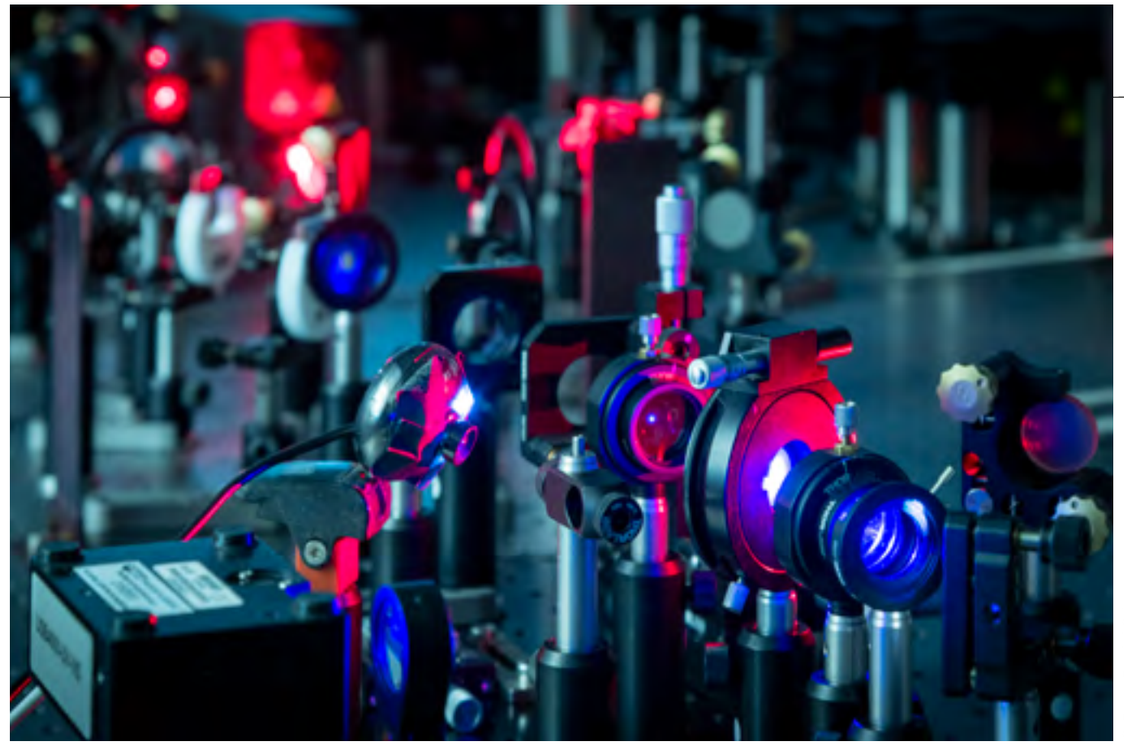


© Foto: Daniel Schumann

An optical structure for observing the four-wave mixing signal generated by three ultrashort laser pulses in a beta barium borate crystal.

Faculty of Chemistry

With around 1700 students distributed more or less evenly across its three degree programmes of chemistry, water science and teacher training in chemistry, the UDE's Faculty of Chemistry is one of the largest of its kind in Germany. Twenty-two professors and three independent junior research groups conduct research in eight fields: inorganic chemistry, organic chemistry, physical chemistry, technical chemistry, analytical chemistry, environmental microbiology and biotechnology, chemistry education, and theoretical chemistry. Between 50 and 60 young scientists complete their doctorates with us every year. Due to the interdisciplinary nature of research at our faculty, their backgrounds range from chemistry to physics, biology and the engineering sciences.

Our research covers the entire range of chemistry, from pure basic research to application-oriented topics. Many projects are externally funded. According to the latest figures, the Faculty secures more than 9 million euros in third-party funding every year, which nearly doubles its regular budget. The Faculty of Chemistry is a member of many coordinated, national research alliances, including five DFG Collaborative Research Centres (CRC), three DFG Priority Programmes (PP) and one NRW Forschungskolleg. Four of these alliances are managed and coordinated by our Faculty. We also coordinate several EU projects fully or partially, one of them being an ERC Advanced Grant in the field of environmental microbiology and biotechnology. This is in addition to many other projects funded by the German Research Foundation (DFG), the Federal Ministry of Education and Research (BMBF), the German Federation of Industrial Research Associations (AiF), the Volkswagen foundation and various industry players.

