum is a versatile element. The plant and animal metabolism needs it as a vital mineral. Industry uses the metal to harden steel or in lubricants. And last but not least, molybdenum selenide and molybdenum sulfide are excellent catalysts for hydrogen production.

FUEL CELL PRINCIPLE

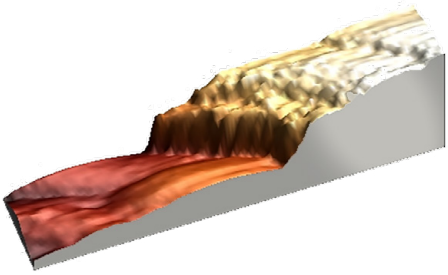


At the anode, hydrogen is oxidized into two protons (H^+) and two electrons (e^-). The protons migrate through the membrane (or an electrolyte solution). The electrons move through the anode to the cathode and current flows. At the cathode, the electrons reduce the oxygen and in the last step, the oxygen ions combine with the protons to form water.

Today, the focus is on fuel cells that work with a proton exchange membrane (PEMFC) instead of liquid electrolytes. In comparison, these systems are very durable and require little maintenance, contain no alkalis or acids, are quickly ready for operation and work with ambient air instead of pure oxygen. They are already being used in some heaters and as prototypes in cars, buses and vans.

Both substances are layered systems, similar to a stack of paper. The surface is atomically smooth, the side edges are rather stepped like a stack of paper that is quickly folded. It is already known that the hydrogen evolution reaction (HER) is less efficient on the surface of the materials than on the sides. A group of *e*-conversion members got to the bottom of this phenomenon and investigated exactly where the catalytically active centers are located and how one can increase their number.

Using an electrochemical scanning tunneling microscope (EC-STM), they followed the behavior of individual molecules in real time. The 3D image (see below) visualizes the measurement results of a gold base with several layers of molybdenum sulfide. While scanning the surface, the highly specialized microscope



Highest catalytic activity on the edges: STM image of molybdenum disulfide layers on a gold surface.

detects whether and how the tunnel current between the surface and an atomically thin tip changes from atom to atom. Elmar Mitterreiter, one of the first authors of the publication, explains the result: “In places where the tunnel current changes significantly, the catalytic activity and thus the amount of hydrogen produced is particularly high. In our experiments we were able to prove that smooth surfaces are hardly active at all. At corners, edges and steps significantly more hydrogen is produced. That is why we tried to deliberately destroy the surfaces of the materials by removing single atoms.“

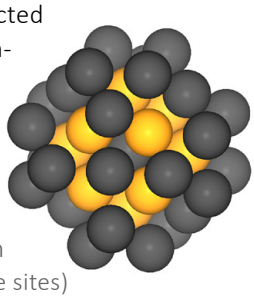
The scientists created these so-called defects with the ion beam of an impressively large helium-ion microscope (see image on the right). The success was clear: the catalytic activity on the previously almost inactive surface increased dramatically and the overall activity of the material doubled.

43 atoms are perfect

For fuel cells to become interesting for the mass market, not only the cost for hydrogen must be reduced. Also the fuel cells themselves are still too expensive. One reason is the high price of platinum. The precious metal sits on the cathode in the form of particles only a few nanometers in size, where it catalyzes the reduction of oxygen.

The scientists at *e*-conversion asked the question of how many platinum atoms the particles must consist of for the most efficient catalysis. The result is impressive: particles consisting of only 43 platinum atoms show a catalytic activity on one electrode that is twice as high as that of commercially available specimens.

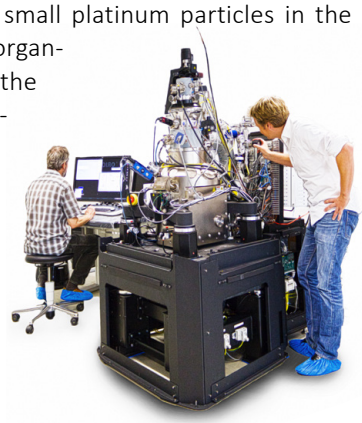
For the publication, two *e*-conversion groups from the chemistry and physics departments of the TU Munich worked closely together. In the first step, the three first authors Batyr Garlyyev, Kathrin Kratzl and Marlon Rück predicted by computer simulation that, among others, particles consisting of 43 atoms with a diameter of 1.1 nanometers have a particularly high catalytic activity.



