Dear colleagues and friends,

Nearly a year of the second funding period of EAM has passed and I am pleased to report that numerous important achievements have been registered. Most significantly, the long term impact of EAM on the university structure is secured thanks to the recent approval of a large new building for interdisciplinary thin film research and also to the official establishment of the Helmholtz Institute Erlangen-Nürnberg for Renewable Energy Production. The opening of the EAM-inspired technology transfer center »VerTec« in May and the signing of a strategic alliance with Procter & Gamble in July also indicate the firm link between fundamental research, materials and process engineering and real world applications which the Cluster has helped to forge.

Besides these large infrastructural achievements, our scientists and engineers have been highly productive, evidence for which can be seen in some excellent recent publications on energy-related topics highlighted in this newsletter. We are also especially proud of our EAM Prof. Ana-Suncana Smith and EAM Member Prof. Patrik Schmuki who fought off stiff competition from across Europe to receive coveted ERC Starting and Advanced Grants respectively. In May Prof. Erdmann Spiecker successfully proposed a new DFG Research Training Group on the topic of in situ nanoanalysis and electron microscopy, a clear indication of the rapidly rising stature of Erlangen in this field. And in June, we played host to 130 experts from 11 countries for the 1st Erlangen Symposium on Flexible Electronics.

It is clear that we are on track for another excellent year and I look forward to our scientific discussions, for example at the upcoming 5th EAM Symposium in November. I wish you a successful start to the Winter Semester.

Wolfgang Peukert

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HIGHLIGHTS

Opening ceremony of the Helmholtz Institute Erlangen-Nürnberg (HI ERN)

Unveiling the sign for the new Helmholtz Institute (from left to right)
Prof. Dr. Jürgen Mlynek
Helmholtz Association
Katja Hessel
Bavarian State Secretary for Economic Affairs
Dr. Wolfgang Heubisch
Bavarian State Minister of Sciences, Research and the Arts
Joachim Herrmann
Bavarian State Minister of the Interior
Prof. Dr. Johanna Wanka
Federal Minister of Education and Research
Prof. Dr. Karl-Dieter Grüske
President of FAU
Prof. Dr. Harald Bolt
Forschungszentrum Jülich
Prof. Dr. Achim Bachem
Forschungszentrum Jülich
Thomas Frederking
Helmholtz-Zentrum Berlin

Image: FAU/Georg Pöhlein
Opening ceremony of the Helmholtz Institute Erlangen-Nürnberg for Renewable Energy Production

The »Helmholtz-free Zone« of northern Bavaria is history. On 20 August 2013, a cooperation contract establishing the new Helmholtz Institute Erlangen-Nürnberg (HI ERN) was signed in the presence of the Federal Minister of Education and Research, Prof. Dr. Johanna Wanka, three Bavarian State ministers Dr. Wolfgang Heubisch, Joachim Herrmann and Dr. Markus Söder as well as Bavarian State Secretary for Economic Affairs Katja Hessel.

Cutting edge research is the key to the success of the German "Energiewende". The main goal of the new institute will be to conduct fundamental and applied research to explore and develop material- and process-based solutions for climate-neutral and sustainable energy production at acceptable costs to society. Developed solutions will be transferred into practical applications. More specifically, HI ERN will focus on two main topics: Materials for printable photovoltaics and solar fuels, and hydrogen applications for renewable energies. To achieve its aims, HI ERN brings together three internationally recognized research institutions in the area of materials, process and energy research: Forschungszentrum Jülich (FZJ), Helmholtz-Zentrum Berlin für Materialien und Energie (HZB) and FAU/EAM. In addition the multinational Siemens AG provides support from the industrial side.

EAM has laid the scientific and structural foundation for HI ERN and so the establishment of the institute represented a key step towards creating a lasting legacy of the Cluster following the second and final funding period. Following the Cluster’s model of promoting young scientists, especially at the assistant and associate professor level, HI ERN will create 6 new professorships including two junior research groups.

Support from the state has been key to the establishment of HI ERN. The Free State of Bavaria intends to finance € 32m for a new research building on the southern campus of FAU with 2500 m² of laboratory and office space. Furthermore, it will participate in the financing of operational costs during the institute’s foundation for a period of five years. The Helmholtz Association will contribute € 5.5 m per year for personnel, operations, consumable and instrumentation costs.

