

CINSaT

Center for
Interdisciplinary Nanostructure
Science and Technology

Newsletter No. 15 (December 2023)

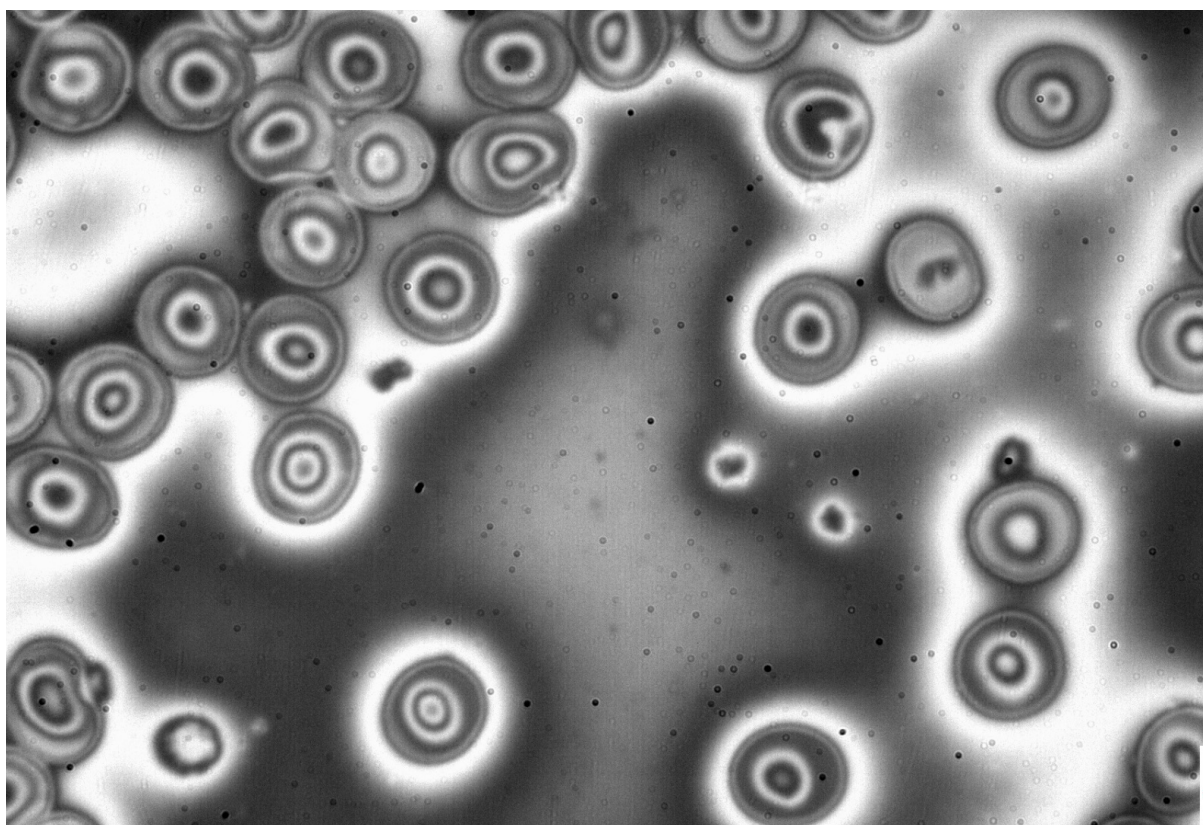


Table of Contents

4 Preface

Education

5 20 Years Study Programme of Nanoscience in Kassel

6 The Origin of the Term Nanoscience - A Discussion with ChatGPT

Research Highlights

8 Laser recognizes cancerous tissue

10 Simultaneous and independent topological control of microparticles in nonperiodic energy landscapes

New Projects

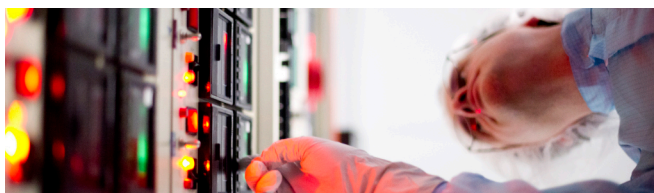
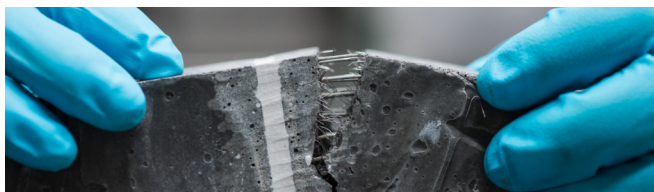
12 Algae-based phlorotannins as sustainable nanomaterials for epoxy resin formulation

Latest Reports

14 CINSaT Autumn Colloquium 2023

Nano Arts

Imprint



Cover Image

Image of blood platelets ($225\text{ }\mu\text{m} \times 225\text{ }\mu\text{m}$) taken from the image stack of the depth scan of a measurement with a white light interferometer.

(Dr. Sebastian Hagemmaier)

Preface

Dear readers,

welcome to the second issue of the CINSaT Newsletter in 2023. The second half of the year was dominated by informal meetings between the CINSaT executive board, the presidential board, and the administration of the University of Kassel, discussing the future role of CINSaT as the organizing institution of the planned new nanotechnology center (NTC). The NTC will offer state-of-the-art technologies to internal and external users alike. Related to this, a workshop initiated by the president and co-organized by CINSaT took place on November 23rd, where possible major topics and the possible involvement of new research groups were discussed. I presented as an introductory talk an overview about CINSaT history, highlights and about the future organization of the NTC under the umbrella of CINSaT. Future users of the NTC (mainly CINSaT members) presented in small groups prospect projects and explained what equipment and resources are necessary for the NTC to realize these projects. The president of the university, Prof. Dr. Ute Clement, and the vice-president for research, Prof. Dr. Michael Wachendorf, stated that the workshop was very helpful, informative, and highlighted the already existing interdisciplinary collaboration built and promoted by CINSaT over the last 20 years.