Simulation of a nanoparticle with 43 platinum atoms and a diameter of 1.1 nm (Yellow atoms: enhanced catalytic active sites)

In principle, each platinum atom of a particle can bind an oxygen molecule and thus act as a catalyst. Whether and how active it actually is is determined by the strength of the bond: if it is too weak, the molecule is released before the reaction. If it is too strong, it will stick afterwards. “The binding energies and thus the catalytic activity are largely determined by the number and arrangement of the platinum atoms – that means the nanostructure of the particle,“ explains Marlon Rück. ” With the corresponding data we were able to develop catalysts, first on the computer and later in the laboratory, that are precisely adapted to the reduction of oxygen.”

The synthesis was extraordinarily challenging. Kathrin Kratzl describes the method she developed herself: “First, we used an electrode to deposit very small platinum particles in the pores of a so-called metal-organic framework. This prevents the particles from sticking together and makes it easier to modify them. The scaffold is then dissolved slowly and in a controlled manner using an acid to release the platinum particles on the electrode.”



Helium ion microscope

It will still take a while before fuel cells hit the market at a bargain price. However, the motivation of the experts is high and *e*-conversion and laboratories all around the world continue to work diligently towards this goal.

[1] In-situ visualization of hydrogen evolution sites on helium ion treated molybdenum dichalcogenides under reaction conditions (Link). E. Mitterreiter, Y. Liang, M. Golibrzuch, D. McLaughlin, C. Csoklich, J. D. Bartl, A. Holleitner, U. Wurstbauer and A. S. Bandarenka. npj 2D Mater Appl 3, 25 (2019).

[2] Optimizing the Size of Platinum Nanoparticles for Enhanced Mass Activity in the Electrochemical Oxygen Reduction Reaction (Link). B. Garlyyev, K. Kratzl, M. Rück, J. Michalicka, J. Fichtner, J. M. Macak, T. Kratky, S. Günther, M. Cokoja, A. S. Bandarenka, A. Gagliardi, and R. A. Fischer. Angew. Chem. Int. Ed., 5, 1 – 6 (2019).

Here we are – the new player on the field!

Impressions from the first *e*-conversion conference in Venice

The ingredients for the first *e*-conversion conference had been just perfect: around 120 motivated participants, top-level speakers from all over the world, warm September sunshine and as venue an ancient monastery on the island San Servolo in the Venice lagoon. The historic buildings now house the Venice International University (VIU) where *e*-conversion was able to organize its first conference from September 9-13, 2019.

Arrival at the conference venue – Isola di San Servolo

The focus of the meeting was on the scientific exchange between the members and about 70 PhD students of the cluster, and a unique line-up of top-level external speakers. “Our cluster *e*-conversion doesn’t live in isolation somewhere in free space,” remarks Karsten Reuter, one of the three cluster coordinators. “We wish to know what is done all over the world and in comparable kinds of centers. And so we have asked our most distinguished colleagues from all over to educate us what is going on in their kind of frontier research.“ Yet, the current conference and the ones to follow shall also serve another purpose: Being a signal to the scientific world as Reuter formulates: ”It is also important that the others know that we exist now. That we are a new player on the field.“

What’s going on in energy conversion?

Following the cluster’s broad and integrative research focus, the scientific talks covered a wide range of energy conversion technologies. Latest advances in perovskite-based solar cells were discussed, as was progress on suppressing dendrite formation in all solid-state batteries. More fundamental contributions centered on the role of chirality and spin, or on using plasmonic nanoparticles as energy converters. This was contrasted by talks that described the state of the art in scalable (electro-)chemical energy conversion technologies like electrolysis, CO_2 reduction or ammonia synthesis. The range of methodologies covered extended from interface engineering and characterization to frontier use of modern machine learning approaches. The overview talks by the international experts were thereby nicely complemented by contributions from members of the cluster, in particular from emerging scientists and new members that were only recently appointed at the Munich universities.

Plenty of time for discussions

When planning the program the cluster coordinators had deliberately included plenty of time for informal scientific discussions: a welcome reception in the idyllic monastery courtyard, two poster sessions and long enough breaks between the talks.

