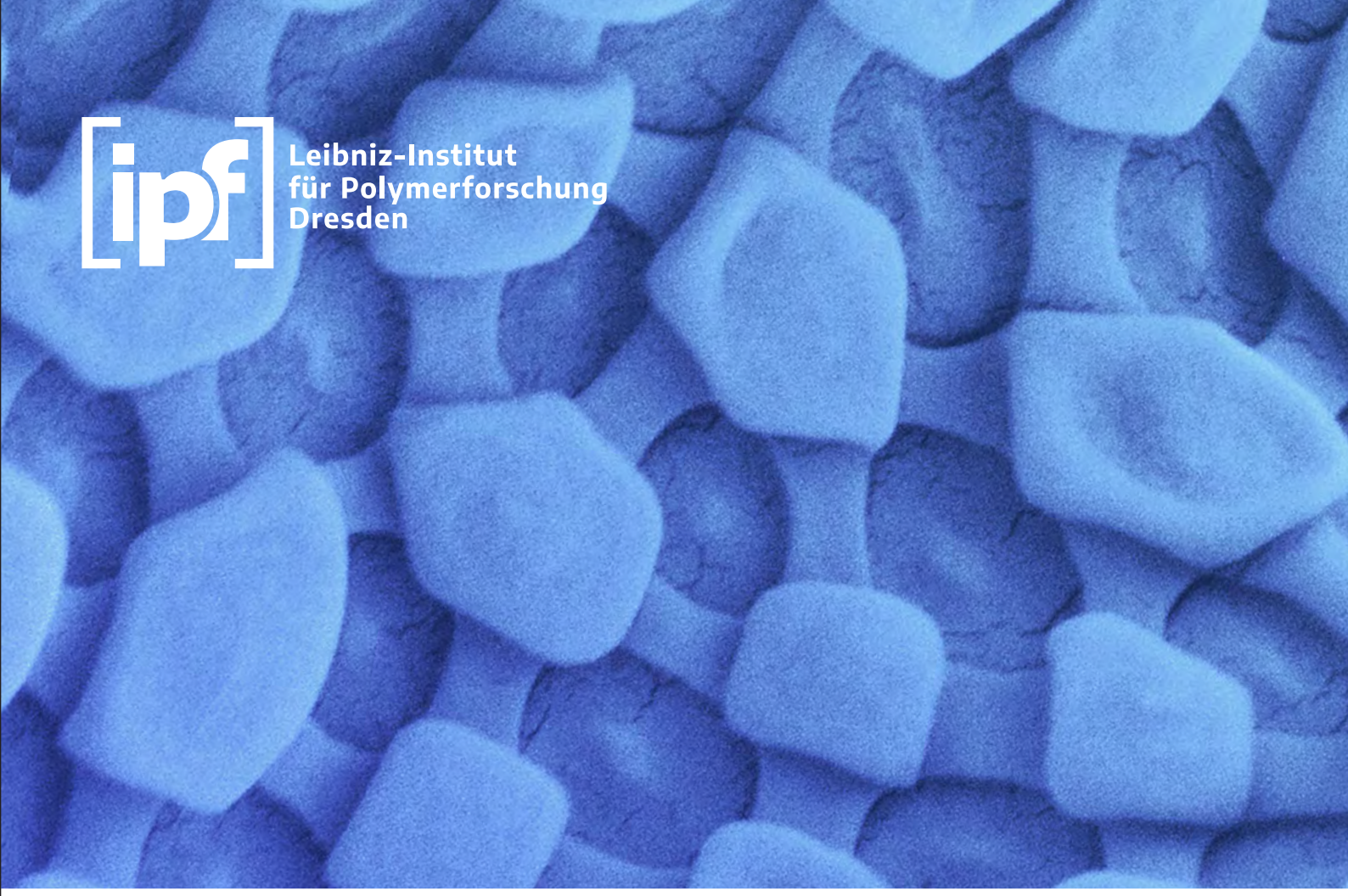
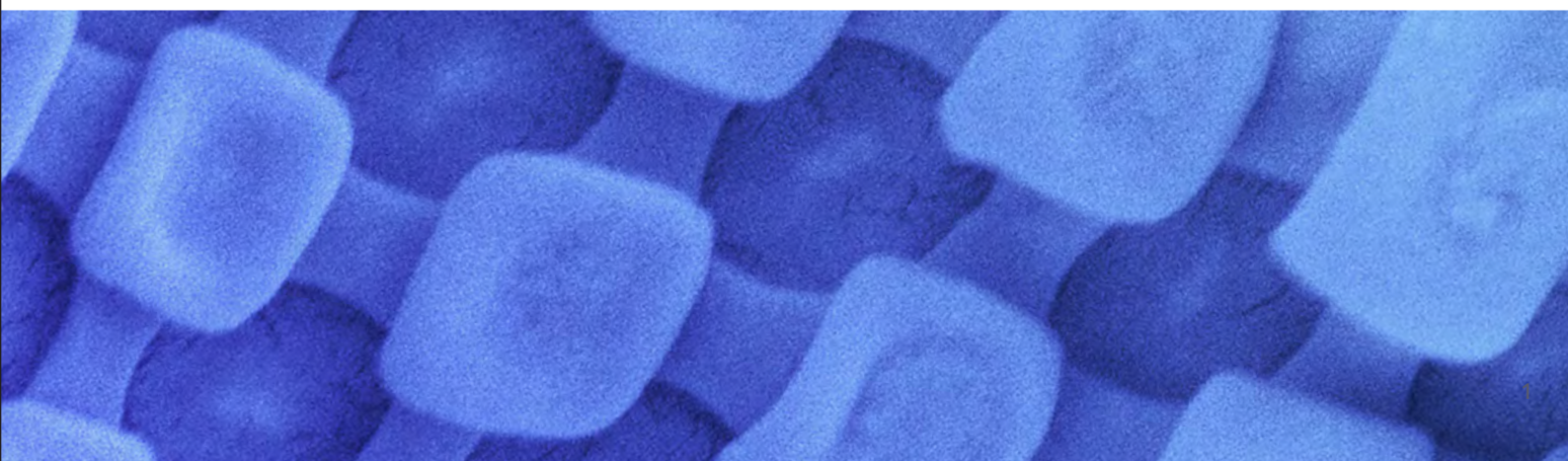


Leibniz-Institut
für Polymerforschung
Dresden

Annual Report 2023

Leibniz Gemeinschaft

DRESDEN concept



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Leibniz Institute of Polymer Research Dresden

Annual Report 2023

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Preface

Dear readers,

The year 2023 was marked by severe international crises that persist and have also impacted our institute. Nevertheless, we remain optimistic and continue to diligently pursue the substantive and organizational development of the IPF.

After two new joint appointments, a total of 15 professors are now active at the IPF. Ivan R. Minev assumed the chair for Electronic Tissue Technologies, which was newly established in collaboration with the Else Kröner Fresenius Center for Digital Health at the Dresden University of Technology. Arash Nikoubashman strengthens the connection between the IPF and the Excellence Cluster Physics of Life with a Heisenberg professorship for the Theory of Biologically Inspired Polymers. Furthermore, outstanding young scientists have been recruited to establish new research groups at the IPF.

The performance overview for 2023 that is presented here records successes with exceptional visibility: For the first time in the history of the IPF, research results from the institute were published in the journal Nature. Among the newly acquired projects in highly competitive programs are an ERC Consolidator Grant for Ivan R. Minev, an ERC Proof-of-Concept Grant for Daniela Lössner, and a project led by the team of Uwe Freudenberg in the Tissue Engineering Program of the Federal Agency for Disruptive Innovation. The active participation of IPF scientists in two (out of three) new Excellence Cluster initiatives of the Dresden University of Technology, which have reached the final selection round, demonstrates the institute's firm anchoring at its globally outstanding research location.

The new research program of the IPF was developed interactively and focuses on topics that, due to their relevance and innovation potential, further enhance the scientific excellence of our research. To implement this program, the independent research groups and their dynamic cooperation will be strengthened as the operational basis of the institute.

We are grateful for the funding and support we have received, as well as for the dedicated and creative work of our employees.

The Board of the IPF
Carsten Werner and Agnes Schausberger

Research Program

The interdisciplinary materials research at the IPF aims to create fundamental knowledge and enable technological innovations in the fields of resources, health, and information.

The IPF is divided into five Scientific Institutes / Program Areas, supported by administrative and technical services.

Program Area 1

The IPF Institute

Macromolecular Chemistry

develops effective and sustainable synthesis methods, complemented by characterization techniques, for multifunctional polymers, hybrids, assemblies, and nanocomposites.

Program Area 2

The IPF Institute

Physical Chemistry and Polymer Physics

focuses on the understanding, synthesis, and chemical modification of colloids and interfaces, the rational design and assembly of particle-based and/or nanostructured materials, and their integration into systems for sensing, optoelectronics, and energy applications.

Program Area 3

The IPF Institute

Polymer Materials

is dedicated to research topics along the development and processing chains of polymer materials, with a particular emphasis on multiphase and hybrid materials.

Program Area 4

The IPF Institute

Biofunctional Polymer Materials

explores living matter from a materials science perspective, develops bioinspired materials, and supports their translation into biomedical applications.

Program Area 5

The IPF Institute

Theory of Polymers

is dedicated to the theory and simulation of polymers and soft matter, working closely with experimental research.

With the following Strategic Topics, the IPF aimed to synergistically bring together the expertise of the Program Areas:

- Basic concepts of soft matter
- Bioinspired materials
- Functional materials and systems
- Process-controlled structural materials
- Data science-based material research
- Sustainability and environmental protection

Polymer model networks for innovative applications of tomorrow

Customized polymer networks and gels with a defined structure at the macroscopic and molecular level are becoming increasingly important in materials research. Particularly at the interfaces between biological-medical, electronic, and technical applications, there is a growing demand for innovative, highly adaptable materials. To be able to tailor material properties flexibly to the respective application, new synthesis and preparation methods are required. Such methods are being researched by Frank Böhme together with Michael Lang and other colleagues at the IPF and six German universities. Their focus lies on “amphiphilic co-networks” (ACN) with model characteristics, which open up new perspectives for fundamental research, but also for the development of innovative medical products.

“We can adjust the parameters of these polymer networks with increasing precision,” explain Frank Böhme and Michael Lang. “This allows us to control, for example, the degree to which they are hydrophobic (water-repellent) or hydrophilic (water-absorbent), how well they transport specific substances on a microscopic level in which direction, or how stiff they are.” These special properties are highly interesting for many application scenarios: For example, to replicate the microenvironment in human tissues and organs for growing cell cultures in tissue engineering, the carrier substances should have adjustable stiffness, be water-repellent in certain areas, water-absorbent in others, and allow specific substance transport within them. To achieve this, close collaboration between chemists, physicists, biochemists, and specialists in material analysis and simulation is required. This interdisciplinary cooperation enables a precisely defined construction and use of the co-networks.