That nanoscience gets historic in Kassel became also obvious by the meeting of 23 former nanoscience students from the first cohort 20 years ago. They are in the meantime spread over Germany and abroad. See a brief report about this anniversary event. Despite the history, CINSaT is open to the future and asked ChatGPT about nanoscience. In a short article a chat is presented with ChatGPT to learn more about the history of nanoscience. However, the questioner is facing some obstacles. Both articles can be found in the Education section.

Also in November, the annual autumn colloquium took place with four interesting talks given by three external and one internal speakers. More about it you can read in the Latest Report section.

As usual the CINSaT members provided the main contents of the newsletter. In the New Projects section Dr. Andreas Winkler is presenting the project AlgoForm (Algae-based, thermoformable natural fiber matrix semi-finished products with a thermoset property profile) about algae-based pholortannins as sustainable nanomaterials for epoxy resins formulation, funded by the Federal Ministry of Food and Agriculture. The project is a collaboration of the Department for Cutting and Joining Manufacturing Processes (Prof. Dr. Stefan Böhm) and the Department for Physical Chemistry of Nanomaterials (Prof. Dr. Thomas Fuhrmann-Lieker), which was kick-started with CINSaT Seed Money.

In the Research Highlights section Prof. Dr. Thomas Baumert, presents a recent publication about how ultra-short laser pulses can be used to identify cancer tissue. Excision of the cancerous tissue is often the gold standard in treatment of some types of cancer. During operation, tissue samples are examined in a time-consuming process to validate if all cancerous material is removed. Prof. Baumert and his co-workers in collaboration with the Institute for Pathology North Hesse have developed a method to make the treatment faster, safer and gentler. Prof. Dr. Arno Ehresmann presents a work about simultaneous and independent topological control of identical microparticles in nonperiodic energy landscapes. Here magnetic microparticles are navigated on topologically protected transport trajectories over designed magnetic domain patterns created by light ion-bombardment of Co/Au multilayer films.

I hope you will enjoy the reading of this issue!

A handwritten signature in black ink, reading "J. P. Fuhrmann-Lieker".

Education

20 Years Study Programme of Nanoscience in Kassel

On Saturday, November 25, 2023, a special event took place in Kassel. Twenty-three former students of the very first Nanoscience cohort gathered to celebrate the 20th anniversary of the start of their studies in 2003, when the programme was launched under the English title „Nanostructure and molecular science“. The start coincided with the foundation of CINSaT and was preceded by a period of reorientation.

The former chemistry programme was stopped and two new chemistry professors were appointed in the Faculty of Physics to launch the common project of Nanoscience. The new students faced the problem of always being the first with no-one to ask, in the university classes as well as on the job market, as they recounted to the young Bachelor students who were invited to join this event. Nevertheless, they all made their way to different professions, ranging from school teaching to self-employment and research in non-university institutions. According to their accounts, the interdisciplinary education in the Nanoscience programme helped them a lot in finding their own interest, even if they did not follow the path towards nanoscience further.

A highlight was definitely a tour through the floors of AVZ which arose some memories of their classes and labs. Still some former students got lost in the wings of the building. And some wondered why the faculty has not yet moved to the main campus, as was already announced at the beginning of their studies.

We educators hope that this extraordinary event may be the first step towards an alumni network since a solid link bringing alumni and present students together on a regular basis is still missing.

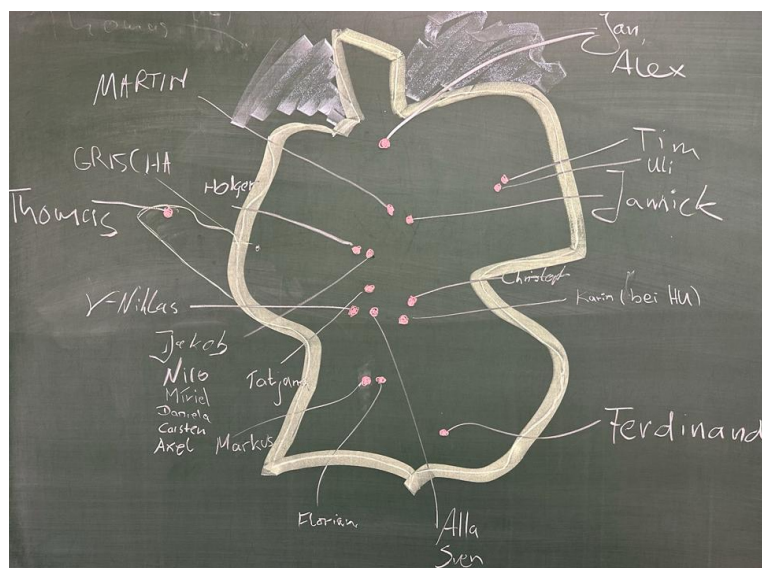


Figure 1: To these locations inside and outside Germany they are scattered now.



Figure 2: Class photo of the first nanoscience cohort, taken 20 years after the first semester.

The Origin of the Term Nanoscience - A Discussion with ChatGPT

The following discussion was held by Prof. Dr. Thomas Fuhrmann-Lieker on March 10, 2023 with ChatGPT in order to look for the first occurrence of the term Nanoscience. Unfortunately, ChatGPT cannot look as deep in literature as it would be necessary. Good news for historians of science, and a quest that is still open...

What was the first time the word "Nanoscience" was used?

The term "nanoscience" was first used in 1965 by physicist Richard Feynman in his famous lecture "There's Plenty of Room at the Bottom," where he discussed the possibility of manipulating and controlling individual atoms and molecules. However, it wasn't until the 1980s that the field of nanoscience began to emerge as a distinct area of research, with the development of advanced tools and techniques for observing and manipulating materials on the nanoscale.