Enjoying a sunny photo session







For more impressions please visit the picture gallery: **www.e-conversion.de/image-galleries**

Many members of the still young cluster took the chance to get to know each other beyond faculty and university boundaries. For the PhD students and PostDocs the informal exchanges had a particular significance. Here they were able to discuss their projects with some of the best-known scientists in the corresponding discipline. As for PostDoc Batyr Garlyyev: "I work in electrocatalysis and for me it was really special to see Ib Chorkendorff and Jens Nørskov from Denmark. They are the leading people in this field." PhD student Theresa Grünleitner has benefited too: "I'm growing molybdenum disulfide and there were other people growing different materials, but you can exchange experiences, what measurements they do and how we might improve." Also the external speakers enjoyed the lively discussions and the special atmosphere of the conference and the venue. For Prof. Justin Gooding from the University of New South Wales in Sydney, the long travel was definitively worth it:

» *What I see here is high-quality work being done, adressing and answering important questions related to clean energy sources.* «

Remarkable Kick-Off

The three coordinators of the *e*-conversion cluster, Prof. Karsten Reuter, Prof. Thomas Bein and Prof. Ulrich Heiz were highly pleased with the course of the conference. Thomas Bein summarized: "This was a remarkable kick-off for our cluster that already created a very special atmosphere and a great team spirit. As the next step, we will now have a series of more focused workshops that will then deepen the understanding and collaboration in the various research areas." And indeed, the Venice conference has already been followed by three workshops, to which *e*-conversion members invited colleagues from all over the world to discuss special research topics: "Fundamentals of Solar Cell Research", "Hybrid 2D Materials" and "Chemical and Energy Conversion at Interfaces" (see articles on page 8).

We are looking forward to Venice 2021!

Due to the uncertainties surrounding the corona pandemic, we unfortunately have to cancel our conference in Raitenhaslach planned for September 2020. All the more we are looking forward to welcome the scientists of e-conversion and many international guests in Venice once again in September 2021! And please check our website regularly for other upcoming cluster activities such as virtual lab tours, online tutorials, scientific workshops, talks and public events.

Venice – we will be back in 2021!

Living the networking idea

Previous *e*-conversion workshops

Fundamentals of Solar Cell Research

Fundamental energy conversion processes in new types of photovoltaic materials and devices are an important topic of ongoing research and discussion worldwide. Recently, *e*-conversion co-funded and participated actively in a dedicated workshop entitled "Hot Carrier Dynamics in Advanced Concept Solar Cells" hosted by the TUM Institute for Advanced Study (IAS) on the Garching research campus from October 28-29, 2019.

Organized by the Koblmüller-Group from the Walter Schottky Institute (WSI) at TUM, the workshop formed part of the "TUM-IAS Focal Periods 2019" program. A particular emphasis was placed on theoretical and experimental understanding of the dynamics and multiplication of charge carriers in nanostructured materials such as quantum wells, dots, wires, perovskites and two-dimensional materials.

Please visit: www.wsi.tum.de/hot-carrier-dynamics

Chemical and Energy Conversion at Interfaces

Interfaces play an important role in many technological applications, ranging from heterogeneous catalysis in combustion control and fine chemical synthesis over photovoltaics to battery technologies.

On February 17 and 18, 2020, scientists from all over Europe had the opportunity to exchange ideas on the specific topic of "Chemical and energy conversion at interfaces" at a workshop in Munich. The meeting was organized by Dr. Barbara Lechner, member of *e*-conversion, and Jun.-Prof. Mirijam Zobel, both scholarship holders of the Bavarian Academy of Sciences. In the gorgeous rooms of the Academy, the speakers presented their recent experimental and theoretical research.

The talks covered a wide variety of topics from "solid-liquid interfaces" to "nanostructured interfaces" and from "conversion by light" to "catalytic conversion". A special "Lightning Session" enabled doctoral students to present their own results as brief talks to the renowned scientists. During the breaks, intensive discussions ensued and were vividly continued during the conference dinner at a typical Bavarian tavern.

Emerging Hybrid 2D Materials

Hybrid 2D materials offer many opportunities from quantum engineering to energy applications. But innovative research and solutions require openness and professional exchange across traditional subject boundaries. With the goal to foster collaboration, Prof. Thomas Weitz (LMU Munich) and Prof. Stephan Hofmann (University of Cambridge) had invited numerous scientists to join a special workshop in Munich. It took place on October 7-8, 2019 and was supported by both the Cambridge-LMU strategic partnership program as well as the cluster of excellence *e*-conversion.