Our research is concentrated in four key areas: supramolecular chemistry with a focus on issues in biology and materials science, nanosciences with a focus on heterogeneous catalysis and energy research, water research, empirical educational research. With its expertise in these areas, our faculty is an important contributor to three of the five main research areas of the University of Duisburg-Essen. Several central academic institutes of the University are managed by members of our faculty: the Centre for Water and Environmental Research (ZWU), the Centre for Teacher Education (ZLB) and the Interdisciplinary Centre for Educational Research (IZfB). Two external institutes are associated with the Faculty: the Deutsche Textilforschungszentrum Nordwest (DTNW) in Krefeld and the Rheinisch-Westfälisches Institut für Wasserforschung (IWW) in Mülheim. Both specialise in practical, application-oriented research. Members of our faculty hold positions as academic directors at the DTNW (Professor Jochen S. Gutmann) and the IWW (Professor Rainer U. Meckenstock and Professor Torsten C. Schmidt).

Research

The two Collaborative Research Centres based at the Faculty of Chemistry, SFB/TRR 247 Heterogeneous Oxidation Catalysis in the Liquid Phase and SFB 1093 Supramolecular Chemistry on Proteins, are in their first and second funding period, respectively. Both teams are making excellent progress. Audits for a second and third funding phase, will take place over the course of the next two years. The NRW Forschungskolleg Future Water and the DFG Priority Programme 2122 Materials for Additive Manufacturing are also based at the Faculty of Chemistry; their work has been similarly successful. We presented these ongoing collaborative projects at length in the last research report. Three CRCs and CRC/TRRs were established and extended, in 2019 and 2020, respectively. The Faculty of Chemistry was a major contributor to this development. The CRC/TRR 270 Hysteresis Design of Magnetic Materials for Efficient Energy Conversion, based at TU Darmstadt, works on developing and characterising new magnetic materials as a core element of efficient energy technologies. In particular, it focuses on two major categories of magnetic materials: strong, permanent magnets based on rare-earth metals with maximised hysteresis and soft magnets with minimised hysteresis. CRC 1439, Multilevel Response to Stressor Increase and Release in Stream Ecosystems, is based at the Faculty of Biology. The project studies the impact of three selected stressors – temperature, salinisation and hydromorphological degradation – on the components of the stream food web and on ecosystem functions. CRC 1242 Non-equilibrium Dynamics of Condensed Matter in the Time Domain, based at the Faculty of Physics, has been extended. In its first funding phase, the researchers deepened their understanding of these dynamics. Now, the project focuses on manipulating non-equilibrium dynamics through ultrashort, pulsed external stimuli, such as light, pressure and tension. Professor Eckart Hasselbrink's and Professor Sebastian Schlücker's research groups, both from the field of physical chemistry, represent the Faculty of Chemistry in the project. They apply methods of ultrashort

laser spectroscopy (IR/Raman) to observe the behaviour of molecules on surfaces.

Scientists of the Faculty of Chemistry have been working on two projects on the origin of life for several years. The collaborative project of Professor Christian Mayer, Professor Oliver J. Schmitz and Professor Ulrich Schreiber involves deep drilling in the Eifel in order to corroborate the theory of the emergence of the first protocells in the depth of Earth's crust. The core samples, collected from a depth of about one kilometre, are analysed at the Applied Analytical Chemistry group to determine whether they contain any possible precursors of biomolecules that were created in the geological environment. All results are compared with analyses of Australian quartz crystals that are more than three billion years old. Notably, there are long-chain hydrocarbons which were oxidised and spontaneously formed membranes due to their amphiphilic properties. The analysis also found amino acids and precursors of nucleotides. Our physical chemistry team now manages a research group of the German Astrobiological Society (DAbG) focusing on prebiotic chemistry. The team's work on peptide evolution in deep-reaching tectonic faults has continued.

In the second origin-of-life project, which has been funded by the Volkswagen Foundation since 2019, Professor Bettina Siebers, Dr Christopher Bräsen and Dr Sven Meckelmann work with colleagues from the Faculty of Biology and the Wageningen University & Research to solve an issue in evolutionary biology that continues to puzzle researchers: how were eukaryotes able to develop from the archaea domain? The project 'Lipid Divide' seeks to understand the timing and causes of a fundamental change that occurred in the composition of the membrane lipids during the evolutionary process of eukaryotes.

In the field of chemistry education, several research projects took place during the introductory study phase. Professor Maik Walpuski's BMBF-funded CASSIS project ('Chemie, Sozialwissenschaften und Ingenieurwissenschaften: Studienerfolg und Studienabbruch'), which examined institutional and individual variables influencing academic drop-out, concluded successfully. Three members of the chemistry education group – Professor Stefan Rumann, Professor Elke Sumfleth and Professor Maik Walpuski – are participating in the DFG-ALSTER projects, which explore the perception of models in chemistry courses and the influence of digital feedback on exercises.

The outstanding success of our Faculty's young researchers in competitive programmes has been a particular highlight of the past years. Professor Jochen Niemeyer, Professor Michael Giese and PD Dr Bilal Gökce were accepted into the DFG Heisenberg Programme; Professor Corina Andronescu secured a BMBF NanoMatFutur early-career research group; Dr Kai Exner was accepted into the academic returnee programme of the state of North Rhine-Westphalia. Having outlined our Faculty's ongoing research alliances, we dedicate the remainder of this year's report to the work of our young members.