Two different types of specific polymer stars serve as a starting point. These stars each have four arms each, consisting of polyethylene glycol (PEG) or polycaprolactone (PCL). While the PEG arms are hydrophilic, the arms of the polyester component PCL are hydrophobic. The length of each arm can be adjusted to determine whether a water-repellent or water-absorbent segment dominates in the final network. To ensure that such an arm only connects with the arm of a neighboring star, researchers attach a kind of molecular connector to each arm of one type of star. These coupling groups then react with the amino groups of the second type of star. This increases the likelihood of forming a three-dimensional polymer network in which each star forms exactly one connection with a neighboring star. Such co-networks, which exclusively contain such ‘single links’, are particularly desirable. They are considered model networks, where physical and chemical laws can be experimentally verified under nearly ideal conditions. Therefore, these networks are suitable not only for specific applications but also for fundamental research.

Dr. Frank Böhme studied chemistry at the Dresden University of Technology from 1976 and completed his doctorate in 1984. From the same year, he worked at the ITP (the predecessor institute of the IPF) and at the IPF, among other roles as the head of the departments “Self-Reinforcing Polymers” and “Polymer Reactions and Blends”. In 2004, he took up a guest professorship at the Laboratoire des Matériaux Macromoléculaires (INSA) in Lyon, France. Since 2022, he has been retired – and yet continues his research. His focus lies on the chemical modification of polymers, self-healing elastomers, and amphiphilic networks.

» We won’t be able to create perfect networks – but we will come pretty close. «

Although Frank Böhme and Michael Lang cannot simply switch off entropy and therefore only approximate ideal model networks, they do it better than most other colleagues. They adjust many parameters, such as the arm lengths of their polymer stars, the volume fractions of the hydrophobic and hydrophilic components, or the structure of the couplers used. “We have developed some unique features,” says Frank Böhme.

An example of such a special variable: If the polymer stars are given particularly long arms, they can assemble into nanometer-sized structures (tiny tubes, lamellae) that transport oxygen, nutrients, or other substances in a specific direction. On the other hand, the star design can also be used to create barriers that can be opened or closed by external influences. The theoretical foundations of these molecular ‘design principles’ were developed and refined from 2019 as part of a DFG (German Research Foundation) research group. In the second phase (since 2022), Frank Böhme, Michael Lang, and their external research partners are increasingly exploring practical applications for their co-networks. This includes experiments with cell cultures, which are exemplarily being advanced by the University of Hannover. Other research groups are attempting to design smart surfaces with the ACNs. Yet other groups are focusing on novel filters, such as those needed for mini-labs of chip size.

The research consortium will present its project results by 2026. Frank Böhme hopes that more projects will follow, to bring promising approaches to maturity for application.

Original publication on the subject:
https://pubs.acs.org/doi/abs/10.1021/acs.macromol.2c00693

Self-assembling nanocubes for the energy transition

Perovskites are seen as a beacon of hope for the energy transition: If they can be made usable for the solar industry on a larger scale, these materials could increase the energy yield of photovoltaic systems and improve the environmental footprint of solar cell production. A polymer-based approach to this is being pursued by the team led by Tobias A. F. König and Andreas Fery at the IPF Institute Physical Chemistry and Polymer Physics. Using a lithography-free printing process, the researchers create soft polymeric nanostructures. This allows them to specifically develop optical meta-surfaces from nanocubes with precisely defined photonic properties. As a result, higher photoluminescence quantum yields can be achieved with ten percent of the usual material input compared to traditional methods.

The underlying concept is actually centuries old. Tobias König likes to explain it using the colorful windows in medieval churches: “In these windows, tiny particles of gold, silver, and other metals create the unique color effects,” explains the physical chemist. “The size and shape of these particles determine whether the glass appears blue, red, or green.” Moreover, the hue changes depending on whether daylight from outside shines into the church or candlelight from inside illuminates the windows.

What the glassmakers of the Middle Ages achieved through trial and experimentation can now be controlled quite precisely with modern nanotechnology. To create a meta-surface with the desired luminescence, Tobias König and his team use a multi-step process that resembles the processes in semiconductor factories. Initially, they project overlapping, i. e., interfering patterns onto a light-sensitive layer that is applied to a glass or silicon substrate using a special laser lithography process. They then replicate these structures, which are only a few hundred nanometers in size, creating a soft but precise polymer template. Using these templates, the team structures nanocubes of perovskite in an organic solution to form large meta-surfaces and then solidifies them. These structures direct and amplify the normally non-directional light emission of the perovskites.

Once the assembly is completed, the IPF researchers analyze the photonic and energetic properties of the nanostructured perovskites. Subsequently, partner teams from the Leibniz Institute for Solid State and Materials Research Dresden design new experimental solar cells to measure their efficiency. In the future, these new materials are also to be used for nanolasers in quantum computers or optical diodes for signal processing (as part of a Freigeist scholarship from the Volkswagen Foundation awarded to Tobias König). Moreover, not only the assembly of perovskite nanocubes can be controlled, but also that of silver or gold nanoparticles. This opens up a wide range of further application possibilities.

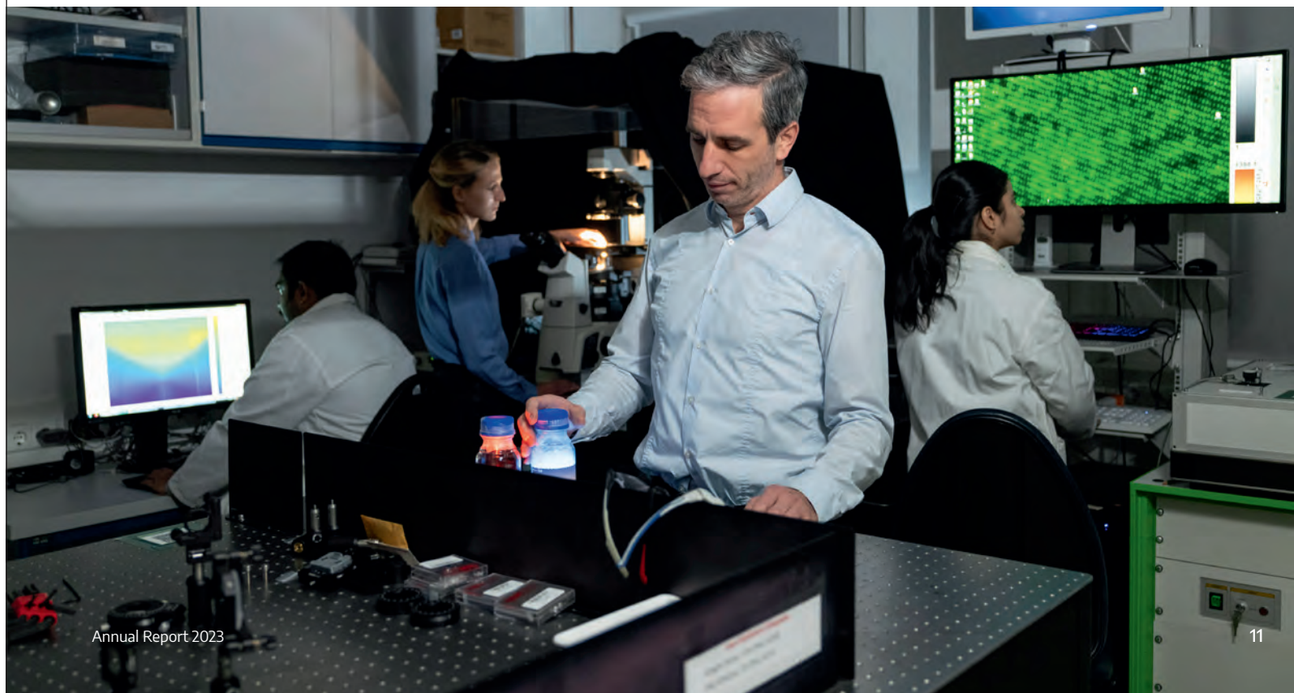
However, before practical implementation, particularly in the photovoltaic industry, many questions still need to be addressed, such as: How can the manufacturing process be optimized to meet industrial requirements? To what extent can transparent polymer protective layers contribute to extending the lifespan of future solar cells?

» Nanoparticles are like Lego bricks to us: From them, we can repeatedly assemble new materials with quite astonishing properties. «

On one point, the team is unanimous: Answers to these and other questions can primarily be found through interdisciplinary collaboration and diverse perspectives. The group’s composition reflects this diversity: Members come from India, Germany, Ukraine, and Turkey. The team includes physicists, chemists, and optics specialists. Olha Aftenieva sees this diversity as a particular strength: “Perhaps that is also a unique feature of us: Just as we use self-assembly in our experiments, everything in our group also comes together naturally.”

Original publication on the subject:
https://doi.org/10.1021/acsnano.2c09482

Private lecturer Dr. Tobias A. F. König studied physics at the Universities of Hamburg and Karlsruhe. He received his doctorate in 2011 in Freiburg and habilitated in physical chemistry at the Dresden University of Technology in 2020, where he has been a private lecturer since 2021. At the IPF, he leads the group “Plasmonic Functional Surfaces”. His team currently includes Dr. Swagato Sarkar, Dr. Olha Aftenieva, Sezer Seçkin, and Lavanya Beri.



Digitalization for a closed life cycle of polymer materials

Digitalization can significantly contribute to making plastics in cars, airplanes, electronic components, and other products more durable, environmentally friendly, and better recyclable – this is something Anna Katharina Sambale firmly believes in. In her research group “Engineering of Circular Polymer Materials”, she is working on digitally capturing the entire life cycle of plastics.

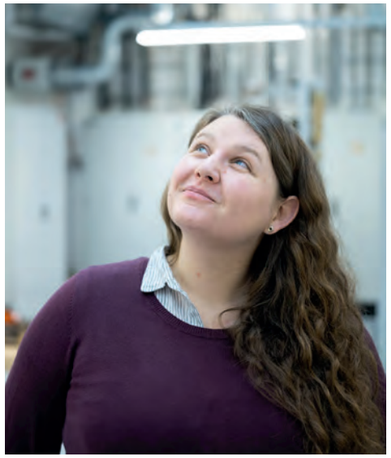
Currently, there is a lack of sufficiently precise digital models that can comprehensively depict the changes in the material over longer periods of time. However, the digitalization of processing processes and the use of powerful, digitally supported systems for monitoring test specimens open up new possibilities for precisely capturing and analyzing the properties of a plastic component in the various phases of its life cycle.