In addition to the researchers from LMU and Cambridge University, the list of invited speakers included scientists from TU Munich and the Bundeswehr University Munich. They all gave profound insight into their cutting-edge research ranging from synthesis, characterisation to future applications of emergent layered low dimensional material systems.

To encourage discourse especially among young researchers, a shotgun session took place after the first set of talks. As teaser, every poster presented in the subsequent poster session was presented briefly by the young scientists to the participants to spark interest in a way an abstract could not.

With fun and success through the PhD thesis

Start of the *e*-conversion graduate program

The newly elected student board: Dr. Tayebeh Ameri (Program Coordinator), Manuel Scheel (TUM Physics), Clara Eisebraun (TUM Chemistry), Dominic Blätte (LMU Chemistry), Jakob Blahusch (LMU Chemistry) and Linh Nguyen (LMU Physics)

With a Kick-Off meeting, the *e*-conversion graduate program officially started on St. Nicholas' Day 2019. The newly elected student board is looking forward to the ideas of their PhD colleagues and to creating a lively network.

Above the rooftops of Munich, in the Vorhoelzer Forum at the Technical University, the *e*-conversion graduate program officially started on St. Nicholas' Day 2019. The lecture hall has historical significance for the cluster, explained Prof. Thomas Bein to the approximately 40 doctoral students gathered. In September 2018, representatives of the TUM and the LMU eagerly followed the DFG press conference to announce the sponsored clusters. The cheers were enormous when it was clear that *e*-conversion and three other Munich clusters of excellence had been successful.

The euphoria and optimism of the cluster's first year were clearly noticeable during the kick-off of the graduate program. Five doctoral students at once had registered as candidates for the Student Board and were elected unanimously as a team. One of them, Linh Nguyen, already brings experience from another graduate program: "That's where I realized how useful such a network is. Especially during the retreats you get to know each other in different ways than in the laboratory or at purely scientific events. You discuss much more relaxed and become more creative. And even as a physicist you dare to go to a chemist's poster ..."

A piece of home

Dr. Tayebeh Ameri, coordinator of the graduate program, presented its benefits. A winter meeting, a summer retreat lasting several days and an exclusive exchange program with 14 renowned research centers worldwide are regular features. In addition, the doctoral students have plenty of room for ideas of all kinds, whether for soft skill courses, company visits or completely new formats. Magnus Bauer showed how versatile and lively this freedom can be shaped. In his short talk about "tales from the past" he gave an insight into his time in the student board of the cluster "Nanosystems Initiative Munich (NIM)". For him, the doctoral program even meant much more than exciting events and a living network: "For me, the program and the cluster have become a piece of home and another "family" next to colleagues from the laboratory".

Exotics welcome

Most doctoral students, like Magnus Bauer, are physicists or chemists. The only two biologists Marcel Dann and Milena Zhivkovikj feel somehow exotic. At the chair of Dario Leister from the Department of Synthetic Biology, they work on Photosystem I, a protein complex that is responsible for energy conversion in the photosynthesis of plants and cyanobacteria. Already now there are close cooperations within *e*-conversion. Together with physicists, they are investigating how to couple the photosystem to graphene electrodes for energy generation. In addition, a chemistry group uses their data to develop a mathematical model of energy transfer processes. "For us, this is the best situation in years!" explains Marcel Dann enthusiastically. "So far, there was only one doctoral candidate for the whole topic. With *e*-conversion and the ERC grant of Prof. Leister (see page 11) more people can be hired and we are much better connected. Now we will get somewhere!" Website Graduate Program

Listening to stories from a former student board

With supercomputers to the perfect material

David Egger

At only 32 years, David Egger has quite an impressive scientific career with stages at TU Graz, the Weizmann Institute in Israel and the University of Regensburg. Since June 2019 the physicist is Professor for "Theory of Functional Energy Materials" at TU München and member of *e*-conversion. We asked him about his research, why he loves being a scientist and what are his wishes and ideas concerning the cluster.

"Theory of Functional Materials" – What does that mean?

