

01/2024



# PTS NEWS

FIBRE based solutions for tomorrow's products

## PTS Networking Day – “Wir für Papier”



**TomoBale – High Tech  
meets Reality** p. 8

**EL-Cat – Graphite paper-based cathodes in  
AEM electrocatalysis for CO<sub>2</sub> conversion** p. 10

**Adhesive strength test – The upgraded corrugated-board adhesion tester** p. 20

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# Summary

## Cover page topic

- p. 04 PTS Networking Day – Interview with Frank Miletzky and Thorsten Voß

## Latest news from research

- p. 06 Let's talk: Our FCM (Food Contact Materials) Team
- p. 08 TomoBale – High Tech meets Reality
- p. 10 Graphite paper-based cathodes in AEM electrocatalysis for CO<sub>2</sub> conversion – EL-Cat project completion
- p. 11 New challenges for a time-tested and sustainable material system – Development and qualification of vulcanized fibre papers
- p. 12 Start of "maNIPulate" IGF project – Development of polyurethane dispersions with better sustainability for paper coatings
- p. 14 Control of the cooking process by fibre-based active microwave packs (MicrowavePack)
- p. 15 SeaweedPack – Innovative packaging material based on brown algae
- p. 17 ACETAL – Development of biobased alternatives for increasing paper strengths

## Service & technology

- p. 19 Successful expansion of the scope of accreditation
- p. 20 Adhesive strength test – The upgraded corrugated-board adhesion tester (WKM)
- p. 21 Second DOMAS NIR measuring system for quick quantification of stickies and non-stickies in papers has been delivered

## Networking

- p. 22 Papermaking for the little ones: a big deal!
- p. 23 PTS support for regional initiatives
- p. 24 Paper for Power – Clean Hydrogen Convention 2023
- p. 25 Encouraging civic engagement in the Saxon Switzerland / East Erzgebirge Mountains District: "Social village development – we are in"
- p. 26 Science Project Week of the Martin Andersen Nexö Grammar School in Dresden
- p. 26 PTS at the Science Festival SPIN 2030
- p. 27 20th Meeting of the Saxon Transfer Network

## Advanced training

- p. 28 Advanced training of the lab personnel from Hamburger Rieger GmbH, Spremberg Paper Mill
- p. 28 Follow-up on the PTS Conference on "Paper & Board for Food Contact", 6 and 7 March 2024 – Highlights
- p. 31 Events 2024
- p. 31 PTS Winter Party

Editorial deadline: 28/03/2024

Testing  
services



Industrial  
solutions



Research



Events



# Editorial

Dear readers,

Nature is in bloom, the days grow longer, making us look forward with confidence to the challenges that will, no doubt, shape the near and distant future also in our industry. The climate study of the PAPER INDUSTRY that was prepared together with us provides a first impression of the future steps to take to achieve the transformation goals of our business and research sector. We have the opportunity to develop effective solutions for the paper industry in close collaboration with industrial partners, non-profit organisations and other interest groups and stakeholders.

Here, in Heidenau, a lot has happened over the past few months – the renovation of the PTS main building built in 1992 with a view of the beautiful Elbe river has been successfully completed as a major and sustainable investment in our site. For example, the energy refurbishment measures have led to a reduction by about 20 per cent in the Institute's energy consumption. Height-adjustable desks for all employees, modern meeting and conference rooms, as well as nesting places for birds and bats all contribute to a healthy and liveable future for both people and the environment. We would like to take this opportunity to express our sincere thanks to our founders, the Saxon Development Bank (SAB) and all other parties involved, for their constructive cooperation and flexibility in finding solutions.

We are looking forward to celebrating this milestone during the **Networking Day on the 28<sup>th</sup> of May** and warmly invite you – long-standing and new partners alike – to enjoy this very special occasion together with us on our premises right by the river. You will find all information in our interview on page 4 of this issue.

The next issue of our PTS News bulletin will be published in the middle of November. Until then, I wish you all the best for your projects and upcoming tasks and I am looking forward to our exchanges during the Networking Day or any of our other events.



Yours, Dr. Thorsten Voß  
PTS Director

## Fibre Symposium 2024: for the first time as a cooperation between PTS and Zellcheming



Plant fibres are the basis for the manufacture of papers and paper-related products. These fibres, which are at present mainly produced from wood, will be a much sought-after raw material in the future, because the usable wood resource will become scarcer due to climate change, legislative regulations and increasing benefit competition against a rising demand in all processing sectors. In order to avoid fibre supply bottlenecks also for the future, it will be necessary to utilize so-called non-wood fibres to a much larger extent than today. They can be derived from intentionally grown fibrous plants or can be coupled products of other industries such as the food sector. This approach can in fact provide performant fibre materials. However, it is crucial to understand the relationships between availability aspects, logistics, fibre origin, fibre preparation, and the effect in the paper structure against product-related requirement profiles in order to build up financially and socio-economically acceptable business models.