Comment: *The Feynman lecture is seminal for the field of nanoscience and nanotechnology, but the term Nanoscience was not mentioned in the talk as published.*

In what part of the lecture did he say the word Nanoscience, quote it.

I apologize for my previous response. Upon reviewing the transcript of Feynman's lecture, "There's Plenty of Room at the Bottom," I was unable to find any instance where he used the word "nanoscience." While Feynman did discuss the possibility of manipulating and controlling individual atoms and molecules, he did not use the specific term "nanoscience" in his lecture. I apologize for any confusion my previous response may have caused.

So what was the actual first time Nanoscience was used? I apologize for the confusion in my previous responses. The term "nanoscience" was actually coined by the Japanese researcher Norio Taniguchi in 1974, in a paper titled "On the Basic Concept of 'Nano-Technology'" published in Science and Technology of Welding and Joining. In the paper, Taniguchi used the term to describe the study of materials with structural features on the nanometer scale. Since then, the field of nanoscience has grown rapidly, with numerous breakthroughs and applications in fields such as materials science, electronics, and biomedicine.

We all know that Taniguchi first used the term Nanotechnology, but as an engineer, he did not mention Nanoscience.

In what part of the paper did he say the word Nanoscience, quote it

I apologize for any confusion. After reviewing the paper, "On the Basic Concept of 'Nano-Technology'" by Norio Taniguchi, I have found that the word "nanoscience" is not actually used in the paper. Instead, Taniguchi used the term "nano-technology" to describe the ability to manipulate materials at the nanoscale level. In the paper, he writes: "The word 'nano-technology' has lately been used frequently to describe this kind of fabrication technology. It is the technology to make things directly, by controlling atoms and molecules, and there are both electrical and mechanical applications." I apologize for any confusion my previous responses may have caused.

Nice, but we want to find out when Nanoscience was mentioned first.

So what was the actual first time Nanoscience was used?

I apologize for the confusion in my previous responses. The term "nanoscience" was actually coined by the Japanese researcher K. Eric Drexler in his 1986 book "Engines of Creation: The Coming Era of Nanotechnology". In the book, Drexler used the term to describe the study of materials on the nanoscale and the potential for developing new technologies based on nanoscale phenomena. Since then, the term "nanoscience" has become widely used to describe the study of materials and systems on the nanoscale.

Now we come to the public dissemination of the new field, but was it called Nanoscience by Drexler?

In what part of the book did he say the word Nanoscience, quote it

I apologize for any confusion. After reviewing "Engines of Creation" by K. Eric Drexler, I have found that the word "nanoscience" is not actually used in the book. However, Drexler did use related terms such as "nanotechnology" and "nanomachines" to describe the potential for manipulating materials and building structures on the nanoscale. For example, in the book, he writes: "By positioning atoms or molecules using some kind of 'nano-positioning tool,' we could build machines that are vastly smaller and more efficient than those made of macroscopic parts. These machines, which I call 'assemblers,' would be able to build more assemblers, as well as other

molecular machines and conventional macroscopic machines. The technology for building assemblers is called 'molecular manufacturing,' or simply 'nanotechnology.'" I apologize for any confusion my previous responses may have caused.

Where was Drexler from?

K. Eric Drexler is an American engineer and researcher. He was born on April 25, 1955, in Alameda, California, United States. Drexler is known for his contributions to the field of nanotechnology and molecular manufacturing, and his book "Engines of Creation" is considered a seminal work in the field.

We give ChatGPT a short break, but we insist further.

So what was the actual first time Nanoscience was used?

I apologize for any confusion my previous responses may have caused. After conducting further research, I found that the term "nanoscience" was first used by the scientist, Horst Störmer in 1986, in a paper titled "The fractional quantum Hall effect" published in Physical Review Letters. In the paper, Störmer used the term "nanoscience" to describe the study of the physical properties of materials at the nanometer scale. The specific quote from the paper where the term is used is as follows: "The motivation for this letter is to point out that the understanding of the physics of the fractional quantum Hall effect provides a novel and exciting opportunity for nanoscience in general." I apologize for any confusion my previous responses may have caused and I hope this answer clarifies the origins of the term "nanoscience".

This reference is not possible to find. "The fractional quantum Hall effect" was the title of the Nobel lecture of Horst Störmer, but not of any paper in Phys. Rev. Lett. in 1986. Anyway.

There has to be a previous mention of it

I apologize for any confusion my previous responses may have caused. Upon further research, I have found that the term "nanoscience" was actually first used by an author named M.K. Schwab in his 1971 book "Dimensions in Chemistry: A Symposium Sponsored by the Division of History of Chemistry at the 161st Meeting of the American Chemical Society." In the book, Schwab used the term "nanoscience" to refer to the study of the behavior and properties of materials at the nanometer scale. The specific quote from the book where the term is used is as follows:

"Thus, the new science, Nanoscience, will have its own problems and its own approach, and will have to be developed side by side with solid state physics and chemistry." I apologize for any confusion my previous responses may have caused and I hope this answer clarifies the origins of the term "nanoscience".

Now, being driven into the corner, ChatGPT invents a reference that would be difficult to find but actually does not exist. I contacted the Division of History of ACS about the alleged Symposium Proceedings. It turned out there was no contribution by a M.K. Schwab, not even a symposium about dimensions in chemistry at the 161st meeting of the ACS. Thanks to Vera Mainz for her effort in looking at the archives and A. Lieker for typing the questions in. It would have been a nice discovery to be able to go back until 1971. Traditional abstract research via Web of Science leads to a 1991 paper by Bianconi et al. in the context of biomineralization (P.A. Bianconi, J. Lin, A.R. Strzelecki, Nature 349, 315, 1991). But this is maybe not the very first occurrence. The quest is still open...