“Digital monitoring systems could enable precise predictions about how plastic components change over time and how they react under stress,” explains Anna Katharina Sambale. Her goal is to first comprehensively investigate the key factors influencing plastic, in collaboration with her research partners, and then model the changes in structure-property relationships. Anna Katharina Sambale employs a combination of experimental methods, such as thermomechanical characterization linked with structural elucidation through X-ray radiation. In addition, extensive sensor data from processing processes and environmental monitoring are utilized to identify parameters for mathematical models that describe the changes in structure and properties.

Emphasis is given to understanding and describing how the morphology in the plastic, and thus the properties of the plastic product, change over time. To capture the entire life cycle of a plastic product, it is important to consider all phases from conception, through production, to the use and disposal/recycling of the product. As Anna Katharina Sambale emphasizes, it is crucial to have as much information as possible about the circumstances under which the samples or components were manufactured, stored, used, and stressed, in order to trace changes in the structure and properties of the plastic. For this purpose, various data streams are brought together: Sensor data from the processing process can provide insights into the original structures and properties. Information from sensors during product use, such as temperature, humidity, or UV sensors, enable a profound understanding of the relationships between material, process conditions, dimensional tolerances, and

product properties. This approach allows possible changes to be tracked over longer periods of time.

For her research work, Anna Katharina Sambale also relies on analytical techniques that can only be carried out at large particle accelerators, such as the “Deutsches Elektronen-Synchrotron” (DESY) in Hamburg. There, she utilizes various highly specialized experimental setups developed at the IPF to perform *in situ* structural analysis on plastics under technical processing conditions. This allows for a comprehensive understanding of the mechanisms occurring within the material.



Dr.-Ing. Anna Katharina Sambale studied materials science and engineering at Saarland University until 2016. In 2023, she completed her PhD at the Dresden University of Technology. Since April 2023, she has been establishing the “Engineering of Circular Polymer Materials” group at the IPF. Her research work is supported by Dr.-Ing. Carsten Zschech, who leads the “Process Monitoring” group. Additionally, she closely collaborates with the research groups “Material Characterization” (led by Dr.-Ing. Kai Uhlig), “Mechanics and Structure of Elastomeric Materials” (led by Dr.-Ing. Eric Euchler), and “Structure Characterization and Visualization” (led by Dr. Regine Boldt) at the IPF.

» Only when we fully understand the structure-property relationships from the processing of plastics and can mathematically describe them using models, are we able to digitally capture the temporal and spatial change in the structure and thus the properties of the resulting component – also when using recyclates. «

By integrating data from process monitoring, environmental monitoring, and material characterization, relevant measurements, boundary conditions, and model parameters are identified. Based on this data, numerical calculations of samples and components can be carried out using both established and tailored material models, and evolving material structures and property relationships can be mapped over increasingly longer periods of time. This enables, for example, the prediction of behavior under load, and ultimately allows for a simulated prediction about how the aged material will respond to operational loads. The results of these calculations are validated through experiments.

With this approach, the condition of the material can be assessed in a time-resolved manner until the end of the product life, which facilitates the decision on material or chemical recycling. In perspective, the digital representation of the changes in structures and properties on different time scales also allows for a better understanding of the use of recyclates. The use of recyclates remains a challenge, especially for technical plastic components with narrow (dimensional) tolerances or high property requirements: batch fluctuations, lower (mechanical) performance, and the uncertain prediction of important material characteristics complicate their use. Therefore, they are often used in areas where the property requirements are low, which is known as downcycling. Counteracting this is an important long-term goal of the group.

DNA-programmed hydrogel for the search for new therapies

Hydrogels with embedded cells could help to avoid numerous experiments on humans and animals in the development of new drugs and therapies. However, many of these gels only inadequately simulate human organs and other complex tissues. Elisha Krieg and his team aim to change that: The chemists and molecular biologists at the IPF Institute Biofunctional Polymer Materials can tailor their hydrogels using DNA molecules to provide the embedded cells with an adaptable environment with programmable mechanical, geometric, and thermodynamic properties.

“A human brain is structured very differently from a muscle, a bone, or the skin,” explains Elisha Krieg. “Therefore, the mechanical properties of the hydrogels significantly influence how the cell cultures behave within them.” Hence, it is important to be able to adjust these gels as precisely as possible. “The consistency can, for example, resemble that of toothpaste or that of gummy bears, and with our solution, we can even adjust everything in between.”

While traditional hydrogels based on animal cells can distort laboratory cell experiments due to their biological components, and sometimes yield varying results from batch to batch, these new hydrogels are synthetically and reproducibly produced from polymers. This is made possible by a combination of DNA nanotechnology and a specific polymer synthesis. The key factor here is the precisely chosen sequence of bases in the DNA sequence. Elisha Krieg and his colleagues combine these sequences of DNA nanomodules, each of which is specialized in particular properties, such as stiffness, elasticity, or plasticity. The design for the specific ‘recipe’ is usually

» We see a great demand for synthetic hydrogels with adjustable and reproducible properties. This opens up new possibilities to avoid animal experiments and to better understand developmental biological processes. «

created on the whiteboard. Subsequently, the sequence is optimized using a specialized software.

To enable the programmed sequence to transform the initially still liquid gels into a comparatively solid matrix, Elisha Krieg and his team synthesize the starting polymers in a specific way that is somewhat reminiscent of the Lego principle: Each molecule is given up to 100 special docking sites to which the programmed DNA can then attach. In addition, peptide side chains are assigned to the polymers, which later serve as docking sites for those cells users want to experiment with later on. In the practical implementation, the scientists pipette the initially liquid polymers with the docking sites into vessels. They then add the selected synthesized DNA nanomodules. This process results in the self-organization of the hydrogel matrix called “DyNAtrix”. Elisha Krieg and his team have already demonstrated that this matrix is indeed suitable for simulating organ-like structures and tissues for biological, pharmaceutical, and medical experiments. The “DyNAtrix” has already proven itself with embedded stem cells and placental tissue. Furthermore, the team is testing the structuring of brain organoids.

In these experiments, the group collaborates closely with colleagues at the IPF, the Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG), and other partner institutes. This includes the groups of Carsten Werner at the IPF, Claudia Gerri at the MPI-CBG, and Alf Honigmann at the Biotechnology Center of the Dresden University of Technology. For some ‘first adopters’, Elisha Krieg and his team regularly provide “DyNAtrix” samples so that colleagues can test the structured hydrogel for their own cell experiments. The company “PELOBiotech” from Planegg supports the project as an industrial sponsor.

Given the promising results at the laboratory scale, the research group is aiming for a spin-off. This company is intended to commercially exploit the patented “DyNAtrix” technology. Meanwhile, the group continues to work on refining the “DyNAtrix” technology, particularly with the aim of more efficient programming of the matrix and exploring new application fields.

Dr. Elisha Krieg completed his chemistry studies at the University of Cologne and the Weizmann Institute of Science in Israel, where he received his doctorate in 2013. He then worked as a postdoc at Harvard University before joining the IPF in Dresden in 2018. Since 2020, he has been leading the NanoMatFutur project “Programmable DNA-Based Nanomaterials for Biomedical Diagnostics and Personalized Medicine”, funded by the German Federal Ministry of Education and Research (abbrev. BMBF in German). His team is multicultural and interdisciplinary, consisting of chemists, materials scientists, and molecular biologists from Germany, Taiwan, India, and the USA. His team includes Yu-Hsuan Peng, Krishna Gupta, Sarah Speed, and Syuan Ku Hsiao.

Original publication on the subject:
www.nature.com/articles/s41565-023-01483-3

Molecular design for waterproof organic sensors

Organic electronics, developed in Dresden, are increasingly encountered in everyday life, whether in smartphones or televisions. Despite this, the potential of this technology is far from being fully exploited. In the future, it could enable the development of organic electronic sensors, for instance for neuroimplants or smart patches. However, the systems for this are still too slow and too sensitive to moisture. Olga Guskova from the IPF Institute Theory of Polymers aims to change that: Together with her colleagues from the IPF Institute Macromolecular Chemistry, she is working on organic semiconductors that are resistant to water.

Dr. Olga Guskova is recognized as an expert in the material properties of semiconductor polymers and the modeling of these materials at various scales. She studied chemistry at the Technical University in central Russia's Tver starting in 1998. From 2005, she pursued her doctorate in Ulm. After that, she conducted research as a postdoc at the Max Planck Institute of Colloids and Interfaces in Potsdam, before joining the IPF in 2011. Since 2015, she has been working as a junior research group leader, focusing on the material properties of semiconductor polymers.

The aim is to achieve more robust organic electronics through conjugated polymers with charged side chains. With a special molecular design, Olga Guskova wants to "lower the energy level of these polymers to the oxidation level of water." This is intended to prevent reactions between the doped polymers and the surrounding fluid, thereby also avoiding unwanted 'aging processes' of organic electronics.

» With this approach, organic electronics that are robust enough for use in aqueous environments are within reach. «

For this purpose, the team first synthesizes a polymer from naphthalene diimides (NDI). This compound is then doped to obtain an excess of negative ("n") charge carriers in the planar molecular structure. Oxalate or the organometallic compound cobaltocene, for example, are used as doping materials. However, the n-doped organic semiconductor materials can be oxidized in the presence of air and water. To prevent this, charge-stabilizing groups are incorporated into the polymer framework, rendering the system water-stable.

The design of these novel organic semiconductors is systematically improved by the IPF team through a combination of simulations and experiments. Olga Guskova focuses on modeling the atomistic structure and the electronic properties of the conjugated polymer segments connected by double bonds and their interaction with the side chains of the macromolecule. The synthesis and experimental investigations are carried out by Fabian Borrmann, Takuya Tsuda, and Nataliya Kiriy from the IPF Institute Macromolecular Chemistry. "The synthesis of these positively charged side chains, in particular, is based on the special expertise at the IPF," emphasizes Olga Guskova.

Original publication on the subject:
https://doi.org/10.1002/advs.202203530

Before these promising experiments and computer simulations become practically usable organic sensors and other electronic components, a lot of research still needs to be done. For example, the design of the semiconducting molecules, such as the length of the side chains, could still be optimized.

Once the molecular design is finalized, the teams at the Dresden University of Technology take over: Experts in organic electronics will then construct the first components for practical testing from the optimized polymers. "Prototypes are expected in about five years," estimates Olga Guskova. If the tests on the prototypes also prove successful, commercial use of the water-stable organic sensors can be considered, for instance in medical technology or the pharmaceutical industry. Moreover, this approach could also be of interest to manufacturers of OLEDs and organic solar films, who currently invest considerable effort and cost into protecting the sensitive screens and solar collectors from the environment.