We use supercomputers to understand physical effects in functional materials microscopically and predict new compounds of interest to our partners from experimental and synthesis labs. The focus is on the theory of energy materials, where electronic-structure and molecular-dynamics techniques are used and further improved. Our aim is to describe novel materials that can be employed in efficient energy devices. In this quest, the development of theoretical methods and implementation into computer code is one of our areas of expertise.

How is your theoretical work connected to practical research?

Our motivation are theoretical proposals of novel materials that can be used directly in practical applications. These include highly efficient solar cells, nanoscale molecular devices and batteries. To this end, we study a wide range of compounds that include hybrid molecule-metal interfaces, halide perovskites, organic semiconductors, ion conductors, photocatalytic molecules and more, all of which have massive potential for technological applications in energy conversion or storage. At the moment, our main experimental partners are groups from the Weizmann Institute of Science in Israel, the Imperial College London and the National University of Singapore.

What have been formative experiences that convinced you to study physics?

I was very fortunate to have an excellent physics teacher. He showed us how much physics can help to understand some of the things that surround us, which motivated me to study it.

If not physics what would you have liked to study / learn?

Philosophy, for the same reasons: similar to physics, but often in a different way, it is a wonderful subject for those who like to make sense of "what it all means".

And later on: What convinced you to stay in science?

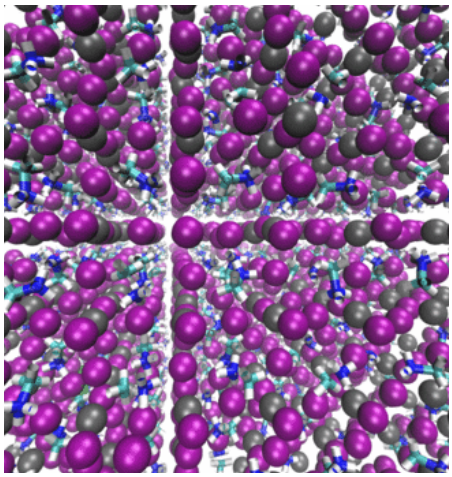
It is a dream job for me: to constantly learn new things, while being able to work in an environment of creative, smart, and kind people – it is just great fun! I think it is also a wonderful opportunity to work with young people my whole life, supporting them in reaching their goals as best as I can.

What are the moments when you "feel the flow" and you know "Yeah, I love being a scientist!"?

There are many, especially with leading a group it is always very motivating to see that a student's project is going well or that something that didn't work for a while finally does. But I would say the "best" moments for me personally are those when something that didn't make sense for a while suddenly does, when the pieces of the puzzle finally fit together. It means that I have learned something!

What do you wish for being a member of *e*-conversion? Do you have any specific ideas what the cluster could offer beyond the existing features?

For us, being physicists working on the theory of materials, I think the most important aspect about *e*-conversion will be collaborations with experimental and synthesis groups via the cluster. I believe that there lies a true potential in close experimental-theory collaborations, namely when the two not only complement each other, but really interlock to reach the next level in discovering new things. I cannot say much about how to go beyond existing features of *e*-conversion, because we have just joined the



Simulation of the molecular dynamics within perovskites crystals - a common structure for solar cells

cluster. But from my time at the Weizmann Institute of Science in Rehovot, Israel, I do believe that it will be important for us to meet and talk, often informally, as much as possible. Discussing questions that may appear "naïve" in an open and constructive way from multiple perspectives, addressing things that really puzzle us, could be very useful. Maybe we can define big open questions in this way, or find synergies and commonalities among different fields of the cluster?

Has there already been anything that was made possible by *e*-conversion?
Absolutely yes: It immediately enabled me to meet colleagues of the cluster, for example in internal meetings at the ZNN. Furthermore, *e*-conversion has organized a conference in the beautiful city of Venice, which I experienced as really inspiring and motivating.

Thank you very much for this interview and good luck with all your research!

Vita of David Egger

- Born 1987 in Klagenfurt (Austria)
- Undergraduate and PhD studies in Physics at TU Graz (Prof. Egbert Zojer, with a DOC fellowship)
- PostDoc at Weizmann Institute (Prof. Leeor Kronik, with a Schrödinger and Koshland fellowship)
- Group leader in Theoretical Physics at Regensburg (with a Sofja-Kovalevskaja award)
- Since June 2019 Professor on "Theory of Functional Energy Materials" at TU München (as a Rudolf-Mößbauer Fellow)

More portraits coming soon...
Together with Prof. David Egger, *e*-conversion welcomed three other young researchers as new members in summer 2019: Prof. Emiliano Cortes (Nano Institute, LMU Munich), Dr. Gregor Koblmüller (Walter Schottky Institute, TU Munich), and Dr. Jacek Stolarczyk (Nano Institute, LMU Munich). You will find their portraits in the next edition of *e*-conversion news and soon at www.e-conversion.de.