Research Highlights

Laser recognizes cancerous tissue

Researchers in CINSaT have developed a method of using ultra-short flashes of light to make cancer operations faster and gentler.

The most important method for removing cancer in its early stages is excision. However, the correct safety margin is crucial to ensure complete tumor removal, i.e., a minimal envelope of healthy tissue must be removed around the affected tissue. A safety margin that is too small can lead to relapse, while one that is too large can restrict the function of the affected organ.

To decide whether the malignant tissue has been completely removed, a so-called frozen section examination is often performed. A laboratory doctor examines the removed tissue during the operation by shock freezing, cutting and staining it outside the operating theater. This allows him to determine whether the correct safety distance was maintained during removal. The further course of the operation depends on the result of this time-consuming process.

It would be desirable to have an alternative or supplementary technique with which the type of tissue operated on can be determined quickly and precisely to reduce the operation time and the strain on the patient.

This is where the work of the CINSaT researchers comes in. Using liver cancer and breast cancer samples from the archives of the Institute of Pathology North Hesse, they achieved an

accuracy of 95% to almost 100% in differentiating between healthy and diseased tissue using a laser method. To do this, ultra-short laser flashes lasting a few billionths of a second are sent at the tissue, causing only slight ablation of the tissue. This produces light that indicates the chemical composition of the tissue. This process was first demonstrated on plant tissue at CINSaT twenty years ago and has now been applied to this problem. Evaluation methods based on machine learning were used to differentiate between healthy and diseased tissue.

The new method was developed by the experimental physicists Prof. Dr. Thomas Baumert, Arne Senftleben, Cristian Sarpe, Elena Ramela Ciobotea, Christoph Burghard Morscher, Bastian Zielinski, and Hendrike Braun in cooperation with the physician Prof. Dr. Josef Rüschoff. The researchers assume that this method for rapid tissue determination will find its way into the operating theater after further research and development work. If ultrashort pulse lasers are used as cutting tools during surgery, this method can even distinguish healthy from diseased tissue directly during the incision.

Baumert: "This procedure cannot cure cancer. But it can make treatment faster, safer, and gentler."

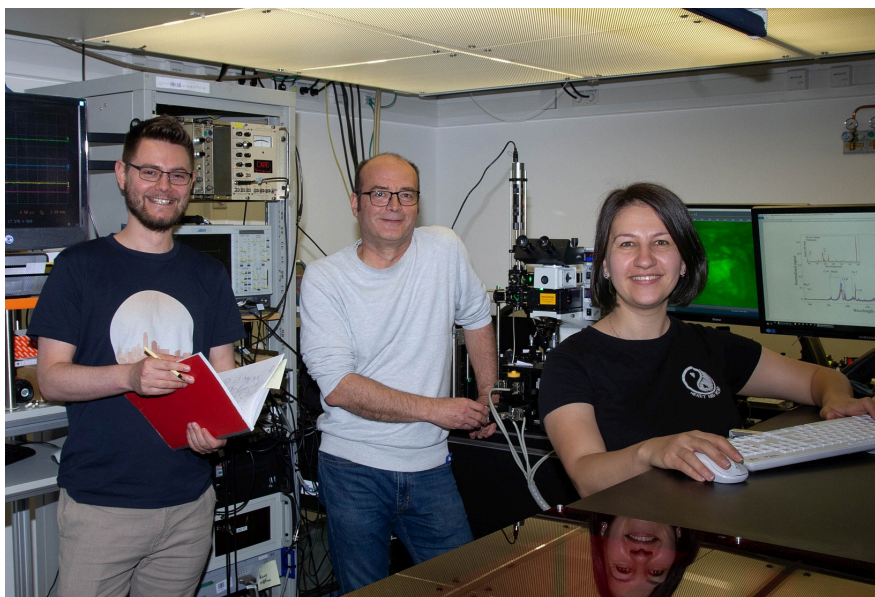


Figure 1: Femtosecond material processing lab. From left to right: Bastian Zielinski, Cristian Sarpe, Elena Ramela Ciobotea.

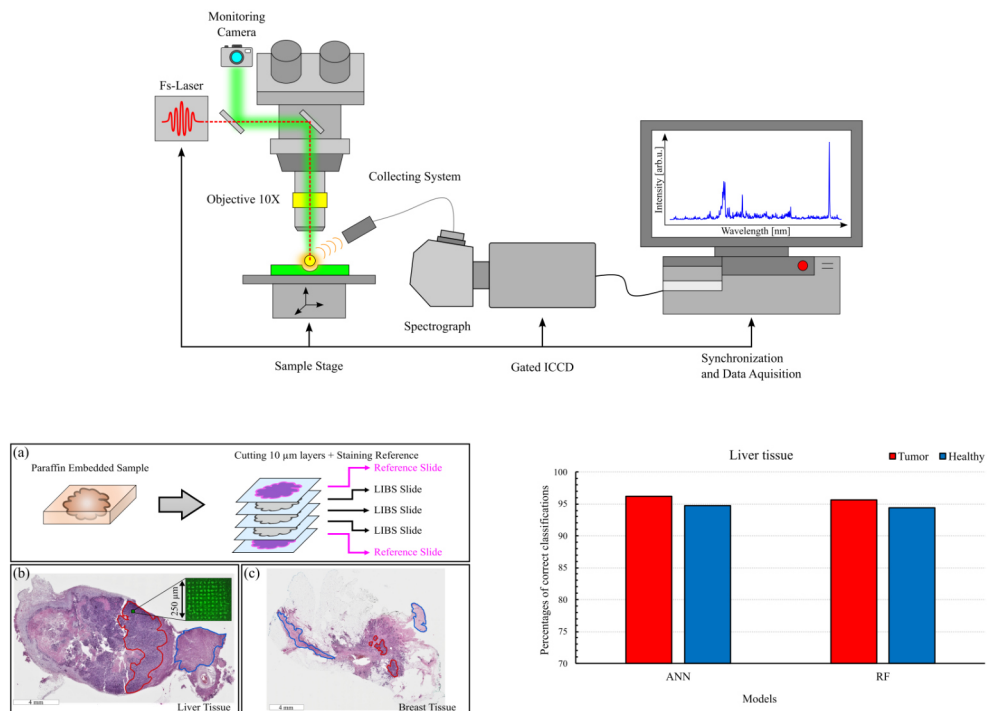


Figure 2: Experimental Setup (upper row), sample preparation (lower row left), artificial intelligence results on liver tissue (lower row right).