In a panel discussion the partners laid out the structural and strategic basis for the cooperation in addition to the research plan. HI ERN plans to collaborate with the technology-oriented Energie Campus Nürnberg to play a leading role in the worldwide search for energy technologies of the future.
New EAM research building – Interdisciplinary Center for Nanostructured Films

In its annual recommendation for the construction of new research facilities, the German Council of Science and Humanities (Wissenschaftsrat) placed a proposed new EAM building at the top of the priority list. On 28 June the Joint Science Conference (Gemeinsame Wissenschaftskonferenz) upheld the recommendation. Consequently, work on the new building, which will cost an estimated €40m, can commence in 2014. The Interdisciplinary Center for Nanostructured Films (IZNF) will house activities from the natural and engineering sciences regarding the fabrication of functional thin films. Thin films are layers of material with a thickness of up to a few micrometers and which often show different physical behavior compared to the bulk material. Particular focus is on thin films having specific electrical properties, e.g. conductivity, or on reactive layers. The research concept in Erlangen encompasses the unified analysis of thin films with a spectrum of experimental and theoretical methods. The resulting materials are relevant for a range of application areas including photonics, optoelectronics, catalysis, energy technology and even the life sciences. The activities comprising this highly innovative field will be integrated in the new research centre as six research areas. These will be coordinated by EAM Professors Brabec, Göken/Sandoghdar, Leugering, Peschel, Halik and Wasserscheid. The building will be located on the southern campus in the immediate vicinity of the departments and partner institutes involved in EAM. The building, with a floor space of more than 4600 m² will house around 30 research groups from seven departments of the FAU.

Technology Center for Additive Manufacturing and Catalysis »VerTec« inaugurated

Whether in the energy or automotive sector, the fabrication of innovative products places ever higher demands on the complexity of the components. At the technology transfer center »VerTec« at the Central Institute for New Materials and Processes (ZMP) in Fürth, prototype high performance components for these and other sectors will be produced. The fabrication process will be based on the additive manufacturing principle of selective electron-beam melting. The main advantage of this technique lies in the freedom of three dimensional design granted which makes it highly relevant for fabricating components for the chemical industry, for catalysis, energy technology or for automotive engineering. »VerTec« is open for cooperation with researchers and application engineers from academia and industry and will strive to transfer ideas into commercializable concepts. For EAM, »VerTec« will serve as an efficient, powerful and modern technology transfer center which will take the latest research results from key Cluster fields, such as the catalytic coating of high surface area metallic supports, and drive them towards the market.

On Friday 17 May 2013, the technology transfer center »VerTec« was officially opened by Bavarian State Secretary Katja Hessel. The Bavarian Ministry for Economic Affairs, Infrastructure, Transport and Technology supported the project with a grant of €11m distributed over 5 years. The 1200 m² laboratory and office space will host up to 40 scientists and engineers under the direction of Prof. Robert F. Singer, Prof. Carolin Körner (both from the Institute of Metals Science and Technology) and Prof. Peter Wasserscheid (Institute of Chemical Reaction Engineering).
New Materials for the long term energy policy reform

»Energiewende«

»Salted« catalysts offer promise for the storage of energy from renewable sources: New catalyst technologies from the production of hydrogen from methanol

A key problem associated with renewable energies such as wind, solar and tidal power is the continuous fluctuation of the output. One solution to this might be to store the obtained energy in the form of hydrogen, readily generated by the hydrolysis of water. As this option opens up new problems associated with the storage and transport of hydrogen, a further step to immobilize hydrogen as part of methanol molecules is being considered. This can be achieved by reacting hydrogen with carbon dioxide. The liquid product, an alcohol, could be stored in tanks and the hydrogen obtained used at a later point in time to generate electricity, for instance in a fuel cell. The process to free hydrogen from methanol is called »steam reforming«. It is, in principal, a reversal of the reaction used to produce methanol. In order to realize the process economically in small, decentralized plants it is important to identify effective catalysts for low temperature operation. The research groups of Prof. Peter Wasserscheid and Prof. Jörg Libuda (both EAM Research Area D) have developed such improved catalysts in the form aluminium oxide supported platinum nanoparticles. While this itself is a well-known catalytic system, the Erlangen teams have improved performance with a simple but effective twist: The surface of the material is coated with a thin film of a basic molten salt (ionic liquid). The »salted« catalyst accelerates the hydrogen release from methanol significantly and furthermore greatly improves the selectivity of the reaction compared to conventional catalysts. The use of an ionic liquid is crucial to a long term steam reforming performance enhancement as it does not evaporate under the reaction conditions used and so the metal nanoparticles remain activated. The molten salt layer furthermore ensures that produced hydrogen is rapidly removed from the reaction zone and thus increases the conversion of methanol. It is also hygroscopic, meaning that water, a component in the reaction, is drawn to the activated surfaces. Finally, the alkali ions enable a stronger binding of the intermediate product (carbon monoxide) to the catalyst, thus raising the probability of further reaction to carbon dioxide and reducing the amount of carbon monoxide in the product gas. The latter is important since carbon monoxide is a notorious poison for catalysts used in fuel cells. In comparison to uncoated catalysts the material developed in Erlangen has been shown to raise the selectivity to hydrogen and carbon dioxide from between 60 and 99% when the molten salt layer is applied.