Professor Corina Andronescu's project 'MatGasDif', which is funded within the scope of the BMBF's NanoMatFutur research competition for early-career scientists, seeks to optimise electrocatalytic CO_2 reduction in terms of catalyst selectivity and electrode stability. Her team works on developing catalyst materials that selectively catalyse the electrochemical reduction of carbon dioxide to basic chemicals such as ethanol or ethylene while suppressing parasitic hydrogen evolution as much as possible. The project aims to go further than merely designing catalysts. Its objective is to develop an optimised, porous composite electrode architecture. Ideally, the active catalyst will be embedded stably into this architecture, facilitating the selective conversion of CO_2 at industrially relevant current densities. In particular, MatGasDif seeks to establish strategies for immobilising several different catalyst materials within a carbon matrix. This causes complex secondary reactions to occur in a specific order as a cascade reaction, which increases the selectivity of the reaction.

Interlocked molecular architectures have been known since the last century, but their application is still in its infancy. They consist of several components that are topologically connected, much like the links of a chain or a ring on a bilaterally closed axis. In 2016, the Nobel Prize in Chemistry was awarded to a team of researchers who mastered the highly complex production of interlocked molecular architectures. At the University of Duisburg-Essen, Professor Jochen Niemeyer and his research group use interlocked molecular architectures in processes of cooperative catalysis, where two active units work in concert to control a reaction. They focus particularly on stereoselective catalysis to create chiral products. The German Research Foundation (DFG) accepted Professor Niemeyer's project 'Cooperative Systems Based on Chiral Organophosphoric Acids' to its Heisenberg Programme in 2019. Since November 2020, he has been continuing his work at the Faculty of Chemistry in the capacity of Heisenberg Professor of Organic and Supramolecular Chemistry.

Professor Michael Giese holds a junior endowment professorship funded by the Professor Werdelmann Foundation. Since Professor Carsten Schmuck's tragic passing in 2019, however, he has been representing his late colleague at the Chair of Organic Chemistry. Professor Giese has also received funding under the DFG Heisenberg Programme for his project on supramolecular liquid crystals ('Supramolekulare Flüssigkristalle – Ein modulares Konzept für „smartere" Materialien') in 2020. He and his team are working on a modular kit whose components can be combined to form substances with specific properties. The project focuses on liquid crystals. With the modular kit, the researchers can create liquid crystals with structural colouration, for example. The liquid crystalline materials are also adaptive, meaning that they react to environmental changes. During changes of temperature or in the presence of certain chemicals, the liquid crystals can adapt by changing their properties. This may alter their colour, for instance, which is useful in constructing sensors. Professor Giese intends to continue his work at the Faculty of Chemistry in the capacity of Heisenberg Professor of Supramolecular Chemistry. The appointment procedure is currently in progress.

Dean: Professor Dr Torsten C. Schmidt

In addition to their own research, Michael Giese and Jochen Niemeyer (along with Junior Professor Jens Voskuhl and Dr Christoph Hirschhäuser) help to supervise the research group of the late Professor Carsten Schmuck, since 2019. The first doctoral candidates in the group have already completed their doctorates, and many excellent academic works were completed and published in 2020. In honour of Professor Schmuck's scientific achievements and his role as a researcher, colleague and mentor, his young colleagues have collaboratively produced a review of his life's academic work. Their article 'Guanidiniocarbonyl-Pyrroles (GCP) – 20 Years of the Schmuck Binding Motif', published in ChemPlusChem, provides

Professors

Analytical Chemistry
Professor Dr Torsten C. Schmidt
Professor Dr Oliver J. Schmitz

Anorganic Chemistry
Professor Dr Malte Behrens
(now CAU Kiel)
Professor Dr Matthias Epple
Professor Dr Stephan Schulz

Chemistry Education
Professor Dr Mathias Ropohl
Professor Dr Stefan Rumann
Professor Dr Elke Sumfleth
Professor Dr Maik Walpuski

Organic Chemistry
Professor Dr Gebhard Haberhauer
Professor Dr Jochen Niemeyer
Professor Dr Thomas Schrader

Physical Chemistry
Professor Dr André Gröschel
(now WWU Münster)
Professor Dr Jochen S. Gutmann
Professor Dr Eckart Hasselbrink
Professor Dr Christian Mayer
Professor Dr Sebastian Schlücker

Technical Chemistry
Professor Dr Corina Andronescu
Professor Dr Stephan Barcikowski
Professor Dr Mathias Ulbricht

Theroetical Chemistry
Professor Dr Georg Jansen
Professor Dr Eckhard Spohr

Environmental Microbiology and Biotechnology
Professor Dr Rainer Meckenstock
Professor Dr Alexander Probst
Professor Dr Bettina Siebers