IPF Fellows

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3D Cancer In Vitro Models

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Nanostructured Organic Materials

Igor M. Kulic
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Strasbourg, France
Biopolymer Physics and Active Condensed Matter

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Photochemical Polymerization, Polymer Networks

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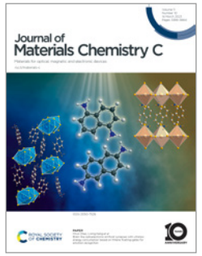
Polymer Composites, Surface Modification of Carbon Nanotubes and Graphenes

Kim Williams
Colorado School of Mines,
Golden, USA
Field-Flow Fractionation Techniques

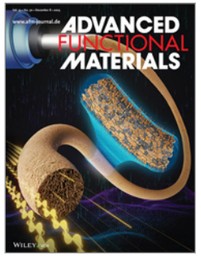
Exemplary Publications



Molecular engineering of naphthalene spacers in low-dimensional perovskites

Andrei Mitrofanov, Yonder Berencén, Elaheh Sadrollahi, Regine Boldt, David Bodesheim, Hendrik Weiske, Fabian Paulus, Jochen Geck, Gianaurelio Cuniberti, Agnieszka Kuc, Brigitte Voit

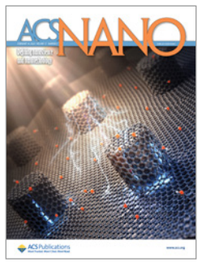
Journal of Materials Chemistry C, DOI: 10.1039/D3TC00132F



Protocells capable of generating a cytoskeleton-like structure from intracellular membrane-active artificial organelles

Dishi Wang, Silvia Moreno, Mengfei Gao, Jiaqi Guo, Bing Xu, Dagmar Voigt, Brigitte Voit, Dietmar Appelhans

Advanced Functional Materials, DOI: 10.1002/adfm.202306904



Directional amplified photo-luminescence through large-area perovskite-based metasurfaces

Olha Aftenieva, Julius Brunner, Mohammad Adnan, Swagato Sarkar, Andreas Fery, Yana Vaynzof, Tobias A. F. König

ACS Nano, DOI: 10.1021/acsnano.2c09482

Integrated FRET polymers spatially reveal micro- to nanostructure and irregularities in electrospun microfibers

Xiaojian Liao, Dmitrii Sychev, Khrystyna Rymsha, Mahmoud Al-Hussein, José Paulo Farinha, Andreas Fery, Quinn A. Besford

Advanced Science, DOI: 10.1002/advs.202304488

Micromechanical study on poly-propylene-bicomponent fibers to improve mechanical interlocking for application in strain-hardening cement-based composites

Michaela-Monica Popa, Andreas Leuteritz, Markus Stommel, Ines Kühnert, Victor Mechtcherine, Christina Scheffler

Cement and Concrete Composites, DOI: 10.1016/j.cemconcomp.2023.105181

Design of sacrificial network in modified natural rubber leads to strikingly improved mechanical performance with self-healing capability

Subhradeep Mandal, Mikhail Malanin, Bholanath Ghanti, Susanta Banerjee, Jun Sawada, Toshio Tada, Gert Heinrich, Sven Wießner, Amit Das

Chemical Engineering Journal, DOI: 10.1016/j.cej.2023.145838

Dynamic matrices with DNA-encoded viscoelasticity for cell and organoid culture

Yu-Hsuan Peng, Syuan Ku Hsiao, Krishna Gupta, André Ruland, Günter K. Auernhammer, Manfred F. Maitz, Susanne Boye, Johanna Lattner, Claudia Gerri, Alf Honigmann, Carsten Werner, Elisha M. Krieg

Nature Nanotechnology, DOI: 10.1038/s41565-023-01483-3

A tumor microenvironment model of pancreatic cancer to elucidate responses toward immunotherapy

Verena Kast, Ali Nadernezhad, Dagmar Pette, Anastasiia Gabrielyan, Maximilian Fusenig, Kim C. Honselmann, Daniel E. Stange, Carsten Werner, Daniela Loessner

Advanced Healthcare Materials, DOI: 10.1002/adhm.202201907

Strain-controlled critical slowing down in the rheology of disordered networks

Jordan L. Shivers, Abhinav Sharma, Fred C. MacKintosh

Physical Review Letters, DOI: 10.1103/PhysRevLett.131.178201

Reversible networks made of star polymers: Mean-field treatment with consideration of finite loops

Kiran Suresh Kumar, Michael Lang

Macromolecules, DOI: 10.1021/acs.macromol.3c00796

Events and Achievements

Ivan R. Minev appointed to the chair for Electronic Tissue Technologies

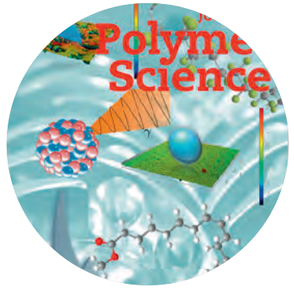
Ivan R. Minev assumed the professorship for Electronic Tissue Technologies at the Dresden University of Technology, a newly established joint appointment of the IPF and the Else Kröner Fresenius Center for Digital Health (EKFZ-DG). As one of the leading researchers in the field of bioelectronic implant systems, Ivan R. Minev integrates materials research and electronics with medicine and biology.

Cover Story in the scientific journal *Nature*

With their article “Entropic Repulsion of Cholesterol-Containing Layers Counteracts Bioadhesion”, Jens Friedrichs, Ralf Helbig, Julia Hilsenbeck, Prithvi Raj Pandey, Jens-Uwe Sommer, Lars D. Renner, Tilo Pompe, and Carsten Werner demonstrated why the accumulation of proteins and bacteria can be significantly reduced on cholesterol-containing surfaces. The study was inspired by organisms from the Collembola genus, which breathe through their skin.
doi.org/10.1038/s41586-023-06033-4

Arash Nikoubashman assumes new Heisenberg professorship in Dresden

Arash Nikoubashman has accepted the joint appointment to a Heisenberg professorship at the Dresden University of Technology and the IPF. The professorship is funded by the German Research Foundation and focuses on the theoretical modeling and simulation of biologically inspired materials, particularly polymers.



Special issue for the 75th Institute Anniversary

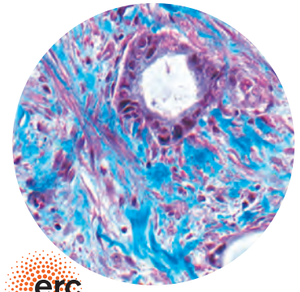
To celebrate the 75th anniversary of the founding of the predecessor institution of today’s Leibniz Institute of Polymer Research Dresden, the *Journal of Polymer Science* (Volume 61, Issue 16) published a special issue featuring 17 articles on current research results from the institute.

ERC Consolidator Grant for Ivan R. Minev

Ivan R. Minev was awarded the ERC Consolidator Grant for his project “GELECTRO – Hydrogel Machines for Seamless Living System Interfaces”.

SPRIN-D FUNKE funds project for innovative treatment of cartilage defects

Uwe Freudenberg and his team, in collaboration with partners at the University Hospital Heidelberg, were successful in the competition for radically new tissue engineering concepts funded by the Federal Agency for Disruptive Innovation (SPRIN-D FUNKE).



ERC Proof-of-Concept Grant for Daniela Lössner

Daniela Lössner and her research group received an ERC Proof-of-Concept Grant to develop a 3D cancer model supporting research on therapies for pancreatic cancer.

Cluster of Excellence initiatives with IPF participation in the final round

The IPF is involved in two new Cluster of Excellence initiatives of the Dresden University of Technology, which are among the finalists in the current selection process: CARE – Climate-Neutral and Resource-Efficient Construction and REC^2 – Responsible Electronics in the Climate Change Era. The institute is also engaged in the existing Excellence Cluster PoL – Physics of Life, for which a continuation is being applied for.

ISPAC Conference

Under the leadership of Albena Lederer, the 34th International Symposium on Polymer Analysis and Characterization took place in Stellenbosch, South Africa, in April 2023. The symposium was organized by her research group “Polymer Separation”, which is an international team affiliated with both the IPF and Stellenbosch University.

18th Dresden Polymer Discussion

In the historic premises of the St. Afra conference house in Meißen, Andreas Fery and his team hosted the 18th Dresden Polymer Discussion. Under the title “From Particulate Building Blocks to Functional Soft Matter Assemblies”, leading scientists from around the world presented their latest research findings.

SPIN2030

On February 3, the Saxon Prime Minister Michael Kretschmer and the Minister of Science Sebastian Gemkow launched the campaign “SPIN2030. Science State Saxony”. At the kick-off event in Leipzig, the IPF presented its research activities on polymer-based technologies for medical applications.

Science Meets School

International doctoral students Krishna Gupta (India), Sarah K. Speed (USA), Yu-Hsuan Peng (Taiwan), and Syuan Ku Hsiao (Taiwan) conducted a workshop at the Johann-Gottfried-Herder-Gymnasium in Pirna together with students of the biology advanced course.

IPF AHEAD!

Annual Reception in new format

Under the slogan IPF AHEAD!, the institute held its Annual Reception at the Deutsches Hygiene-Museum Dresden. The program included a keynote speech by Karl Leo, one of the pioneers in the field of organic electronics, a concert by the Kurt Masur Academy of the Dresden Philharmonic Orchestra, and the presentation of awards of the IPF’s Association of Supporters.