In the test rig for the catalytic steam reforming of methanol catalysts modified with molten salts are investigated.

REFERENCE
Enhanced activity and selectivity in catalytic methanol steam reforming by basic alkali metal salt coatings
Matthias Kusche · Florian Erzenberger · Stephanie Bajus
Heiko Niedermeyer · Andreas Bösmann · Andre Kaftan
Mathias Laurin · Jörg Libuda · Peter Wasserscheid
http://dx.doi.org/10.1002/anie.201209758
Model studies on liquid organic hydrogen carriers

To realize simpler and more efficient hydrogen storage, chemical approaches are being developed. One promising strategy involves the use of liquid organic hydrogen carriers (LOHC). N-ethylcarbazole (NEC) has been identified as a highly attractive candidate, since it satisfies the criterion of a high storage capacity, e.g. up to six molecules of H₂ are reversibly bound to one carrier molecule (dodecahydro-N-ethylcarbazole, H₁₂-NEC). For mobile applications, hydrogenation to H₁₂-NEC would be carried out off-board the vehicle. Once the LOHC is loaded with hydrogen, it can be transported and stored without any loss and for any period of time. At the desired location, catalytic dehydrogenation, typically performed over noble metal catalysts, will then release hydrogen to supply a fuel cell or a combustion engine. An even more promising application route, which is also simpler to realize, involves stationary energy storage units. Such units could be used to compensate local and temporal energy over- and underproduction, the primary challenge that we are facing upon transition to renewable energy sources.

The present collaborative project between BMW and EAM addresses the LOHC topic in manifold ways. One important contribution has been recently made in a joint project by the groups of Prof. Libuda and Prof. Steinrück (Physical Chemistry II, Research Area A2, B, D), Prof. Wasserscheid (Chemical Reaction Engineering, Research Area D), and Prof. Görling (Theoretical Chemistry Research Area A3, B, D). Their work aimed at understanding the elementary reaction mechanisms in H₁₂-NEC dehydrogenation on Pt and Pd catalysts. Following a surface science and model catalyst approach, in situ spectroscopies under ultrahigh vacuum conditions in combination with density-functional calculations provided detailed insights into the mechanistic steps at the microscopic scale.

The latest publication focuses on the dehydrogenation of H₁₂-NEC on a well-defined Pd(111) single crystal surface. By applying different surface-sensitive spectroscopies in combination with temperature-programed molecular beam methods, the principal surface species, the reaction intermediates, their transformation mechanisms, and energetics, and the related microkinetics were elucidated.

Further research in the framework of the Cluster of Excellence in close collaboration with BMW will be dedicated to the identification of differences in activity and selectivity of atomically well-defined active sites. These studies will guide the knowledge-based design of efficient dehydrogenations catalysts in future LOHC technology.

REFERENCE

Dehydrogenation mechanism of liquid organic hydrogen carriers: Dodecahydro-N-ethylcarbazole on Pd(111)

Max Amende · Stefan Schernich · Marek Sobota · Ioannis Nikiforidis · Wolfgang Hieringer · Daniel Assenbaum · Christoph Gleichweit · Hans-Jörg Drescher · Christian Papp · Hans-Peter Steinrück · Andreas Görling · Peter Wasserscheid · Mathias Laurin · Jörg Libuda

Chemistry - A European Journal, 2013, 19 (33), 10854-10865
http://dx.doi:10.1002/chem.201301323
ITO-free and fully solution-processed semitransparent organic solar cells with high fill factors

Transparent conductors are traditionally based on tin-doped indium oxide (ITO) and are a major component of most electronic devices which rely on the coupling in or out of light. To make organic photovoltaic (OPV) cells both light-transmissive and affordable it is important to find a way to replace the expensive raw material indium. A search for alternatives is also driven by the development of cost-effective processes which enable fully solution based OPV fabrication. One approach is to replace the ITO with a layer of silver nanowires. These silver nanowires are less expensive both in terms of raw material and processing. However, it is challenging to integrate the nanowires with a complete solar cell while maintaining conductivity comparable to ITO and maximizing efficiency. A team from Erlangen recently developed advanced processing techniques leading to transparent OPV cells, as reported in the journal Advanced Energy Materials. Fei Guo, from the Institute of Materials for Electronics and Energy Technology (Prof. Christoph Brabec) was supported in fabrication and characterization by the research groups of Prof. Marcus Halik, Prof. Dirk Guldi and Prof. Erdmann Spiecker.