Honored!

We are very happy to congratulate seven *e*-conversion members on highly renowned and well endowed awards:

A Starting Grant of the European Research Council (ERC) was awarded to **Dr. Barbara Lechner** (Chair of Physical Chemistry, TU Munich). Dr. Lechner and her team study how the structure of catalyst particles and substrates change under reaction conditions. They investigate how highly reactive particle structures appear and disappear, how this process can be controlled, and how it influences the function of the catalyst. The results could lead to more cost-effective alternatives for the precious metal catalysts used today.

Prof. Dario Leister (Chair of Plant Molecular Biology, LMU Munich) received an ERC Synergy Grant. His project is entitled "PhotoRedesign: Redesigning the Photosynthetic Light Reactions". The scientists develop strategies to boost the fraction of solar radiation captured by the light reaction of photosynthesis. This approach can improve the levels of carbon fixation attainable, thus increasing the yield of biomass from algae and plants as a sustainable source of both energy and food.

The journal ACS Nano named **Prof. Stefan Maier** (Chair of Hybrid Nanosystems, LMU Munich) as Nano Award Lecture Laureate. According to the editors the scientist is not only "a world leader in understanding and applying plasmonics and dielectric nanophotonics in nanoscale systems," but also an "insightful and engaging lecturer." Maier and his research group explore the interactions between light and matter on scales at which quantum effects come directly into play.

Prof. Ian Sharp (Chair of Experimental Semiconductor Physics, TU Munich) has been awarded an ERC Consolidator Grant. His group seeks to develop photovoltaic systems that are able to efficiently store solar energy chemically. Transition metal nitride semiconductors are highly suitable materials for this purpose. Using spectroscopic techniques, the group studies their photochemical stability, mechanisms of energy conversion, and the role of defects and perturbations.

Furthermore three young scientists from chairs of *e*-conversion members also received an ERC Starting Grant: **Dr. Felix Deschler** (Chair of Experimental Semiconductor Physics, Prof. Ian Sharp, TU Munich), **Dr. Wolfgang Tress** (Chair of Physical Chemistry, Prof. Thomas Bein, LMU Munich) and **Dr. Thomas Christian Jagau** (Chair of Theoretical Chemistry, Prof. Christian Ochsenfeld, LMU Munich).

Outlook

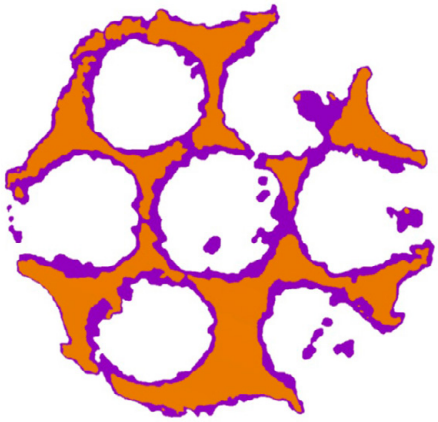
QD 2020 - 11th Biannual International Conference on Quantum Dots
December 7 - 11, 2020
Leonardo Royal Hotel, Munich
The conference will bring together leading researchers and groups from industry working on the fundamental physics, materials, synthesis and applications of Quantum Dots in both experiment and theory. www.qd2020.de

2nd *e*-conversion conference
September 12 - 17, 2021
Venice International University, San Servolo, Venice
After the successful start of the *e*-conversion conference series in 2019 the cluster invites experts from all over the world again to the beautiful converence venue in the Venice lagoon.

Due to the current situation we don't know if the events can take place. Please check our website in advance.

MYSTERIOUS SCIENCE

WHAT'S THIS?



GUESS AND...

Have a look at three possible answer options at our website:

www.e-conversion.de/newsletter/mysterious-science

Send us an e-mail with the correct one to info@e-conversion.de
Deadline: 30 September 2020

WIN!

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