Innovation Award for Quinn A. Besford

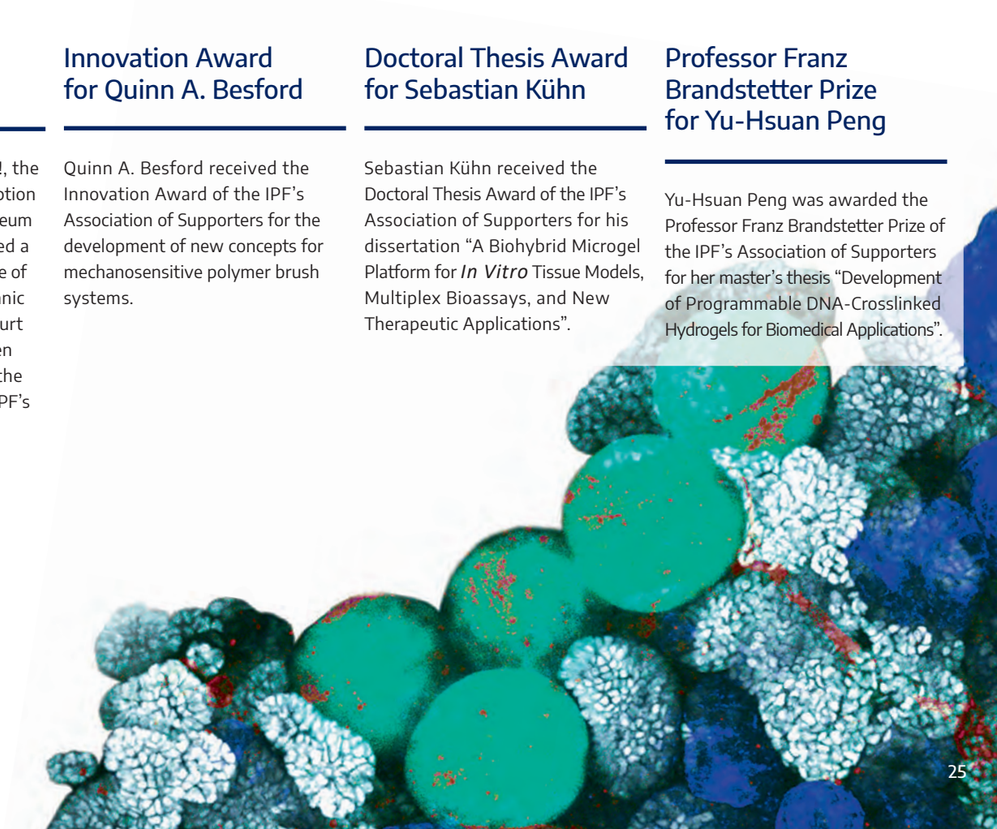
Quinn A. Besford received the Innovation Award of the IPF’s Association of Supporters for the development of new concepts for mechanosensitive polymer brush systems.

Doctoral Thesis Award for Sebastian Kühn

Sebastian Kühn received the Doctoral Thesis Award of the IPF’s Association of Supporters for his dissertation “A Biohybrid Microgel Platform for *In Vitro* Tissue Models, Multiplex Bioassays, and New Therapeutic Applications”.

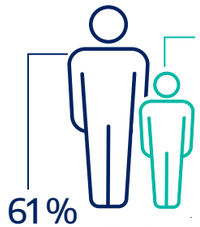
Professor Franz Brandstetter Prize for Yu-Hsuan Peng

Yu-Hsuan Peng was awarded the Professor Franz Brandstetter Prize of the IPF’s Association of Supporters for her master’s thesis “Development of Programmable DNA-Crosslinked Hydrogels for Biomedical Applications”.



Figures

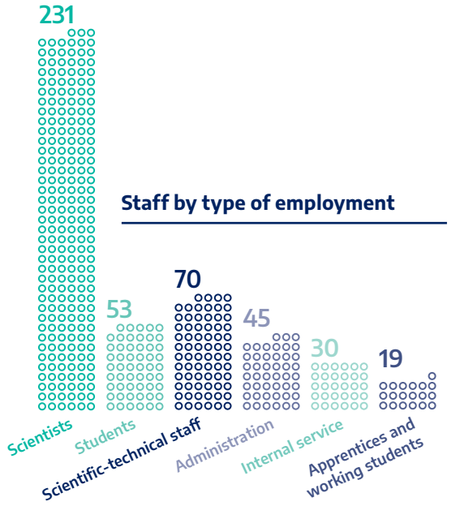
Employees by funding source



39 %
third-party funds

61 %
institutional funds

Staff by type of employment



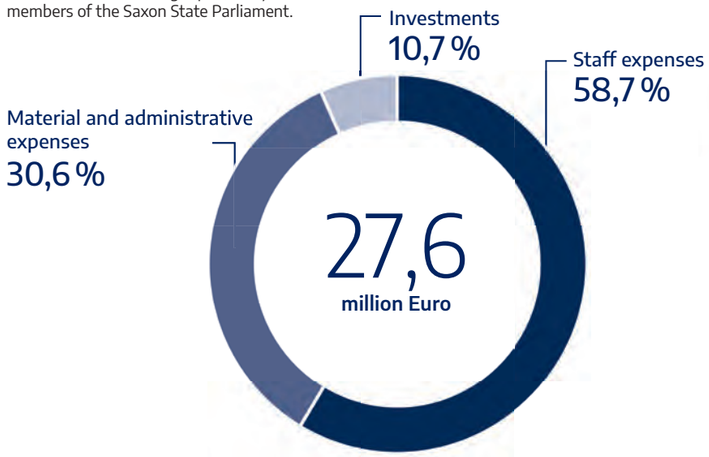
48 %
Female employees

26 %
International employees

162
Visiting scholars

Institutional funding

The IPF is jointly funded by the federal and state governments. The institute is co-financed by tax funds on the basis of the budget passed by the members of the Saxon State Parliament.



Apprentices 19

- Chemical lab technicians 11
- Biotechnologists 8

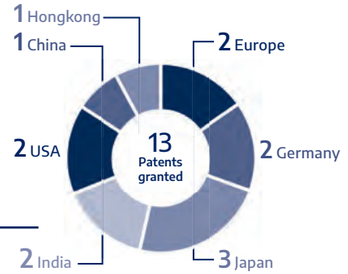
Publications 809

- Articles in journals 258
- Books 2
- Book chapters 8

Graduations completed 48

- Doctoral theses 18
- Diploma and Master's theses 19
- Bachelor's theses 11

Patents



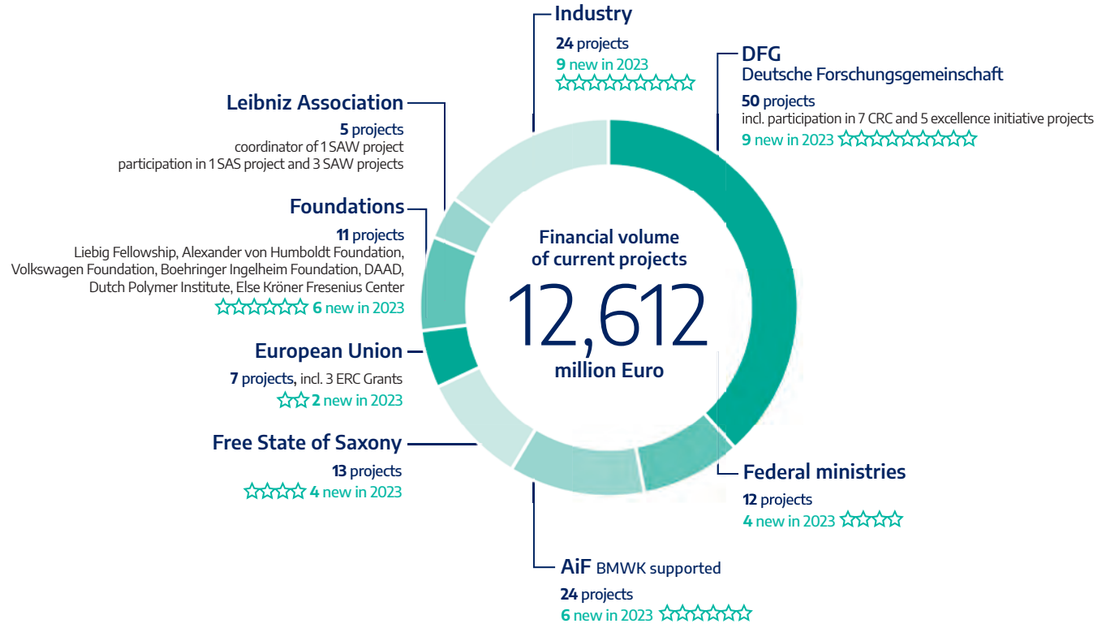
First filings

- 5 Patents
- 5 Patentable inventions
  transferred to industrial and cooperation partners

Subsequent filings

- 12 Patents
- 2 Wordmarks

Third-party funding



Organisation Organization

ORGANE ORGANS

Mitgliederversammlung General Meeting

Freistaat Sachsen (vertreten durch Herrn Dr. Tim Metje, Sächsisches Ministerium für Wissenschaft, Kultur und Tourismus)
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Prof. Dr. Andreas Fery
Prof. Dr. Michael Mertig
Prof. Dr. Gerhard Rödel
Prof. Dr. Dr. h. c. Roland Sauerbrey
Prof. Dr. Jens-Uwe Sommer
Prof. Dr. Ursula M. Staudinger
Prof. Dr.-Ing. Markus Stommel
Prof. Dr. Carsten Werner
Dr. Agnes Schausberger
Achim von Dungern
Prof. Dr. Manfred Stamm

Kuratorium Board of Trustees

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Bundesrepublik Deutschland – vertreten durch das Bundesministerium für Bildung und Forschung, vertreten durch Herrn Ingo Höllein, stellvertretender Vorsitzender

Prof. Dr. Ursula M. Staudinger, Technische Universität Dresden, von der Mitgliederversammlung gewähltes Mitglied des Vereins

Prof. Dr. Dr. h. c. Peter Fratzl, Max-Planck-Institut für Kolloid- und Grenzflächenforschung, von der Mitgliederversammlung gewählter Sachverständiger

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FORSCHUNG RESEARCH

Institut Makromolekulare Chemie
Leiterin: Prof. Dr. Brigitte Voit
mit den Abteilungen Polymerstrukturen, Bioaktive und responsive Polymere und Funktionale Nanokomposite und Blends
sowie dem Zentrum Makromolekulare Strukturanalyse

Institut Physikalische Chemie und Physik der Polymere
Leiter: Prof. Dr. Andreas Fery
mit den Abteilungen Funktionale Kolloidale Materialien, Polymergrenzflächen und Nanostrukturierte Materialien
sowie dem Zentrum Multi-Skalen-Charakterisierung

Institut Polymerwerkstoffe
Leiter: Prof. Dr.-Ing. Markus Stommel
mit dem Forschungsbereich Elastomere und den Abteilungen Verarbeitungstechnik sowie Werkstofftechnik

Institut Biofunktionelle Polymermaterialien
Leiter: Prof. Dr. Carsten Werner
mit dem Forschungsbereich Electronic Tissue Technologies und den Themengruppen Bio-Grenzflächen und Matrix & Tissue Engineering

Institut Theorie der Polymere
Leiter: Prof. Dr. Jens-Uwe Sommer
mit dem Forschungsbereich Theorie biologisch inspirierter Polymere und den Gruppen Theorie der weichen Materie und Polymerphysik
sowie Materialtheorie und Modellierung

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Forschungstechnik
Leiter: Dr. Michael Wilms

Leibniz-Institut
für Polymerforschung
Dresden

Jahresbericht 2023
Annual Report 2023

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Publikationen Publications

VERÖFFENTLICHUNGEN IN FACHZEITSCHRIFTEN
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Xu, X.; Moreno, S.; Gentzel, M.;
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Zhang, K.; Moreno, S.; Wang, X.; Zhou, Y.;
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BÜCHER
BOOKS