In this work individual components of the cell were dissolved in liquid and were printed as ink onto a thin plastic foil before being left to dry. The device structure could thus be built up layer by layer. To provide a transparent and conductive top contact, the researchers avoided the traditional ITO (and thus vacuum deposition processes) by placing a wire mesh with nanoscale thickness over the photoactive layer of the solar cells. Besides being highly conductive, the mesh was fine enough to allow plenty of light into and through the cell. The reference cell tests showed that the new variant had the same efficiency as conventionally-produced OPV cells. With a fill factor (one of the key indicators of a solar cell’s performance) of 63%, the researchers have even achieved the highest value documented so far for OPV cells produced with a printing process. The reproducibility was also good: over 50 of the other cells produced had a fill factor between 58 and 63%.

The implications of this work are that large sheets of OPV cells can be produced with comparative ease. Due to the high flexibility of the structure, a feature lacking in brittle ITO-containing devices, such OPV cells could be readily attached to fabrics, for instance for producing a bag-integrated charger for laptops or smartphones. The new research findings are furthermore relevant for organic LEDs, currently used in phone displays and lighting.

**REFERENCE**

ITO-Free and Fully Solution-Processed Semitransparent Organic Solar Cells with High Fill Factors

Fei Guo · Xiangdong Zhu · Karen Forberich · Johannes Krantz · Tobias Stubhan · Michael Salinas · Marcus Halik · Stefanie Spallek · Benjamin Blüth · Erdmann Spiecker · Tayebeh Ameri · Ning Li · Peter Kubis · Dirk M. Guldi · Gebhard J. Matt · Christoph J. Brabec


http://dx.doi.org/10.1002/aenm.201300100
EAM German Class

Since Summer Semester 2012 the GS AMP has offered, together with the university's language center, an exclusive German class for EAM researchers from abroad who want to improve their German skills. The course is specially designed for the particular needs of EAM researchers, taking into account their time constraints and their requirements for using the German language in their academic and daily life. Therefore the class meets 3 days per week during the lunch break from 12.30 to 14.00 in a relaxed and friendly atmosphere. The size of the group allows individual learning, group activities and intercultural exchange among participants. Two excellent teachers ensure a good balance among different aspects of the language such as grammar, vocabulary, German culture and history. Topics of current interest are proposed both by teachers and participants and are regularly discussed. During the past semester special attention was paid to the communication and presentation skills. Finally, the participants learnt how to write a scientific proposal and defend it in front of «a referee committee». EAM researchers who want to join in should be proficient in German to at least B2 level.

ANNOUNCEMENT With the winter semester 2013/2014 a new beginner class will start with 3 places still available.

CONTACT Dr. Monica Distaso · monica.distaso@fau.de
Dr. Marlene Reuschel · marlene.reuschel@eam.uni-erlangen.de

Training Course on Project Leadership on 2 – 3 December 2013 (course in German)

The development of soft skills together with the scientific education represents a central function of the GS AMP. We are now pleased to offer a workshop on how to manage and motivate a team. The lecturer, Gerhard Kranz from Nuremberg does not provide a general recipe on team management, but adjusts the workshop on the individual needs of the attendees. During the course he will give examples of situations he experienced during his time as a consultant, which makes the theory more comprehensible. The course will be held in German.

REGISTRATION Dr. Marlene Reuschel · marlene.reuschel@eam.uni-erlangen.de

Alumni Experiences

The GS AMP series «Alumni Experiences» will continue during Winter Semester 2013/14. Former Graduate School Members are invited to talk about their experiences with job applications and their new position. For the coming series it is planned to invite two to three alumni from industry and academia. The exact dates will be provided via the GS AMP Infornail and also will be available on the GS AMP homepage.

Juniormembership at GS AMP for MAP students

The Graduate School AMP is continuously searching for excellent graduates; therefore the connection to the Elite Master Course in Advanced Materials and Processes (MAP) of the FAU is getting ever closer: in the future MAP senior students with focus on EAM research topics will be able to apply for a junior membership at the GS AMP. The junior members will be invited to Summer and Winter Schools and GS AMP/ EAM workshops. Here they will be able to get in touch with EAM senior scientists and can lay the foundations for a possible PhD project in the GS AMP. The Graduate School is looking forward to welcome the first junior members!