Independent Junior Research Groups

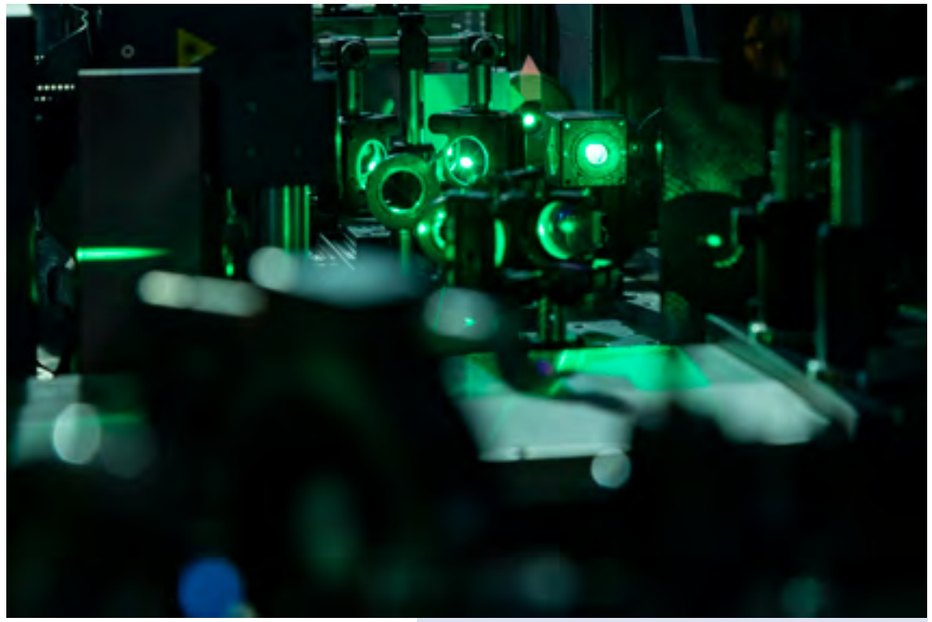
- Jun.-Professor Dr Michael Giese (Organic Chemistry)
  Endowed junior professorship financed by the Professor Werdelmann Foundation
- PD Dr Bilal Gökce (Technical Chemistry)
- Jun.-Professor Dr Jens Voskuhl (Organic Chemistry)

an overview of the GCP binding motif and its entire scope of application. It focuses especially on molecular recognition, (self-)assembly, material applications and biosupramolecular chemistry.

To this day, the enormous potential of powder-based 3D printing remains partially untapped, as many of the available materials are simply not suitable for 3D printers. PD Dr Bilal Gökce's project, funded under the Heisenberg Programme, seeks to facilitate 3D printing of new materials through the targeted addition of nanoparticles and improve the properties of 3D-printed polymer and metal components. His approach is as follows. Firstly, he studies ways of upscaling laser-based colloid synthesis and controlling the nanoparticles it produces. Secondly, he uses these nanoparticles to develop new powder for 3D-printing magnets, lenses or materials with special mechanical properties. With this comprehensive strategy, he aims to examine the entire process chain of 3D printing from the input material down to the finished component. Meanwhile, PD Dr Gökce has accepted a call to the chair of materials for additive manufacturing at the University of Wuppertal.

Dr Kai S. Exner holds a Feodor Lynen Scholarship in theoretical chemistry from the Alexander von Humboldt Foundation. His junior research group focuses on the theoretical description of electrically charged solid/liquid interfaces, which occur in batteries, fuel cells and electrolysers. The solid/liquid interface is particularly challenging to model, as it constitutes a dynamic, multi-scale problem which depends not only on the composition of the electrode material and the physical and chemical dynamics of the adjacent aqueous electrolytes but also on external parameters, such as pressure, temperature and, in particular, electrode potential. Realistic description, then, requires a combination of methods involving various time and length scales, density functional theory, molecular dynamic simulations, microkinetic models and screening techniques.

Dr Exner recently secured funding for a junior research group under the NRW academic returnee programme, which encourages highly qualified early-career researchers to continue their careers in North Rhine-Westphalia following extended stays abroad. In the funded project, the group examines the solid/liquid interface in metal-air batteries using a multi-scale model in order to gain understanding of the complex interplay of factors that influence efficient, bifunctional electrode materials for oxygen electrocatalysis in aqueous and non-aqueous electrolytes. Dr Exner plans to use the



© Foto: Daniel Schumann

A green, pulsed laser beam used in two-colour sum frequency generation spectroscopy for examining molecular adsorbates.

funding to establish his research group at the Faculty of Chemistry based on a recent call for a tenure-track junior professorship in inorganic chemistry, which focuses on the structural analysis of inorganic materials. His call is a case in point for the increasing permeability of traditional discipline boundaries, in this instance between inorganic and theoretical chemistry.