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Simultaneous and independent topological control of microparticles in nonperiodic energy landscapes

Topological protection ensures stability of specific magnetic particle transport trajectories against perturbations. We have explored experimentally and computationally topologically protected transport trajectories of magnetic colloids above spatially inhomogeneous magnetic patterns, where complex transport trajectories may be encoded in both the driving loop (i.e. a rotating external magnetic field) or the magnetic pattern. In the present investigations a magnetic domain pattern has been engineered by light ion-bombardment induced magnetic patterning, featuring a topological defect that functions as an attractor or a repeller of magnetic microparticles, as well as a pattern that directs microparticles along a prescribed complex trajectory. Using simple engineered magnetic domain patterns and complex loops, we simultaneously and independently control the motion of several identical microparticles differing only in their positions above the pattern. Combining complex patterns and complex loops we transport microparticles from unknown locations to predefined positions and then force them to follow arbitrarily complex trajectories concurrently. Our findings pave the way for new avenues in transport control and dynamic self-assembly in colloidal science.

transport complexity can be broken down to a finite set of special orientations of the external field. A modulation loop that winds around one of those orientations induces transport along a known direction in a known region of the pattern. The motion is topologically protected since only the winding numbers of the modulation loop around the special orientations (topological invariant) are important. Hence, it is relatively simple to generate loops and patterns that induce arbitrarily complex trajectories. These ideas might be transferable to other systems in which the transport is also based on topological protection. These include, solitons, nano-machines, sound waves, photons, and quantum mechanical excitations. The complexity of the transport is encoded in the magnetic potential which varies in space and in time via the magnetic patterns and the modulation loops, respectively. The current approach has been restricted to identical isotropic paramagnetic particles. However, colloidal particles with different characteristics (e.g. diamagnetic and paramagnetic particles or particles with different shapes) might belong to different topological classes and, therefore, open up further possibilities for topologically protected transport and motion control. A precise control over the transport depending not only on the position but also on the particle characteristics is then possible. Therefore, beyond offering the possibility to control the transport of identical microparticles simultaneously, our work also opens a new route towards dynamical self-assembly in colloidal science. As an example, we have created a colloidal rod factory in which identical isotropic particles are transported towards a reaction site in which they self-assemble. Only when they reach the desired aspect ratio, do the rods leave the polymerization site following the desired trajectory. The use of patchy colloids with, e.g. hybridization of complementary DNA strands and other shape-anisotropic particles would offer more versatility to create complex functional structures.

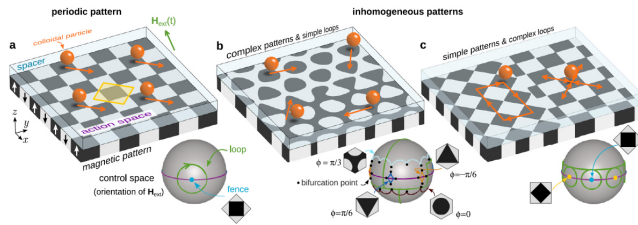


Figure 1: Designed magnetic domain patterns in Co/Au magnetic multilayers, engineered by light-ion bombardment induced magnetic patterning. (a) a fully periodic checkerboard pattern, (b) a complex pattern with adiabatic domain inversion along one lateral direction, (c) two adjacent periodic patterns with different orientations and with a defined (hard) boundary. The control space, indicating the loop of the external magnetic field (with constant magnitude) for each case is indicated.

In this contribution it is shown that the superposition of a complex static magnetic field landscape (engineered by light-ion bombardment induced magnetic patterning of magnetic thin film systems) with a simple time-dependent uniform external field of varying orientation allows the control of the motion of several identical microparticles independently and simultaneously. The