RISE student Aldo Glielmo at Institute for Multiscale Simulation (MSS)

RISE is a summer internship program for Bachelor students from the United States, Canada and the UK. It offers undergraduate students the opportunity to stay in a research group at a university or a research institute in Germany. This year, an overwhelming number of over 2,000 students applied for the available RISE projects for a period of 2 – 3 months. Aldo Glielmo chose the research project offered at MSS out of hundreds of different proposals. He studies physics at the King’s College London. His project in Erlangen was to develop a program for modeling non-spherical complex-shaped particles using a multi-sphere discrete element method. The program will be used to analyze the influence of the particle shape on the stochastic properties of the system. His supervisor Nina Gunkelmann is perfectly satisfied with his work: «I am really surprised that he could achieve such impressive results in the short time of his stay in Germany. Aldo’s work is a great benefit for the group. I can recommend the participation in the RISE program without hesitation.» Moreover, one should not forget the personal experience of an international exchange. Besides his work, Aldo really benefited from the social activities of the group «It has been a great time from every point of view: both formative and fun. On the one hand I was learning how to apply my physical knowledge, on the other hand I was enjoying myself in a very nice university atmosphere, which is why Erlangen, with its extraordinary ratio of students to inhabitants, is a particularly good choice for this kind of experience.»

The RISE 2014 online database for internship providers will open from October 1 – November 30, 2013! You are invited to submit your internship offers online, together with a project description.

FURTHER INFORMATION https://www.daad.de/risedv/
Prof. Dr. Ana-Suncanã Smith from the Institute of Theoretical Physics has been awarded a €1.5 m Starting Grant by the European Research Council (ERC). Her project «MembranesAct – Biological membranes in action: A unified approach to complexation, scaffolding and active transport» was one of just 287 proposals selected for funding out of a record 3329 submissions. The five year research project concerns membranes in living cells – structures which act at the interface of biology, material science and physics. Due to the complexity of membranes and the number of processes occurring simultaneously in their vicinity, the mechanisms driving and controlling protein transport and complexation are not well understood, though are believed to have a biophysical foundation. The aim of MembranesAct is to reveal the underlying physics framework and give it a form of a theory which will be tested by the help of collaborative partners, first in the environment of biomimeticmembranes and then in living cells.

In October 2009 Ana-Suncanã Smith was appointed W1 Junior-professor for Theoretical Physics within the Cluster’s Rising Star program and she became the first EAM Juniorprofessor to be promoted. She decided to accept the call for a W2 Professor for Theoretical Physics (from 01.11.2013) and will thus remain at EAM. Her primary research interest is modeling and designing the adhesive properties of soft fluid interfaces. This means working at the crossover between the molecular and the microscopic length scales. The award of an ERC starting grant follows earlier successes, first in the form of her appointment to the «Förderkolleg der Bayerischen Akademie der Wissenschaften» in March 2010 and second her receipt of a €100,000 EAM Starting Grant in May 2011.

In the next five years, Prof. Schmuki and his team will develop novel photocatalysts which will assist the economic generation of hydrogen either from water or from hydrocarbon waste. The advantage of photocatalysts is that they enable water to be split directly by the action of light. In comparison to other technologies there is considerably less conversion loss and much less material is required. Consequently, up to 90% of the cost of producing hydrogen can be saved – a feature which makes the technology relevant for a wide range of markets. Catalyst structures with a large degree of surface ordering are particularly promising. To produce these, scientists have developed approaches. In the project »APhotoReactor – Entirely self-organized: arrayed single-particle-in-a-cavity reactors for highly efficient and selective catalytic/photo-catalytic energy conversion and solar light reaction engineering« Prof. Schmuki’s team develops and refines processes which rely on the self-organization of atoms and molecules into a regular patterns, structures and shapes. Key is to synchronize multiple mesoscale self-organization processes – this will allow a build up of complex structured materials with an unprecedented definition over critical length scales, chemistry and properties. This entirely novel approach to fabricate entirely self-assembled highly efficient photocatalyst material is not only cost effective but opens wide perspectives in materials science wherever highly defined nanoscale length is desired.

The ERC Advanced Investigators Grant is another accolade for the scientist following a glittering few years. For example, in 2010 he won a €1.5m Reinhart-Koselleck Grant of the German Science Foundation (DFG). 52 year old Schmuki was born in Switzerland and studied at the University of Basel before completing his doctorate at ETH Zürich. Following research stays in the USA, Canada and Switzerland, he has led the Institute for Surface Science and Corrosion since autumn 2000. In EAM Prof. Schmuki contributes to Research Area D.