Biernacka, K.; Dockhorn, R.; Engelhardt, C.; Helbig, K.; Jacob, J.;
Kalová, T.; Karsten, A.; Meier, K.; Mühlichen, A.; Neumann, J.;
Petersen, B.; Slowig, B.; Trautwein-Bruns, U.; Wilbrandt, J.; Wiljes, C.:
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BEITRÄGE IN BÜCHERN
BOOK CONTRIBUTIONS

Anju; Yadav, R. S.; Pötschke, P.; Pionteck, J.; Krause, B.;
Kuřitka, I.; Vilčáková, J.; Škoda, D.; Urbánek, P.; Machovský, M.;
Masař, M.; Urbánek, M.:
CuxCo1-xFe2O4 (x = 0.33, 0.67, 1) spinel ferrite nanoparticles based thermoplastic polyurethane nanocomposites with reduced graphene oxide for highly efficient electromagnetic interference shielding.
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Siddiqui, T.; Celikkaya, H.; Atasavum, Z. T.;
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in: Alzheimer's Disease: Methods and Protocols / J. Chun (Ed.). New York: Humana Press, 2023. 159-170 (Methods in Molecular Biology ; 2561); ISBN 978-1-0716-2654-2

Absolventen Graduates

PROMOTIONEN DOCTORAL THESES

Iman Abdoli
Odd dynamics in diffusion systems
Technische Universität Dresden

Oumaima Aiboudi
Azulene based nanocars
Technische Universität Dresden

Kevin Breuer
Beitrag zur Multiskalensimulation kurzfaserverstärkter Kunststoffe
Technische Universität Dresden

Enrique Caldera Cruz
Novel polymeric and oligomeric materials for organic electronic devices
Technische Universität Dresden

Simon Enders
Synthese von immobilisierbaren p-Dotierungsmitteln und deren kovalente Anbindung an einen polymeren Halbleiter
Technische Universität Dresden

Patricia Flemming
Understanding and tailoring temperature-induced responsive transitions in polyelectrolyte brushes on the nanoscale
Technische Universität Dresden

Tina Helmecke
Hemocompatible surface decoration strategies based on poly(styrene-alt-maleic-anhydride)-copolymers
Technische Universität Dresden

Neda Kargarfard
Fundamentals and development of self-stratifying polymer composites for powder coating industry
Technische Universität Dresden

Anik Kumar Ghosh
Non-lithographic approaches towards plasmonic grating and beyond
Technische Universität Dresden

Labeesh Kumar
Coaxially electrospun nanofibers comprising block copolymer templated yolk-shell nanoparticles for photocatalysis
Technische Universität Dresden

Nikolai Liubimtsev
Complex bisensitive hydrogel systems for microfluidic application
Technische Universität Dresden

Kajari Mazumder
BIS(3-(Trifluoromethyl)Phenyl)thiophene-based high refractive index polymers: Synthesis, characterization, and properties
Indian Institute of Technology Kharagpur, Indien

Thanh Duong Nguyen
Chemisch gekoppelte PA-PTFE-Öl-Compounds als Trockenschmierstoffe für hochbelastete Schneckengetriebe
Technische Universität Dresden

Berthold Reis
Synthesis and characterization of hybrid materials based on conjugated microporous polymers
Technische Universität Dresden

Anna Katharina Sambale
Beitrag zur Charakterisierung und Berechnung von Feuchtigkeitsverteilungen in Polyamid 6
Technische Universität Dresden

Pauline Voigt
Polymere Netzwerke aus biobasierten Bausteinen
Technische Universität Dresden

Dishi Wang
Artificial organelles-in-protocell system for mimicking basic cellular reactions
Technische Universität Dresden

Carsten Zschech
Verfahrenstechnische Untersuchungen zur kontinuierlichen Elektronen-induzierten reaktiven Aufbereitung von Polymerwerkstoffen
Technische Universität Dresden

DIPLOM- UND MASTERARBEITEN
DIPLOMA AND MASTER'S THESES

Richard Achilles
Effect of composition and electrolyte on electrochemical properties of carbon/PANI-composite electrode materials
Technische Universität Dresden

Railia Biktimirova
Tuning of membrane properties of nanoreactors using zwitterionic moieties enhancing their therapeutics features
Technische Universität Dresden

Annika Butler
Pre-resist coating process effects on resist adhesion for i-line lithographic process
Technische Universität Dresden

Karla Günther
Untersuchung der Knochenfixation stichtechnisch hergestellter Implantate für das Tissue Engineering des vorderen Kreuzbandes
Technische Universität Dresden

Elisabet Hauschild
Kristallisationsverhalten von elektronenmodifiziertem PLA
Technische Universität Dresden

Julia Hübner
Grundlegende Untersuchungen zur Anwendung eines Self-Healing Agents zur Rissheilung in Faserkunststoffverbunden
Technische Universität Dresden

Daniel Kochale
Synthese von PA-6 aus ε-Caprolactam zur Erzeugung von stoffschlüssigen Aluminium-Thermoplast Hybriden
Hochschule für Technik und Wirtschaft Dresden

Yashwanth Sai Anjaneya Varma Kosuri
A new self-healing rubber composite based on BIIR/ENR blends with hybrid filler CNT/LDH
Martin-Luther-Universität Halle-Wittenberg

Liesa Künzelmann
Entwicklung thermoplastischer variabelaxialer Multi-Matrix-Faser-Kunststoff-Verbundstrukturen für den Einsatz an neuartigen Skoliose-Korsetts
Technische Universität Dresden

My Duyen Pham
Zellinstruktive Ankerpolymere für die Kultur von induziert pluripotenten Stammzellen
Technische Universität Dresden

Moritz Reinhardt
Optimierung der Kunststoffmetallisierung mit bioinspirierten Haftvermittlern durch statistische Versuchsplanung
Hochschule für Technik und Wirtschaft Dresden

Sai Trinath Suryadevara
Electrical properies of flexible electronic polymers on the nanoscale under strain
Martin-Luther-Universität Halle-Wittenberg

Souha Toukabri
Investigations on the optimal quantity and distribution of overlay measurement points on a wafer map
Technische Universität Dresden

Dmitrij Všivcev
Photokatalytische Suspensionen und Beschichtungen aus Titanoxid und Polyelektrolyten
Hochschule für Technik und Wirtschaft Dresden

Jan-Joris Wiegand
Simulative Beschreibung der Mikrostrukturabformung im Spritzgießen
Technische Universität Dresden

Yuan Zhou
Experimentelle Bestimmung und numerische Beschreibung des Einflusses der Aushärtetemperatur verschiedener Epoxidharzsysteme auf die viskoelastischen Eigenschaften
Technische Universität Dresden

BACHELORARBEITEN
BACHELOR'S THESES

Sascha Bartosch
Rheologische NMR an Polyelektrolytlösungen
Technische Universität Ilmenau

Michaela Bauer
Entropische Abstoßung auf Lipidschichten
von cholesterinanalogen Molekülen
Staatliche Studienakademie Riesa

Christoph Beutner
Biobasierte Schmelzklebestoffe auf Basis von Polysacchariden
Hochschule für Technik und Wirtschaft Dresden

Fritz Förster
Mechanism for storing memory incellular droplets
Technische Universität Dresden

Jason Galeczka
Untersuchung der Phasenübergänge von Polymerstrukturen
in Abhängigkeit des Wechselwirkungspotentials
mittels gitterbasierter Simulationen
Technische Universität Dresden

Luise Hampel
Einfluss von Oberflächenladungsart und -dichte sowie
Ionenstärke des Mediums auf die initiale Besiedlung von Gram+
und Gram-Bakterien in verschiedenen metabolischen Zuständen
Staatliche Studienakademie Riesa

Solveig Klier
3D Vaskulogenesemodell zur Bestimmung von entwicklungs-
toxischen Substanzen: Assays, Modellierung und Bewertung
der Vorhersage anhand einer Substanzbibliothek
Staatliche Studienakademie Riesa

Yahor Paromau
Molecular dynamics study of ideal polymer
chains with variable persistence length
Technische Universität Dresden

Anna Russi
Development of optical transparent structures for the spinal
canal of a (variable-axial) fiber-reinforced scoliosis brace
Technische Universität Dresden

Joshua Benjamin Uhlig
Analysis of the dynamics of reversible star polymer networks
Technische Universität Dresden

Steven Winkler
Untersuchung von Mikroplastik im menschlichem Blut
Hochschule für Technik und Wirtschaft Dresden

Auszeichnungen Awards

Dr. Quinn A. Besford
Innovationspreis des IPF und des Fördervereins des IPF
für seine Arbeiten zu neuen Konzepten
für mechanosensitive Polymerbürstensysteme
"Mechanofluorescent polymer brush surfaces
that spatially resolve surface solvation"

Yu-Hsuan Peng
Professor-Franz-Brandstetter-Preis
für ihre Masterarbeit
"Dynamic matrices with DNA-encoded
viscoelasticity for advanced cell and organoid culture"

Dr. Sebastian Kühn
Promotionspreis
für seine Dissertation
"Cell-instructive multiphasic gel-in-gel materials"

Anna Katharina Sambale
Wilfried-Ensinger-Preis des WAK 2023
für ihre Dissertation
„Beitrag zur Charakterisierung und Berechnung
von Feuchtigkeitsverteilungen in Polyamid 6"

Lucas Kurzweg
Nachwuchsforschungspreis der HTW Dresden 2023
für sein Promotionsvorhaben
„Untersuchungen zur Transformation von polymeren Materialien –
Tribologie, Kohäsion, Adhäsion und Transport in
mehrphasigen aquatischen Systemen"

Mayank Gautam
Best M. Tech Project Cash Award am IIT Roorkee,
Goldmedaille des Fachbereichs C am IIT Roorkee
für seine Masterarbeit
"Glass fiber surface modification by elastomer and its use in concrete"

Chen Jiao
1. Platz im Young Scientists' Award auf der 11th ECNP Conference
für das Poster
"Reversible capture and release of (macro)molecules by
stimuli-responsive hydrogels in microfluidics"
Autor:innen: Ch. Jiao, D. Appelhans, J. Gaitzsch, B. Voit

Dr. Beate Krause, Dr. Petra Pötschke
2. Platz im Posterwettbewerb auf
der Jahreskonferenz von NanoCarbon 2023
für das Poster
"Polymer based conducting films for battery application"
Autor:innen: P. Pötschke, B. Krause, I. Kühnert