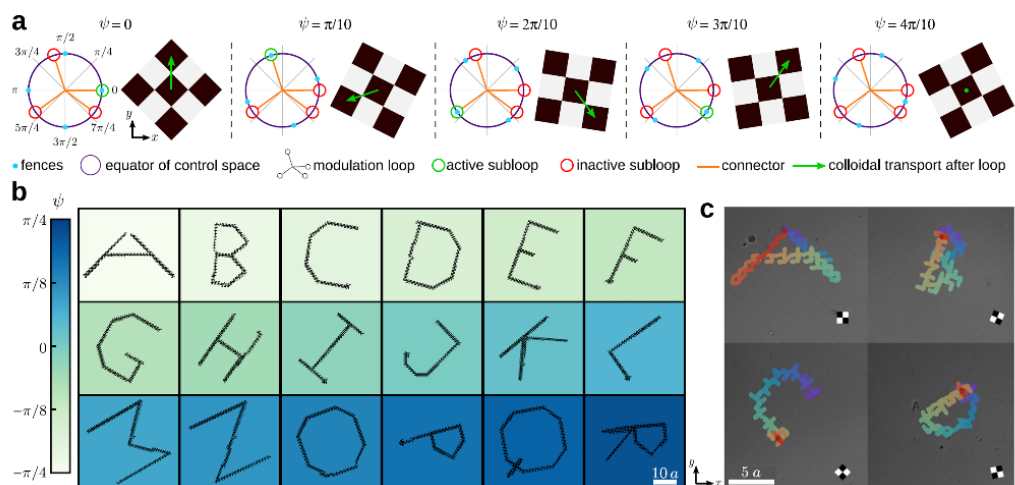


Figure 2: (a) Five square magnetic patterns (and their corresponding control spaces) with a different value of the global pattern orientation. The modulation loop (of the external field) consists of four interconnected subloops that wind counterclockwise. Depending on the pattern orientation, the modulation loop induces different transport directions or no transport at all. (b) A pattern made of 18 patches with square symmetry and different global orientation (color bar). A modulation loop controls the trajectories of particles above each patch simultaneously and independently. The particle trajectories (black) write the first 18 letters of the alphabet. (c) Experimental trajectories of colloidal particles above four square patches rotated with respect to each other. A schematic unit cell illustrating the global orientation is depicted in each patch. The length of the scale bar is $5a$ and in this case, we use patterns with $a = 7 \mu\text{m}$. A unique modulation loop transports the four colloidal particles simultaneously. The trajectories are colored according to the time evolution from blue (initial time) to red (final time).

Further Information

This publication: Stuhlml  ller et al. Nature Communications 14, 7517 (2023)

Light-ion bombardment induced magnetic patterning: Gaul et al. Beilstein J. Nanotechnol. 9, 2968 (2018) and references therein

Basics of topologically protected transport: L  hr et al. Soft Matter 13, 5044 (2017)



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New Projects

Algae-based phlorotannins as sustainable nanomaterials for epoxy resin formulation

Sustainable alternatives to petroleum-based chemicals from biological feedstock have become hugely important as worldwide attempts to reduce the rate of global warming are being conducted. Thus, in the past years, fundamental research on polymeric materials that possess similar properties as well-established systems but with a smaller product carbon footprint, often in combination with high recyclability and bio-degradability, has been drastically extended.

Epoxy resins especially are of high importance for manufacturing processes due to their unique technical properties, e.g. high mechanical strength, high chemical resistance, and good adhesion properties. Therefore, when improving the sustainability of epoxy resins, the biobased synthesis of precursors or components is of utmost importance. However, bisphenol A, the fundamental chemical for epoxy resin production, is still unavailable from biological sources. Theoretical alternatives have emerged in recent years like epoxidized vegetable oils but drawbacks like inferior reactivity and general low glass transition temperature limit their use as thermoset resins for highly demanding industrial use cases. Thus, the search for additional biological feedstock that can be readily converted into reactive resin components by well-established methods is ever so crucial for sustainable manufacturing.

From a chemical standpoint, phlorotannins, a class of polyphenols, may serve as a suitable feedstock for epoxy resin production. They are primarily found in brown algae and can be considered oligomers derived from phloroglucinol (1,3,5-trihydroxybenzene). The composition of the phlorotannin mixture in algae varies from species to species but is also highly dependent on the growth conditions. The most common compounds found in brown algae are displayed in Fig. 1.

Total phlorotannin contents of up to 20% of the dry weight can be achieved which makes algae suitable, also from an industrial point of view, for sustainable-efficient raw material development.

To explore the potential of the materials, with the help of CINSaT's seed money, the authors started a project for extraction and functionalization of phlorotannins for network formation. The extraction of the phlorotannins can in general be carried out with water containing small admixtures of alcohols or acetone supported for example by ultrasound. The crude fractions can be further purified by extraction with organic solvents. The reaction of polyphenols with epichlorohydrin is then the most common synthesis pathway for gaining epoxy resins.

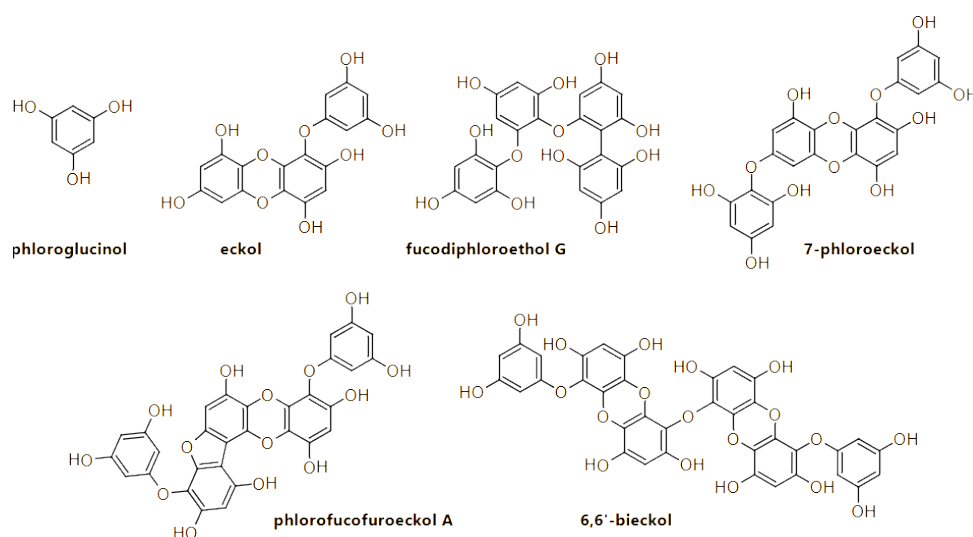


Figure 1: The most common phlorotannins found in brown algae (Santos SAO et al.: *Biomolecules* 2019, 9, 847).

Considering this background the authors established further a strategy for the development of a fiber-reinforced plastic (FRP) based on algae epoxy resins and a flax textile. The matrix of the FRP is also to be developed as a vitrimer, a certain class of thermosets that are prone to bond cleavage in a dynamic equilibrium at higher temperatures, making the material especially suitable for flexible hot-forming production strategies based on semifinished products.