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Boost for a successful academic career – four EAM Starting Grants awarded

Novel light sources, computer designed fracture-resistant materials, efficient energy conversion and novel material combinations in hybrid structures: talented young EAM researchers are active in a broad spectrum of topics. With the EAM «Starting Grant» program, the Cluster of Excellence aims to give additional support of a €100,000 grant to four of its most promising young members.

The scheme, now in its second round. The first years after a PhD are particularly important for young researchers, they must gain experience, build an independent research profile, publish articles, develop networks and establish themselves. However, at this career stage, there is relatively little financial support available. The EAM Starting Grants Scheme, which will invest one million euros from 2007 to 2017, is therefore a very welcome scheme and another excellent reason for young researchers to choose Erlangen as a location for their postdoctoral career.

“We see the EAM Starting Grant as start-up funding to set individual projects on their way and to give the scientists a headstart in the national and international competition for third party funding,” explains Professor Peukert. “Proof that EAM is taking the right approach towards promoting its young researchers can be seen in the form of ERC Starting Grants for Prof. Jana Zaumseil in 2012 and most recently Prof. Ana Smith (see page 8), who was one of the first recipients of an EAM Starting Grant.”

Here are the EAM Grant awardees, whose research projects will be presented in greater detail in the next issue of the newsletter.

Prof. Dr. Erik Bitzek (39) Juniorprofessor, Institute for General Materials Properties · Modeling early stages of fracture and crack – microstructure interactions

Prof. Dr. Julien Bachmann (35) W2-Professor for Inorganic and General Chemistry Energy · Conversion at nanostructured surfaces of well-defined geometry

Prof. Dr. Sabine Maier (34) Juniorprofessor, Institute for Experimental Physics · Structure and electronics properties of hybrid organic-inorganic interfaces

Dr. Rubén Dario Costa Riquelme (30) Humboldt-Post-doctoral Fellow, Institute for Physical Chemistry · Light-emitting electrochemical cells based on sustainable ionic materials

Nanostructured materials are controlled by size and interfaces, which give rise to enhanced mechanical properties and new physical effects leading in turn to new functionalities. The design of novel nanostructured materials and devices demands state-of-the-art nanocharacterization tools and simulation methods. In particular, methods based on short-wave radiation (electrons, X-rays/neutrons) or scanning probes are ideally suited to analyze materials at the nanometer and atomic scale. Recently developed in situ capabilities and the use of complementary characterization and simulation methods allow unique insights into the structure formation, functionality and deformation behavior of complex nanostructures.

Within the doctoral program «In situ microscopy with electrons, X-rays and scanning probe techniques» (GRK 1896) these methods will be further developed and used to address fundamental questions regarding the growth, stability and functionality of complex nanostructures and interfaces. The PhD candidates will be well-positioned in a network of international collaborations and trained in multiple, complementary techniques, which provide them with an essential foundation for a successful career in the field of advanced materials and device development.

The new Research Training Group hosted by the Center for Nanoanalysis and Electron Microscopy (CENEM) is among eleven new GRKs established by the DFG in May 2013. This interdisciplinary doctoral program, coordinated by Prof. Dr. Erdmann Spiecker from the Materials Science Department, brings together research groups from the Faculty of Natural Sciences (Physics, Chemistry), the Faculty of Engineering (Materials Science, Chemical and Biological Engineering), the Max-Planck-Institute for the Science of Light (MPL) and the Fraunhofer Institute for Integrated Systems and Device Technology (IISB) and will start in October 2013. In the first period of the project, starting in October 2013, 12 PhD projects will be funded for 4.5 years with a total budget of €4.5m. This is a great success for the CENEM, which was founded in the framework of Research Area A2 of EAM in order to bring together complementary high-resolution microscopic and analytical techniques, instrumentation and expertise for cooperative research in the field of advanced materials.
Master Collaboration Agreement with P&G

In a strategic cooperation with the global consumer products giant Procter & Gamble (P&G), EAM researchers will take a closer look at the materials in everyday products with a view to optimizing them. A large amount of developmental know-how is behind ubiquitous products such as nappies, toothbrushes and shampoos. Indeed, their fabrication is often as refined as for high-tech products. To obtain further improvements, cutting-edge techniques from modern materials science must be employed. EAM has already shown that through collaboration between mathematicians, scientists and engineers, the computer-assisted design of optimized nanoparticles, electronic devices, catalysts and lightweight materials can be achieved. Now, in the collaboration with P&G, which was initiated by theoretical chemists Prof. Tim Clark and Prof. Dirk Zahn, an interdisciplinary team of scientists will apply the techniques developed in Erlangen to help improve everyday products. For example, molecular models will be used to improve our understanding of the structure of hair and thus feed into the design of hair care products. In another area, the absorbency and durability of super-absorbent polymers, materials which can absorb many times their weight in fluids, will be simulated, assisting with the improvement of nappies and related products. Even the flow fields around rotating toothbrush heads raise fundamental questions and will be a subject of investigation by EAM researchers.