Partnerships and international affairs

Many of the research projects outlined above are highly interdisciplinary. Nearly all research groups at the Faculty collaborate intensively with researchers from other faculties of our university (in particular, Biology, Medicine, Physics, Engineering Sciences and Education Sciences) and with other research groups in Germany and abroad. Our colleagues regularly stay at our international partner institutions as visiting scholars and guest professors, while many international researchers visit our faculty in similar capacities (e.g., as Alexander von Humboldt Research Fellows). The Faculty also maintains close partnerships with its neighbouring universities in Bochum and Dortmund and the universities of applied science in Krefeld and Gelsenkirchen. It collaborates at all levels of research with the Max Planck Institutes for Coal Research and Chemical Energy Conversion in Mülheim and the Max Planck Institute for Physiological Chemistry in Dortmund. Scientists from these institutes hold positions as professors, lecturers and adjunct professors at our faculty.

Within the scope of our ongoing strategic collaboration with Evonik Industries, the industry partner funds joint projects and events held at the Faculty. The Professor Werdelmann Stiftung funds a junior professorship, the 'Werdelmann Lecture' and dissertation projects at our faculty.

Members of the UDE's Faculty of Chemistry are highly regarded throughout Germany, and their membership of national expert associations and committees underscores their excellent reputation. Professor Sumfleth is a member of the review board for the educational sciences of the German Research Foundation (DFG); Professor Schmidt is a review board member in the DFG's chemistry expert forum; Professor Gutmann is a member of expert group no. 5 of the German Federation of Industrial Research Associations. Professor Schmidt is the current chairman of the Water Chemistry Society; Professor Rumann is the board spokesman of the German Society for Chemistry and Physics Education. Many members of our faculty hold positions on the editorial boards of scientific journals.

Awards

Researchers of our faculty are regularly lauded for their work nationally and internationally. We are particularly pleased that our young members have won many prizes and secured competitive external funding again this year. Three of our scientists have been accepted into the DFG Heisenberg Programme in a single year – an unprecedented achievement for any faculty of the University of Duisburg-Essen. The similarly competitive junior research groups awarded to Faculty members within the scope of the NanoMatFutur programme of the Federal Ministry of Education and Research and the academic returnee programme of the state of North Rhine-Westphalia underscore the great achievements of our early-career researchers. We have already talked about their work in the research highlights.

Alexander Probst, Professor of Aquatic Microbial Ecology, has been funded under the NRW academic returnee programme since 2018. He has been awarded the 2020 research prize of the Association for General and Applied Microbiology (VAAM) for his study of bacteria, archaea and viruses in Earth's crust.

Professor Reinhard Zellner has won the Carl-Duisberg-Plakette, one of the highest distinctions of the German Chemical Society (GDCh). The board of the GDCh awards the Plakette to chemists who have demonstrated outstanding commitment to promoting chemistry and the goals of the GDCh. Professor Zellner received the prize for his extensive contributions to the Society's Advisory Committee on Existing Chemicals (BUA) and his achievements in the fields of climate research and atmospheric chemistry.

The Polish Academy of Sciences's committee for analytical chemistry has awarded the 2019 Professor Andrzej Waksmundzki Medal to Professor Oliver J. Schmitz for his achievements in the field of analytical separation and chromatographic techniques, in particular.

Professor Elke Sumfleth and her colleagues at the University of Duisburg-Essen have jointly received the Society of Empirical Educational Research's (GEBF) prize for promoting interdisciplinarity in educational research. The jury highlighted that the awardees spent nearly 20 years systematically developing unique and innovative interdisciplinary structures in various projects and functions, which have significantly shaped the standards of interdisciplinary research.

© Foto: eventfotograf.in

Success in research and teaching – three young scientists from the Faculty of Chemistry jointly received the UDE Teaching Award 2019.

Selected Publications

Alexowsky, C., M. Bojarska, M. Ulbricht (2019): Porous poly(vinylidene fluoride) membranes with tailored properties by fast and scalable non-solvent vapor induced phase separation. Journal of Membrane Science 577, 69–78.

Chen, Y., J. Li, O.J. Schmitz (2019): Development of an At-Column Dilution Modulator for Flexible and Precise Control of Dilution Factors to Overcome Mobile Phase Incompatibility in Comprehensive Two-Dimensional Liquid Chromatography. Analytical Chemistry, 91(15), 10251–10257.

Dickmann, T., M. Opfermann, E. Dammann, M. Lang, S. Rumann (2019): What you see is what you learn? The role of visual model comprehension for academic success in chemistry, Chemistry Education Research and Practice 20(4), 804–820.

Dittrich, S., S. Kohsakowski, B. Wittek, C. Hengst, B. Gökce, S. Barcikowski, S. Reichenberger (2020): Increasing the Size-Selectivity in Laser-Based g/h Liquid Flow Synthesis of Pt and PtPd Nanoparticles for CO and NO Oxidation in Industrial Automotive Exhaust Gas Treatment Benchmarking., Nanomaterials 10(8), 1582.