Fabian Mehner
1. Platz im Posterwettbewerb auf dem
POLY Workshop for Sustainable Polymers 2023
für das Poster
"Branching behaviour of (bio) degradable polyesters
from Radical Ring-opening polymerization"
Autor:innen: F. Mehner, T. Meißner, M. Geisler, A. Lederer, J. Gaitzsch

Victoria Sarangova
1. Platz im Posterwettbewerb auf dem
EPITA Symposium & 41st AIDPIT Workshop 2023
für das Poster
"Development of an advanced microencapsulation strategy
for the treatment of patients with diabetes mellitus"
Autor:innen: V. Sarangova, C. Heller, P. B. Welzel, B. Ludwig, C. Werner

Vaidehi Londhe
1. Platz im Posterwettbewerb auf der
Life Science Campus Summer Conference 2023 des CRTD
für das Poster
"Understanding the biomolecular corona at the nano-bio interface"
Autor:innen: V. Londhe, M. Maitz, C. Werner, A. C. G. Weiss, Q. Besford

Dr. Ron Dockhorn
2. Platz im SaxFDM-FAIRest-Data-Award 2023
für den Datensatz
"Theory of chain walking catalysis:
From disordered dendrimers to dendritic bottle-brushes"
Autor:innen: R. Dockhorn, J.-U. Sommer

Stipendiaten
Visiting Scholars

Humboldt-Forschungsstipendium der Alexander von Humboldt-Stiftung

Dr. Yue Dong
South China Normal University, China
Hybrid cholesteric hydrogels with stimulus reponsive chiral plasmonic structure
01.06.2021 – 31.02.2023

Dr. Jyoti Yadav
Institute of Physical Chemistry,
Polish Academy of Sciences, Warschau, Polen
Spatially resolving charge transport in solution
with mechanofluorescent polymer brush surfaces
01.03.2023 – 01.03.2025

Dr. Helen Pfukwa
Stellenbosch University, South Africa
In-depth profiling of glycopolymer-grafted
gold nanoparticles for colorimetric biosensing
03.07.202 – 30.09.2023

Liebig-Stipendium

Dr. Franziska Lissel
Organometallic donor-acceptor polymers for (opto)electronic applications
01.10.2021 – 31.12.2023

Dr. Christian Roßner
Maßgeschneiderte Nanohybridmaterialien
für die plasmonenverstärkte Photokatalyse
01.12.2022 – 30.11.2024

Stipendium des Deutschen Akademischen Austauschdienstes (DAAD)

Dr. Ana Bárbara Krummenauer Formenton
Federal University of Rio Grande do Sul, Porto Alegre, Brasil
Evaluation, applicability and modifications of hyperelastic models used to determine the mechanical behavior of fiber-reinforced elastomeric polymers with a focus on biological tissues and industrial applications
07.06.2023 – 29.02.2024

Sayan Chakraborty
Indian Institute of Technology Kharagpur, India
Stretchable piezoelectric and thermoelectric elastomer composites
01.10.2022 – 31.03.2023

Rakesh Kumar Maji
Indian Institute of Technology Kharagpur, India
Polymersomes based on azobenzene-containing
amphiphilic block copolymers: A potential drug carrier
05.09.2022 – 31.03.2023

Short-Term Scientific Missions (STSM)-Stipendium
innerhalb einer COST Action der EU

Dr. Ismail Borazan
Bursa Technical University, Turkey
Effect of SWCNT deposition by electrospraying concurrently with electrospinning nanofibers on thermoelectric sensor applications
01.06.2023 – 28.06.2023

Stipendium des chinesischen State Scholarship Funds
vergeben über China Scholarshop Council (CSC)

Li Chen
The stretchable organic electrochemical transistors for flexible gas sensors
31.03.2023 – 01.04.2024

Chen Jiao
Chemical utilization of double cross-linked hydro gels within microfluides
01.10.2019 – 31.05.2024

Zhi Qiao
Development of reactive polymer matrices for MALDI and MALDI MSI
01.02.2020 – 31.12.2023

Kehu Zhang
Integrating attachable, self-sorting, multi-stimuli-responsive polymersomes for applications in microfluidic channels
01.10.2019 – 30.09.2023

Stipendium der Evonik-Stiftung

Fabian Mehner
Synthese eines bioabbaubaren PEK-Surrogats mittels radikalischer Ringöffnungspolymerisation von zyklischen Ketenacetalen
01.11.2021 – 31.10.2023

International Graduate Education Scholarship (YLSY), Türkei

Zeynep Tansu Atasavum
Investigation of the effects of extracellular matrix on neurodegeneration from a molecular and matrix biology perspective
17.08.2020 – 16.08.2024

Schwedisches Regierungs-Stipendium

Radhika Thakore
Lund University, Sweden
Interaction behavior of pseudo-glycodendrimers against Aβ peptide (1-40)
01.08.2023 – 31.08.2023

STUVIN-Stipendium

Viktor Greguš
Jan Evangelista Purkyně University in Ústí nad Labem, Czech Republic
Colloidal nanoaggregates of heteroboranes
14.11.2022 – 12.02.2023

Veranstaltungen Events

WISSENSCHAFTLICHE VERANSTALTUNGEN
SCIENTIFIC MEETINGS

GUMFERENCE: Advanced testing of soft polymer materials
09.02.2023, online

IPF DAY
13.03.2023, Dresden

IPF AHEAD! – Jahresempfang mit Preisverleihungen
20.04.2023, Dresden

ISPAC 2023 – 34th International Symposium on Polymer Analysis and Characterization
24. – 26.04.2023, Stellenbosch, South Africa

32. Seminar „Kunststoffrecycling in Sachsen“
09.05.2023, Dresden

INSA – IPF Workshop
10. & 11.05.2023, Dresden

18th DRESDEN POLYMER DISCUSSION – From particulate building blocks to functional soft matter assemblies
21. – 24.05.2023, Meißen

Leibniz Conference on Bioactive Compounds 2023
24. & 25.05.2023, Braunschweig

Short Course on Nanostructured Polymer Materials für junge Wissenschaftler
24. – 28.08.2023, Lodz, Polen

11th ECNP International Conference on Nanostructured Polymers and Nanocomposites
28. – 31.08.2023, Lodz, Polen

Polymere in der Medizintechnik
06.09.2023, Dresden

Polymers for a Sustainable Future
16. – 18.09.2023, Dresden

CU Workshop ‘Fiber-Matrix-Interphases’
09.11.2023, online

TECHNOMER – 28. Fachtagung über Verarbeitung und Anwendung von Polymeren
09. – 10.11.2023, Chemnitz

Tosoh Polymer Analysis Forum: Polymers of the Future – Spotlight on sustainable materials and biomedical applications
30.11.2023, Dresden

Aachen-Dresden-Denkendorf International Textile Conference 2023
30.11. & 01.12.2023, Dresden

KOLLOQUIEN LECTURES

Prof. Frank Caruso
University of Melbourne, Australia
Engineering metal-organic materials via supramolecular assembly
04.01.2023

Prof. Friedrich Kremer
Universität Leipzig, Deutschland
The extraordinary mechanical properties of (natural and biomimetic) spider silk and its molecular foundation
26.01.2023

Prof. Laurence Meagher
Monash University, Melbourne, Australia
Optimised surface-coated materials for long-term maintenance of human pluripotent stem cells
10.02.2023, hybrid

Prof. Peter Mallon
Stellenbosch University, South Africa
Electrospun copolymer nanofibers: Design, processing and structures for targeted applications
02.03.2023

Dr. Robert Göstl
Leibniz-Institute for Interactive Materials (DWI Aachen), Deutschland
Illuminating network mechanics with polymer mechanochemistry
15.03.2023, hybrid

Dr. Volkmar Stenzel
Fraunhofer IFAM, Dresden, Deutschland
How to use functional polymer brushes in coating technology?
31.03.2023

Dr. Martin D. Hager
Friedrich Schiller University Jena, Deutschland
Self-healing polymers – from the restoration of mechanical properties to functional self-healing materials
31.03.2023

Dr. Gerd-Peter Scherg
Rodenstock GmbH, München, Deutschland
Coatings on spectacle lenses
31.03.2023

Prof. Jose Paolo Farinha
University of Lisbon, Portugal
Structural color from polymer nanoparticles
31.03.2023

Dr. Pagra Truman Sutanto
BMW Group München, Deutschland
The BMW Group meets research
31.03.2023

Ralm Ricarte
Florida A&M University, Tallahassee, USA
Linear viscoelasticity of vitrimer melts
22.05.2023

Dr. Michael D. Schulz
Virginia Polytechnic Institute and State University, Blacksburg, USA
Exploring the connections between chelating polymer structure and rare-earth element binding thermodynamics
25.05.2023

Dr.-Ing. Khiêm Vu Ngoc
RWTH Aachen University, Deutschland
A data-driven statistical learning framework for finite strain inelasticity
30.05.2023

Prof. Mohamed A. Yassin
National Research Centrre (NRC), Cairo, Egypt
Functional polymers derived from sustainable resources
30.05.2023

Prof. Maria da Conceição J. R. Paiva
University of Minho, Braga, Portugal
Polymers and carbon nanoparticle composites – the challenges from preparation and processing to final application
02.06.2023

Dr. Tsuyoshi Nomura
Toyota Central Reserach and Decelopment Lab., Inc., Nagakute, Japan
Topology optimization and prototyping of variable axial composite structures by computational fabrication
02.06.2023

Prof. Marcus Weck
New York University, USA
Materials design via self-assembly: From supramolecular polymers to colloidal assemblies
08.06.2023

Prof. Ravi Kumar
The University of Alabama, Tuscaloosa, USA
The next generation of nano-pills
12.06.2023

Prof. Susanta Banerjee
Indian Institute of Technology Kharagpur, India
An Overview of high-performance polymers for membrane-based applications: Gas separation and prototon exchange membrane applications
15.06.2023

Lukas Mielke
Universität Hamburg, Deutschland
Quantum dot based color conversion arrays for NIR spectroscopy
15.06.2023

Prof. Christiane Helm
Universität Greifswald, Deutschland
Changing structures at soft interfaces: Self-patterning of polyelectrolyte multilayers and different growth modes of domains
19.06.2023

Prof. Sampa Saha
Indian Institute of Technology Delhi, India
Anisotropic colloidal surfactants and their application in catalysis
21.06.2023

Dr. Matthias Hartlieb
Universität Potsdam, Deutschland
Tales about antimicrobial polymers
22.06.2023

Prof. Wenwan Zhong
University of California, Riverside, USA
Advancing analysis of biological complexes and vesicles using open-channel separation
22.06.2023

Prof. Mikhail Chamonine
Ostbayerische Technische Hochschule Regensburg, Deutschland
Magnetoactive elastomers: Extraordinary properties and physics of iron in rubber
30.06.2023