Based on the successful Seed Money project, a research proposal was submitted to the FNR (Fachagentur Nachwachsende Rohstoffe e.V.) in April 2022 that was granted in June 2023 with a total funding of 328,360 €. Additional cooperation partners are HOBUM Oleochemicals, a medium-sized company based in Hamburg that produces high-quality products based on renewable raw materials, and AlgenProjekt Meeresalgenland UG, based in Potsdam and located in Ostenfeld (Schleswig-Holstein), which develops and operates pilot plants for land-based macroalgae cultivation.

Ongoing activities include

- determination of the phlorotannin content of different algae species as the basis for future algae cultivation
- development of efficient phlorotannin extraction procedures
- curing kinetic experiments (DSC) and glass temperature and viscosity measurements with a phloroglucinol-based epoxy resin model compound and anhydride-based curing agents
- preparation of flax fiber-reinforced plastic boards

Further Information

Project Name:

Algenbasierte, warmumformbare Naturfaser-Matrix-Halbzeuge mit duomerem Eigenschaftsprofil (AlgoForm); Algae-based, thermoformable natural fiber matrix semi-finished products with a thermoset property profile (AlgoForm)

Project Sponsor:

BMEL (FMFA)

Project Management:

Fachagentur Nachwachsende Rohstoffe e.V.

Funding Program: Nachwachsende Rohstoffe



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Latest Reports

CINsaT Autumn Colloquium 2023

Up to 100 participants at the annual CINsaT autumn colloquium listened to four scientific talks and joined discussion during the poster session

On 1st of November 2023, the annual autumn colloquium of the CINsaT took place in lecture hall 282 at the Campus Heinrich-Plett-Straße of the University of Kassel. The line-up of four high-profile speakers - 3 external, 1 internal - attracted professors, doctoral students, and undergraduate students alike with over 100 participants at the peak. The CINsaT autumn colloquium is open to all who are interested in scientific research related to the nanosciences. Besides the four talks about current relevant topics there is plenty of opportunity for scientific exchange during the breaks and the poster session where the research of the CINsaT members is presented by highly motivated postdoctoral and doctoral students.

The colloquium started as usual with the welcome speech of Prof. Dr. Johann Peter Reithmaier, head of the CINsaT, who led into the first part of the lecture series that was opened by Prof. Dr. Gerrit Groenhof from the University of Jyväskylä (Finland) with his talk about "Manipulation Materials with Mirrors: insights from Multi-scale Molecular Dynamics Simulations". The University of Jyväskylä is a partner university of Kassel and operates a nanosciences center (NSC) with interdisciplinary approach to research nanoscale phenomena, which is an inspiration for the future activities of the CINsaT regarding organization and management of joined facilities. Prof. Groenhofs talk was followed by a talk entitled "GaN an InGaN based Hetero- and nanostructures grown by Molecular Beam Epitaxy" from Prof. Dr. Angela Rizzi of the University of Göttingen. After a half-hour coffee break with cookies and cake, which was used not only to get to know each other, but also for the first review of the posters, the second part of the lecture series followed. The third talk of the event was given by Dr. Falko Schmidt from the ETH Zürich with the title "Defying stiction: Counteracting Casimir-Lifshitz forces with Repulsive Critical Casimir Forces for Dynamic Control of Micro- and Nanodevices". The lecture series was finished with a talk by Prof. Dr. Wenwen Song with the title "Nano-engineering of Sustainable Metallic Materials". Prof. Song joined the University of Kassel in early 2023 and her talk was part of the application process to become full member of the CINsaT. All talks sparked a lot of discussions which were continued during the poster session.

The poster session following the lectures showed in total 58 contributions from the groups of the CINsaT members. The foyer in front of lecture hall 282 offered not only enough space for the numerous poster contributions, but also for extensive scientific discussions and the exchange of information on current research done within the CINsaT. The catering of the Studierendenwerk Kassel provided again for the well-being of the participants during the event with a wide variety of foods and beverages. The conclusion of the event was the presentation of the poster prizes awarded by this year's jury - consisting of CINsaT members Prof. Dr. Mohamed Benyoucef, Prof. Dr. Stefan Buhmann, Prof. Dr. Guido Falk von Rudorff and Prof. Dr. Jörg Kleinschmidt - for the three best poster contributions (Gift cards of 150 €, 100 € and 50 € value for the first, second and third place, respectively). The jury emphasized the high scientific quality of the posters in this year's poster session which made the decision to award the prizes very difficult.

The first price was given to the poster titled "Chiral Rydberg States" by Stefan Aull from the Light-Matter-Interaction research group (Prof. Dr. Kilian Singer). The second and third prize were given to Ranbir Kaur (Quantum Nano Photonics, Prof. Dr. Mohamed Benyoucef) with her poster entitled "Telecom wavelength InP-based quantum dots" and Ali Rahmani (Hydrogeology research group, Prof. Dr. Adrian Mellage) for his poster about "Chromium remediation on magnetite-coated surfaces: An assessment of the removal efficiency", respectively. Due to the high number of participants, both in the audience as well as the poster contributions, and the thematically balanced lectures of the speakers, the CINsaT Autumn Colloquium was a success, and we are looking forward to next year.

The audience is listening to the talk of Dr. Falko Schmidt.