Exner, K.S. (2020): A Universal Descriptor for the Screening of Electrode Materials for Multiple-Electron Processes: Beyond the Thermodynamic Overpotential. ACS Catalysis 10, 12607–12617.

Ganesamoorthy, C., J. Schoening, C. Wölper, L. Song, P.R. Schreiner, S. Schulz (2020): A silicon–carbonyl complex stable at room temperature. Nature Chemistry 12, 608–614.

Hohrenk, L.L., F. Itzel, N. Baetz, J. Tuerk, M. Vosough, T. C. Schmidt (2020): Comparison of Software Tools for Liquid Chromatography-High-Resolution Mass Spectrometry Data Processing in Nontarget Screening of Environmental Samples. Analytical Chemistry 92(2), 1898–1907.

Hupfeld, T., A. Wegner, M. Blanke, C. Doñate-Buendía, V. Sharov, S. Nieskens, M. Piechotta, M. Giese, S. Barcikowski, B. Gökce (2020): Plasmonic Seasoning: Giving Color to Desktop Laser 3D Printed Polymers by Highly Dispersed Nanoparticles. Adv. Optical Mater. 8, 2000473.

Jansen, D., J. Gramüller, F. Niemeyer, T. Schaller, M. C. Letzel, S. Grimme, H. Zhu, R. M. Gschwind, J. Niemeyer (2020): What is the Role of Acid-Acid Interactions in Asymmetric Phosphoric Acid Organocatalysis? A Detailed Mechanistic Study using Interlocked and Non-Interlocked Catalysts. Chem. Sci. 11, 4381–4390.

Kappelt, A., M. Giese (2020): Photo-switchable Fluorescence in Hydrogen-bonded Liquid Crystals, Chem. Eur. J. 59, 13347–13351.

Kreuzahler, M., A. Daniels, C. Wölper, G. Haberhauer (2019): 1,3-Chlorine Shift to a Vinyl Cation: A Combined Experimental and Theoretical Investigation of the E-Selective Gold(I)-Catalyzed Dimerization of Chloroacetylenes. Journal of the American Chemical Society 141(3), 1337–1348.

Linke, M., M. Hille, M. Lackner, L. Schumacher, S. Schlücker, E. Hasselbrink (2019): Plasmonic Effects of Au Nanoparticles on the Vibrational Sum Frequency Spectrum of 4-Nitrothiophenol, Journal of Physical Chemistry C 123(39), 24234–24242.

Mayer, C. (2020): Life in The Context of Order and Complexity. Life 10, 5.

Müller, H., S. Marozava, A. J. Probst, R. U. Meckenstock (2020): Groundwater cable bacteria conserve energy by sulfur disproportionation, ISME Journal, 14(2), 623–634.

Rojas-Sánchez, L., V. Sokolova, S. Riebe, J. Voskuhl, M. Epple (2019): Covalent Surface Functionalization of Calcium Phosphate Nanoparticles with Fluorescent Dyes by Copper-Catalysed and by Strain-Promoted Azide-Alkyne Click Chemistry, ChemNanoMat, 5(4), 436–446.

Ropohl, M., S. Rönnebeck (2019): Making learning effective – quantity and quality of pre-service teachers' feedback. International Journal of Science Education 41(15), 2156–2176.

Shen, L., M. Kohlhaas, J. Enoki, R. Meier, B. Schönenberger, R. Wohlgemuth, R. Kourist, F. Niemeyer, D. van Niekerk, C. Bräsen, J. Niemeyer, J. Snoep, B. Siebers (2020): A combined experimental and modelling approach for the Weimberg pathway optimization, Nature Communications 11, 1098.

Tarnev, T., H. Barike Aiyappa, A. Botz, T. Erichsen, A. Ernst, C. Andronescu, W. Schuhmann (2019): SECCM investigation of single ZIF-derived nanocomposite particles as oxygen evolution electrocatalysts in alkaline media. Angew. Chem. Int. Ed. 58, 14265–14269.

Timma, L.M., L. Lewald, F. Gier, L. Homey, C. Neyer, A. Nickisch-Hartfiel, J. S. Gutmann, M. Oberthür (2019): Nonfouling textiles with tunable antimicrobial activity based on a zwitterionic polyamine finish. RSC Advances 9(17), 9783–9791.

Tran, V., B. Walkenfort, M. König, M. Salehi, S. Schlücker (2019): Rapid, Quantitative, and Ultrasensitive Point-of-Care Testing: A Portable SERS Reader for Lateral Flow Assays in Clinical Chemistry, Angewandte Chemie – Intern. Ed. 58, 442–446.