The master collaboration agreement between the two partners guarantees a perfect basis for a long term strategic collaboration linking fundamental research and clear applications. The signing on 30 July was carried out by FAU President Prof. Karl-Dieter Größe and P&G, European Vice President for Research and Development Dr. Helen Neville. Bavarian State Secretary for Economic Affairs Katja Hessel, who also was in attendance, hailed the collaboration as clear evidence for the growing strong relationship between P&G and the State of Bavaria. Indeed for some time the state initiatives, Bayern Innovativ and Invest in Bavaria have been supporting the establishment of research and development collaborations with P&G.

Puzzling with molecules on oxide surfaces

EAM Member Prof. Jörg Libuda from the Institute for Physical Chemistry II successfully establishes the DFG Research Group FOR 1878 »funCOS – Functional Molecular Structures on Complex Oxide Surfaces«. Functional molecular films are central components of numerous future technologies, for instance molecular electronics, solar energy conversion, catalysis, sensors or biocompatible interfaces.

Despite the potential of these technologies, the properties of atomic scale molecule-oxide interfaces remain rather poorly understood. funCOS aims to close the gap in knowledge and lay the foundation for the rational design of functional organic films on oxides. funCOS will comprise collaborative activities between 15 research groups from the experimental and theoretical surface and interfacial sciences. A central theme will be the study of the region where molecules and substrates meet, leading to a toolbox of techniques which can be applied for the design of complex interfaces. With the systematic development of a library of prototype oxide surfaces, characteristic structural elements, functional molecules and potential anchoring groups, funCOS will aim to improve the understanding of molecular-oxide interfaces. Key challenges include the study of the bonding behavior, the energetics, the kinetics and the selectivity for atomically-defined surface states. With these fundamental insights, the researchers involved hope to establish the knowledge-based synthesis of organic-oxide hybrid systems based on controlled molecular film growth and tailored physicochemical properties of the resulting interfaces.
Flexible electronics: 
Printable, Bendable, Stretchable

The first International Symposium on Flexible Electronics took place from 19–21 June in Erlangen with 130 participants from 11 countries. More than 50 posters, 14 invited and 12 contributed talks covered a wide range of topics from basic charge transport in organic semiconductors to flexible inorganic circuits for medical applications and carbon nanotube electronics. The three-day symposium brought world-leading scientists and young researchers from Erlangen and Europe together to discuss the latest developments and exchange ideas.

Dan Frisbie (University of Minnesota, USA) opened the symposium with an overview of organic printed electronics and demonstrated all-printed, low-voltage circuits based on electrolyte-gated organic field-effect transistors. Henning Sirringhaus (University of Cambridge, UK) reported on the latest insights into the relationship of charge transport in high mobility organic semiconductors and lattice vibrations probed by electron diffraction. Paul Heremans (IMEC, Belgium) drew the audience’s attention to the problem of doping inorganic semiconductors, while Martin Kaltenbrunner (University of Tokyo, Japan) demonstrated feather-light organic circuits on ultrathin plastic foils. John A. Rogers (University of Illinois at Urbana-Champaign, USA) showed exciting examples of inorganic but highly flexible electrodes for high-resolution monitoring of brain and heart activity and circuits that dissolve within the body after a few weeks. Taishi Takenobu (Waseda University, Japan) and Maria Antonietta Loi (University of Groningen, The Netherlands) introduced recent developments in the field of high performance, solution-processed single-walled carbon nanotube transistors, and Thomas Schmalz (FAU, Erlangen) demonstrated flexible transistors based on self-assembled monolayers that have been developed within EAM Research Area B over the last few years.

The Symposium was organized by Jana Zaumseil, Andreas Hirsch and Marcus Halik (EAM Research Area B) in partnership with the Graduiertenkolleg »Disperse Systems for Electronic Applications« and with the financial support of the Alfried Krupp von Bohlen und Halbach Stiftung.