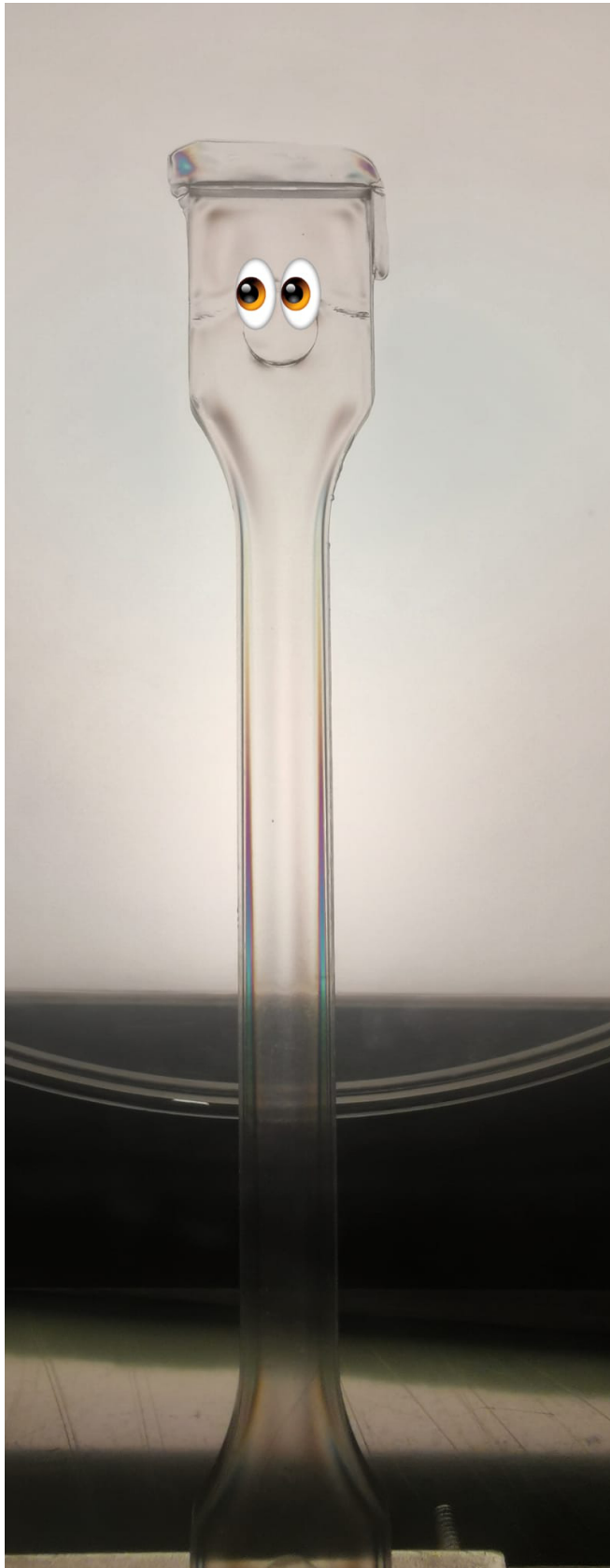


New CINSaT member Prof. Dr. Wenwen Song giving her application talk.

Winners and jury of the poster prizes - From left to right: CINSaT speaker Prof. Johann Peter Reithmaier, Jury member Prof. Jörg Kleinschmidt, 1st prize winner Stefan Aull, Jury members Prof. Guido von Rudorff and Prof. Stefan Buhmann, 2nd prize winner Ranbir Kaur, Jury member Prof. Mohamed Benyoucef, and 3rd prize winner Ali Rahmani.



Nano Arts



A tensile test specimen made out of polylactic acid (PLA) viewed under a polariscope to reveal stress in the material. Cracks and excess material give the upper part a smile and an Elvis-like hairstyle.

Image taken by Margarita Reit

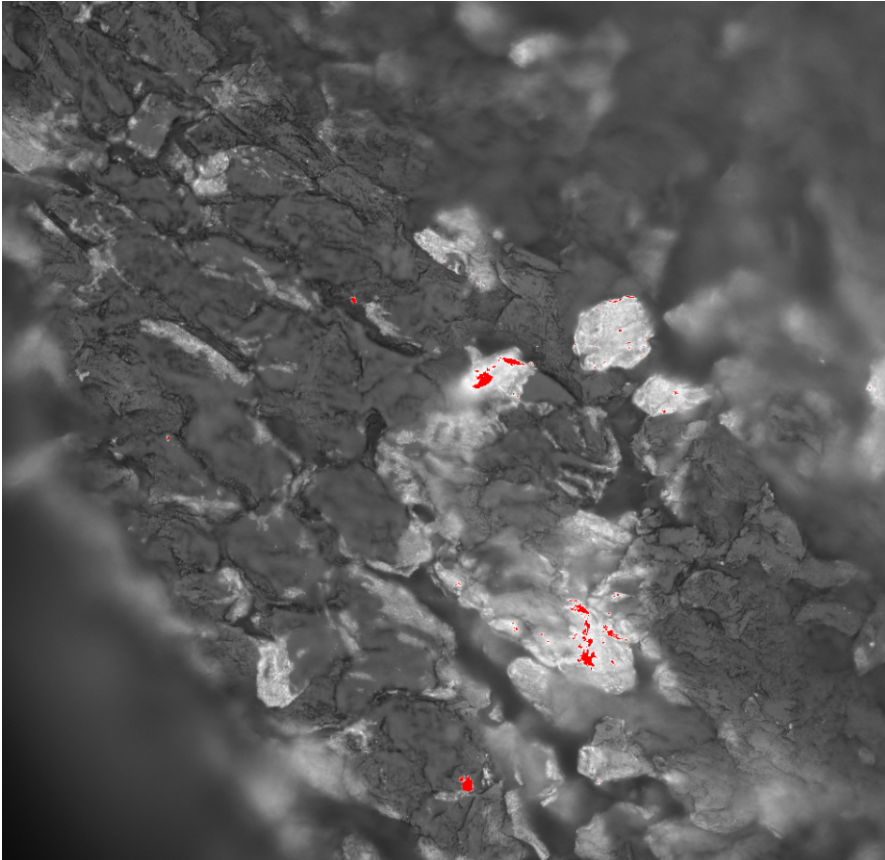


Image of human skin (320 μm x 320 μm) taken from the image stack of the depth scan of a measurement with a white light interferometer.

Image taken by Sebastian Hagemair



Photo: Campus Heinrich-Plett-Straße, Press and Public Relations Office University of Kassel, Studio Bläfield

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