© Foto: Daniel Schumann

Successful young scientists at the Faculty of Chemistry: Prof. Corina Andronescu, Dr. Kai S. Exner, Prof. Bilal Gökce, Prof. Jochen Niemeyer, Prof. Michael Giese (from left to right)

The first prize of the AVRiL 2019 competition, jointly organised by the German Informatics Society's group on VR/AR learning and the Stifterverband, went to Dr Sebastian Habig for his project 'Augmented Reality Chemistry', which is based at the University of Duisburg-Essen.

In 2019, Dr Holger V. Lutze received the Water Chemistry Society's prize for his work on oxidative processes in aqueous systems. The prize is funded by the Walter-Kölle-Stiftung and only awarded every two to four years.

In 2020, Dr Kai S. Exner was awarded the biennial Joachim Walter Schultze Prize of the Arbeitsgemeinschaft Elektrochemischer Forschungsinstitutionen (AGEF) for expanding the volcano concept in electrocatalysis by incorporating overvoltage and kinetic effects. The Joachim Walter Schultze Prize goes to early-career researchers who have achieved a discernible degree of academic independence through a significant contribution to an electrochemical field.

The LUKE project, an industry collaboration on purifying contaminated groundwater headed by PD Dr Ursula Telgheder, was lauded by the Federal Ministry of Economics and Technology as a model of success within the scope of the Central Innovation Programme for Small and Medium-sized Enterprises (ZIM) and is recommended for the German Environmental Award.

Junior Professor Michael Giese, Jochen Niemeyer and Junior Professor Jens Voskuhl won the 2019 UDE teaching prize for their outstanding contributions to teaching and their commitment to their students. The three early-career researchers work in the field of supramolecular chemistry with their research groups. They redesigned the master's lecture on functional supramolecular materials and delivered the new version for the first time in the 2018 summer semester. Their lecture received an ‚excellent' result in the student-led course evaluation. Beyond lectures, the three young academics demonstrated exemplary commitment to supporting their students.

Dr Stéphane Kenmoe, post-doctoral researcher in CRC/TRR 247 (theoretical chemistry), received the 2020 Diversity Leadership Award of the University of Duisburg-Essen.

Appointment at another institution is considered particularly potent proof of high achievements in academia. In the last two years, seven members of the Faculty of Chemistry received external calls. The current spokesman of CRC/TRR 247, Professor Malte Behrens, accepted an appointment to a renowned professorship of inorganic chemistry at the University of Kiel. Endowed junior professor André Gröschel, funded by Evonik Industries, has been appointed to a professorship of physical chemistry at the University of Münster. PD Dr Bilal Gökce has been appointed to a professorship of Materials in additive manufacturing at the University of Wuppertal. Dr Holger Lutze has been appointed to a professorship for environmental analytics and pollutants at TU Darmstadt.

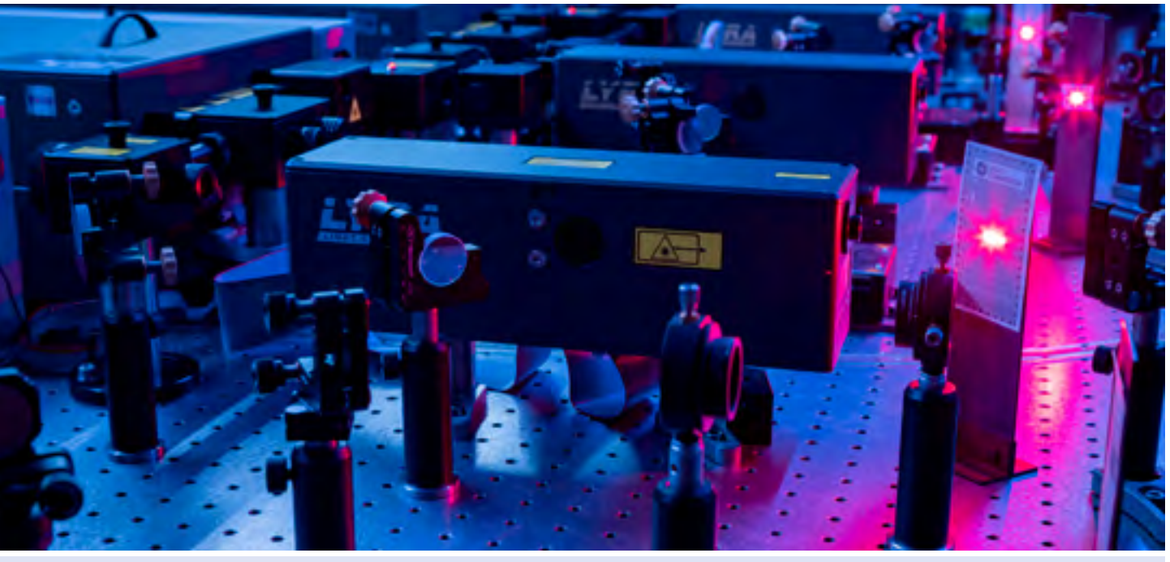
Professor Stephan Barcikowski received a call as Managing Director of the Institute of Technical Chemistry in conjunction with a professorship of technical chemistry at Leibniz University Hannover. Two members of our faculty, Professor Maik Walpuski and Professor Mathias Ropohl, took the first two spots on a list of potential candidates for a professorship of chemistry education at the University of Erlangen-Nuremberg. This high demand for our scientists underscores the excellent reputation of chemistry education at UDE. The Faculty is delighted that the University was able to match these three external calls and convince the colleagues to stay at UDE.