CENEM Workshop: Neutrons for Functional Materials

Neutrons are a perfect probe for the study of structure and dynamics of condensed matter. The extremely wide range of its applications is due to its unique properties (e.g. zero charge, magnetic moment, isotope dependent scattering). Thus with neutrons the microscopic structure of matter can be determined in space and time non-destructively with atomic resolution. The aim of the two-day workshop on 18 – 19 June in Erlangen was to bring together experts for neutron research of the Heinz Maier-Leibnitz Zentrum (MLZ) and researchers of EAM.

The use of neutrons for the research within EAM became obvious by comprehensive introductions to the instrumental methods and research interests of MLZ and by highlighting different possibilities for the use of neutrons for EAM research. Furthermore an introduction of the neutron methods and the neutron research facility in Garching was presented by Prof. Winfried Petry the scientific director of the FRM II and MLZ.

The high interaction potential of the two centers (EAM & MLZ) and the broad relevance of research with electrons for EAM was demonstrated at the workshop. It ranges from small angle scattering (SANS), reflectometry and GISANS to neutron activation analysis, tomography and studies at the positron source. Different possibilities for the use of neutrons for EAM research were highlighted. The impact of neutrons especially for the study of the structure of organic/inorganic hybrid materials is of highest interest within CENEM activities and so several new cooperations were initiated.
EVENT REVIEW

Workshop on Optimal Control of Partial Differential Equations

From 7 – 8 July the international workshop on «Optimal Control of Partial Differential Equations (WOPCO13)» took place in Erlangen. The workshop was held on the occasion of the 60th birthday of Günter Leugering, the coordinator of the DFG Priority Program 1253 on «Optimization with Partial Differential Equations» and head of EAM Research Area A3 Multiscale Modeling and Simulation.

WOPCON13 brought together world leading experts in the field of ODE- as well as PDE- constrained optimization, among them David L. Russell (Virginia Tech) and Tom Seidman (University of Maryland Baltimore County), who co-established the research field almost 60 years ago.

Highlighting recent scientific results keynote lectures were given by Prof. Enrique Zuazua (Basque Center for Applied Mathematics), Karl Kunisch (University of Graz), Jan Sokolowski (University of Lorraine), Georg Schmidt (McGill University), Eduardo Casas (University of Calabria), Peter I. Kogut (Dnipropetrovsk National University) and Fredi Tröltzsch (Technical University of Berlin). Hot topics and future trends identified during the workshop are optimization of networks and structures, material optimization as well as a clear trend towards real world applications, which are all closely related to research carried out in the EAM, in particular in the framework of the Focal Topic «Numerical optimization based on predictive models».

EAM at POWTECH and PARTEC 2013

From 23 – 24 April, very small things became a big deal at the Nürnberg Congress Center. POWTECH, one of the World’s leading trade fairs for mechanical process engineering and PARTEC, one of the largest scientific conferences on the topic of Particle Technology took place under the same roof. Together with the Department of Chemical and Biological Engineering, EAM presented its unique and broad competence, in particular focussing on the latest developments and research results from the fields of particle technology and chemical reaction engineering. At PARTEC over 30 presentations and posters were contributed from Erlangen. A special highlight was the second poster prize awarded to Michael Haderlein (LFG) for the poster: «Optimizing Continuous Syntheses of Quantum Dots using Micro Reaction Technology».

UPCOMING EVENTS

EAM Events

EAM at Lange Nacht der Wissenschaften 2013
19 October 2013, South Campus Erlangen

Erlangen TEM-School 2013
11 – 14 November 2013, CISEM, Erlangen

5th EAM Symposium
18 – 20 November 2013, Kloster Banz, Bad Staffelstein
www.eam.fau.de/symposium2013

6th Cluster Retreat for EAM Members
24 – 25 January 2014, Muggendorf

EAM Young Researchers Day
February 2014

EAM Summer School
16 – 18 July 2014, Kloster Banz

Further Events

funCOS Opening Ceremony
26 November 2013, Erlangen

Preisverleihung 7. Nano-Schulwettbewerb
27 November 2013, Heinrich-Lades-Halle, Erlangen

Fachtagung Graphen
28 November 2013, Heinrich-Lades-Halle, Erlangen

2nd International Congress Next Generation Solar Energy
09 – 11 December 2013, Erlangen
www.bayern-innovativ.de/nextgeneration-pv2013_en

85th Annual Meeting of the International Association of Applied Mathematics and Mechanics
10 – 14 March 2014, Erlangen
http://jahrestagung.gamm-ev.de

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