Dr. Injamamul Arief
Leibniz-Institut für Polymerforschung Dresden e. V., Deutschland
Self-powered tactile sensor array-based artificial skin for soft robots
11.07.2023

Prof. Sergei Egorov
University of Virginia, Charlottesville, USA
Phase separation and nematic order in lyotropic solutions: Two types of polymers with different stiffnesses in a common solvent
12.07.2023

Zifei Chen
University of Melbourne, Australia
The extreme confinement regime: A critical juncture for the mechanical and optical properties of semiconductor quantum dots
13.07.2023

Julien Clegg
Queensland University of Technology, Brisbane, Australia
Validating starPEG-heparin hydrogels as an *ex vivo* drug testing system for breast cancer
25.07.2023

Rodrigo Curvello
Monash University, Melbourne, Australia
Targeting the tumour metabolism
25.07.2023

Prof. Christoph Hagemeyer
Monash University, Melbourne, Australia
Smart polymeric nano systems for bio-responsive drug delivery
11.09.2023

Prof. Rafael Tadmor
Ben Gurion University of the Negev, Israel
Measuring surface energy of a solid surface using centrifugal adhesion balance (CAB)
11.09.2023

Prof. Sergejs Gaidukovs
Riga Technical University, Latvia
Polymer science at Riga Technical University
14.09.2023

Dr. Christina Myra Tringides
ETH Zurich, Switzerland
Bridging the tissue-material interface with multifunctional hydrogels
18.09.2023, hybrid

Prof. Robert Magerle
TU Chemnitz, Deutschland
Interactive haptic exploration of nanomechanical tissue properties
26.09.2023

Prof. Michael Sommer
TU Chemnitz, Deutschland
***In situ* detection of forces using transient mechanochromic polymers**
27.09.2023

Dr. Yingying Cai
Georg-August-Universität Göttingen, Deutschland
From polymeric-hydrogen-bond interaction to precise nanostructures
12.10.2023

Dr. Andrea Belluati
Technische Universität Darmstadt, Deutschland
Synthetic membranes, synthetic cells: Exploring the new frontier of cell engineering with polymers
12.10.2023

Prof. Felipe Stumpf
Federal University of Rio Grande do Sul, Porto Alegre, Brasil
Some aspects of the finite element modelling of nonlinear materials: from polymeric yarns to shape memory polymers
23.10.2023

Prof. Rogério Marczak
Federal University of Rio Grande do Sul, Porto Alegre, Brasil
Some preliminary results of discretely reinforced elastomeric/composite plates
23.10.2023

Dr. Michal Kubik
Brno University of Technology, Czech Republic
Magneto-sensitive materials and their application in smart suspension systems
27.10.2023

Prof. Kristian Müller-Nedebock
Stellenbosch University, South Africa
Theory of branching cytoskeletal networks in confinement
01.11.2023

Prof. Remco Tuinier
Eindhoven University of Technology, Netherlands
On the rich phase behaviour of colloid-polymer and binary colloidal mixtures
06.11.2023

Prof. Harekrushna Sahoo
National Institute of Technology, Rourkela, India
Crowding environment: An impact on protein dynamics and conformation
14.11.2023

Dr. Senentxu Lanceros-Méndez
Ikerbasque, Basque Foundation for Science, Bilbao, Spain
Electroactive dynamic microenvironments based on piezoelectric materials in the scope of tissue regeneration
15.11.2023

Prof. Shang Jiang
University of Iowa, Iowa City, USA
Breaking the symmetry: From janus particles assembly to in-space manufacturing
23.11.2023

Rama Dhali
University of Mons, Belgium
Thermally activated delayed fluorescence: Excited state engineering
05.12.2023, hybrid

Prof. Anthony A. Hyman
Max-Planck-Institut für molekulare Zellbiologie und Genetik, Dresden, Deutschland
Biomolecular condensates and their implications for cell physiology and disease
11.12.2023

Prof. Amit Rawal
Indian Institute of Technology Delhi, India
Engineering a family of disordered fiber networks via a unified theory approach
12.12.2023

Prof. Alfonso Castrejon-Pita
University of Oxford, United Kingdom
Drops and jets: From droplet generation and breakup to impact and splashing
20.12.2023, hybrid

Dr. Thomas Sykes
University of Oxford, United Kingdom
Droplet splashing on dry and wet surfaces
20.12.2023, hybrid

MESSEAUFTRITTE TRADE FAIR PRESENTATIONS

Tire Tech Expo, Hannover
21. – 23.03.2023

JEC, Paris
25. – 27.04.2023

VERANSTALTUNGEN FÜR DIE ALLGEMEINE ÖFFENTLICHKEIT EVENTS FOR THE GENERAL PUBLIC

Woche der Offenen Unternehmen Sachsen „Schau rein!“
15.03.2023
im Rahmen der zentral organisierten Veranstaltungen zur Berufsorientierung für Schülerinnen und Schüler
8 Teilnehmer

Lange Nacht der Wissenschaften
21 offene Labors und Technika, Kinderexperimentierprogramm, Ausbildungsinfostand
30.06.2023
1000 Teilnehmer

Girls’ Day
27.03.2023
Präsenz-Veranstaltung: Forschen an den Werkstoffen der Zukunft:
Online-Veranstaltung: Arbeitsplatz Forschungsinstitut – Zukunft gestalten durch Materialforschung
33 Teilnehmer

Ausstellung “SciArt”
12. – 31.08.2023
Ausstellung “Introduction of Polymer Science Language to Broader Chemical Community through Arts (SciArt)”
45 Teilnehmer

Lehrtätigkeit Teaching

PROFESSUREN PROFESSORSHIPS

Technische Universität Dresden

Bereich Mathematik und Naturwissenschaften, Fakultät Chemie und Lebensmittelchemie

- **Prof. Dr. Andreas Fery**
  Professur für Physikalische Chemie Polymerer Materialien
- **Prof. Dr. Brigitte Voit**
  Professur für Organische Chemie der Polymere
- **Prof. Dr. Carsten Werner**
  Professur für Biofunktionelle Polymermaterialien

Bereich Mathematik und Naturwissenschaften, Fakultät Physik

- **Prof. Dr. Arash Nikoubashman**
  Professur für Theorie biologisch inspirierter Polymere
- **Prof. Dr. Jens-Uwe Sommer**
  Professur für Theorie der Polymere

Bereich Ingenieurwissenschaften, Fakultät Maschinenwesen

- **Prof. Dr.-Ing. Markus Stommel**
  Professur für Polymerwerkstoffe
- **Prof. Dr.-Ing. Sven Wießner**
  Professur für Elastomere Werkstoffe

Medizinische Fakultät Carl Gustav Carus Zentrum für Regenerative Therapien Dresden

- **Prof. Dr. Carsten Werner**
  Professur für Biofunktionelle Polymermaterialien

Medizinische Fakultät Carl Gustav Carus Else Kröner Fresenius Zentrum für Digitale Gesundheit

- **Prof. Dr. Ivan R. Minev**
  Professur für Electronic Tissue Technologies

ANDERE EINRICHTUNGEN OTHER INSTITUTIONS

Hochschule für Technik und Wirtschaft Dresden

Fakultät Design

- **Prof. Dr.-Ing. Axel Spickenheuer**
  Honorarprofessur für Werkstoffe und Simulationstechnik

Otto-von-Guericke-Universität Magdeburg

Fakultät für Verfahrens- und Systemtechnik

- **Prof. Dr. Julian Thiele**
  Leiter des Lehrstuhls für Organische Chemie

Stellenbosch University, Südafrika

Department of Chemistry and Polymer Science

- **Prof. Dr. Albena Lederer**
  SASOL Chair in Analytical Polymer Science

Monash University, Australien

Department Chemical and Biological Engineering

- **Prof. Dr. Daniela Lössner**
  Associate Professor

Technische Universität Hamburg

Head of Functional Electronic Materials Group (FEM)

- **Prof. Dr. Franziska Lissel**
  Professor of Applied Polymer Physics

WEITERE LEHRAUFTRÄGE FURTHER TEACHING ASSIGNMENTS

Technische Universität Dresden

Bereich Mathematik und Naturwissenschaften

- **PD Dr. Tobias A. F. König** – TUD Young Investigator in der Fakultät Chemie und Lebensmittelchemie sowie Privatdozentur im Gebiet Physikalische Chemie
- **Dr. Elisha M. Krieg** – TUD Young Investigator in der Fakultät Chemie und Lebensmittelchemie
- **Dr. Franziska Lissel** – TUD Young Investigator in der Fakultät Chemie und Lebensmittelchemie
- **Dr. Christian Roßner** – TUD Young Investigator in der Fakultät Chemie und Lebensmittelchemie
- **Dr. Abhinav Sharma** – TUD Young Investigator in der Fakultät Physik
- **PD Dr. Martin Müller** – Privatdozentur im Gebiet Makromolekulare Chemie

Bereich Ingenieurwissenschaften

- **PD Dr. Marina Grenzer** – Privatdozentur für Rheologie komplexer Fluide
- **Dr.-Ing. Ines Kühnert** – Lehrauftrag in der Fakultät Maschinenwesen
- **Dr. Andreas Leuteritz** – Lehrauftrag in der Fakultät Maschinenwesen

Bereich Ingenieurwissenschaften, fakultätenübergreifend
Graduiertenkolleg 2430 „Interaktive Faser-Elastomer-Verbunde“

- **PD Dr. Marina Grenzer**
- **Prof. Dr.-Ing. Sven Wießner**

Graduiertenkolleg 2767 “Supracolloidal Structures”

- **Prof. Dr. Andreas Fery**
- **Prof. Dr. Brigitte Voit**
- **Dr. Franziska Lissel**
- **Dr. Christian Roßner**

Graduiertenkolleg 2250 „Impaktsicherheit von Baukonstruktionen durch mineralisch gebundene Komposite“

- **Prof. Dr.-Ing. Christina Scheffler** – TUD Young Investigator in der Fakultät Bauingenieurwesen

Luleå University of Technology (LTU), Sweden

Department of Engineering Sciences and Mathematics

- **Prof. Dr.-Ing. Christina Scheffler** – Gastvorlesung zu Verstärkungsfasern und Faser-Matrix-Grenzschichten

Southwest Jiaotong University (SWJTU) in Chengdu, China

School of Materials Science and Engineering

- **Dr. Manfred Maitz** – Gastprofessur

Brandenburgische Technische Universität Cottbus-Senftenberg

Fakultät Maschinenbau, Elektro- und Energiesysteme

- **Dr.-Ing. Ines Kühnert** – Lehraufträge „Verarbeitungsbedingte Materialstrukturen“ und „Aufbau und Materialverhalten der Kunststoffe“