Transfer and sustainability

The Faculty of Chemistry takes an ecological, economic and social approach to sustainability. It attaches particular importance to the 17 Sustainable Development Goal of the United Nations. Its engagement with sustainability takes many forms:

Our researchers develop new active agents that can be used for transfection and to fight viral infections in completely new ways. They might even be effective against SARS-CoV-2, and an EU-funded research project started in 2020 to examine the potential of supramolecular ligands in this context. It is worth noting the highly advanced stage of development of those ligands, which are extremely effective in preventing pathological protein aggregation in animals. The researchers are hoping to optimise them into potential drugs to treat the currently incurable Alzheimer's disease and Parkinson's disease. Their work constitutes a clear contribution to Sustainable Development Goal no. 3: healthy lives and well-being for all. Many research groups in the University's new main research area of water research work towards SDG no. 6, access to water and sanitation for all, and SDG no. 15, protection of terrestrial ecosystems. Sustainability is a key element of the NRW Forschungskolleg 'Future Water', whose spokesperson is based at the Faculty of Chemistry. Our research in chemistry education pursues SDG no. 4, education for all, by contributing to the development of education standards at the Institute for Educational Quality Improvement (IQB). In partnership with the Leibniz Institute for Science and Mathematics Education at the University of Kiel, our scientists also study communities of practice.

Another transfer activity of our faculty, the ColFerroX spin-off from Professor Rainer Meckenstock's research group, has achieved



Laser output of three synchronised, non-linear, optical parametric amplifiers for time-resolved coherent anti-Stokes Raman scattering (CARS) spectroscopy, a non-linear Raman scattering technique for characterising rapid chemical processes.

© Foto: Daniel Schumann

extraordinary success. With its innovative method of using nanoparticles to purify groundwater contaminated with heavy metals, the young company came first in the Duisburg Pitch Battle in May 2019. It is an excellent example of start-up activities with a focus on water, which the planned FutureWaterCampus will promote and expand.

Outlook

The Faculty will continue to play an active, leading role in the aforementioned three main research areas of the University. This makes sense considering the interdisciplinary nature of chemistry. We focus on chemically motivated partnerships with biology and medicine, nanoresearch, the broad field of water, and empirical educational research. The ability of chemistry to combine multiple research topics is one of the discipline's greatest strengths. This is clearly visible in many projects, such as the WISNA professorship of nanomaterials in aquatic systems, the Alster research group, and the new research buildings that are currently in the application and construction phases. Both the University and the Faculty of Chemistry have welcomed several early-career researchers who have joined us under the Heisenberg Programme and the NRW academic returnee programme. While this underscores our high reputation as an attractive place to conduct research, it also raises several challenges regarding the development of long-term prospects. The integration of these young researchers into the existing and planned coordinated funding programmes, from research groups to Excellence Clusters, is a key component of the strategic evolution of our faculty. In particular, the development of the topic of smart materials is a connecting element: it fits perfectly into the UA Ruhr's Flagship Program Materials Chain and simultaneously offers great potential for incorporating the UDE's three main research areas to which the Faculty contributes.

Over the course of the next years, the Faculty of Chemistry will focus on extending the collaborative projects that are based at the Faculty of Chemistry or involve its researchers to a significant extent. This includes several strategic and structural measures launched at the Faculty during the past few years and will contribute to its sustainable development in the near future. Suitable academic appointments will establish a foundation for a joint application and the extension of the RESOLV Excellence Cluster in the next round of the Excellence Strategy. Dr Kai Exner has already been accepted into the current cluster as an associate member. The Faculty of Chemistry is participating in further applications within the scope of the Excellence Strategy, which are currently in preparation. If successful, they will have an effect on the strategic objectives, too.

Our successful, young scientists are already making great contributions to the Faculty with their new projects. They are expanding the Faculty's portfolio and will further strengthen its research profile, helping to continue the successful work of the Faculty in Essen.

Contact

Dekanat Chemie

University of Duisburg-Essen
Universitätsstraße 5
45141 Essen

+49 201 183 3194
+49 201 183 2449
@ dekanat.chemie@uni-due.de
www.uni-due.de/chemie