In line with the tradition of the **PTS Fibre Symposium**, this topic will be on the agenda in 2024. This symposium, which will be held in the pre-Christmas atmosphere of the city of Dresden on the **4<sup>th</sup> and 5<sup>th</sup> of December**, is for the first time a joint initiative of Zellcheming and PTS in an attempt to find an appropriate place for this complex subject within the future fibre supply scheme for Germany. Moreover, it will build a bridge between technological possibilities, industrial realities and future demands.

### Save the Date!

#### Fibre Symposium 2024 | Zellcheming & PTS

- 04 – 05 December 2024
- Conference language: German
- Penck Hotel Dresden
- Accompanying exhibition & poster session
- Excursion to the Institute of Plant and Wood Chemistry of TU Dresden in Tharandt
- Get together & evening programme

Further information available on our website at:  
[www.ptspaper.com/events](http://www.ptspaper.com/events)

#### Come and be a part of this symposium:

Speaker with **Call for Papers**: Send us interesting papers by 31 May and get the opportunity to present your subject to the participants

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# PTS Networking Day – Interview with Frank Miletzky and Thorsten Voß



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Prof. Dr. Frank Miletzky  
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Impressions from the latest Networking Day

This year's Networking Day will be held on 28 May. We are talking today with the previous and the current Director about the idea of reviving this event and the expectations and hopes associated with it.

What was the significance of this event for PTS in the past?

**Frank Miletzky** The networking days were always an important event for PTS – but also for the attending representatives from industry, research and politics. The event created an opportunity to get into touch with concrete challenges within the industry to identify problems outside and beyond the “box”, get from the symptoms to the actual root causes and substantiate this based on research in PTS. The benefit is high to all parties involved, because the visitors and guests from the industry consciously take their time for topics of the future and present themselves as ideal partners for the employees of PTS who want to align their research with exactly those topics. So, it is a win-win situation for everyone.

Now, after a four-year break, there will be a new Networking Day in Heidenau. What are the changes experienced by PTS in the meantime?

**Thorsten Voß** In the past two years, we made an important step to secure the future by renovating the office and lab building constructed in 1992. The renovation

was made possible by a combination of public grants-in-aid and own funds, and I seize the opportunity to address my express thanks to the Land of Saxony and the foundation council. Not only does the investment underline our clear commitment to the research location, but also is an expression of our ambition to retain a leading position in paper research also in the future. Another important outcome of the past four years was that we obtained the status of “Attached Institute of the Technical University of Dresden”. This close cooperation between the foundation and the university not only underlines the scientific excellence and expertise of the foundation, but also opens up new opportunities for interdisciplinary research and innovative projects. The paper industry itself is currently undergoing an important period of transition. The modern image of this industry is marked by technological innovations, sustainability endeavours, and changing consumer preferences. PTS is open to these challenges and committed to supporting the paper sector in terms of research, development and education.

Which novelties and long-standing traditions can our visitors look forward to for the Networking Day? Which are the highlights awaiting us in terms of contents?

**Thorsten Voß** The Networking Day is not only an occasion for celebration and exchanges between experts and industrial partners, but also a moment of reflection about the past, the present and the future of PTS in Heidenau.





While making preparations for the next decade, we are firmly determined to remain a driver for innovation and progress in the paper industry. One highlight certainly is the presentation of the “Circular Packaging Technologies & Systems (CPTS)” Centre of Competence.

[This format is a bit similar to the research forums which were periodically held at PTS in the past.](#)

**Frank Miletzky** Yes and no. My answer is affirmative to the extent that this platform is used for presenting the latest research and transfer results. My view is a differentiated one especially with regard to the general perspective and the more global approach. Whereas we had e.g. a forum for starch application in the past, today's approach is much more complex and includes aspects of circular economy, sustainability, regulatory framework, and general recycling-friendly product design.

[Which added value can be expected by the participants of the research forums in the future?](#)

**Frank Miletzky** The forums offer an authentic insight into the “engine room” of PTS for the visitors of the Networking Day to become stakeholders. The forums also encourage the available results to be developed into proprietary transfer solutions, with PTS and its entire research network holding themselves available for their implementation as well. The main purpose of PTS research is always transfer to new solutions.

[Who is this year's target group?](#)

**Thorsten Voß** The motto “We for Paper” and the focus on the paper value chain are meant to address all and any persons that are passionate about paper and fibre. This includes not only people from the paper industry, but also experts from related sectors such as forestry, packaging, printing and recycling. Further, representatives from research and development, as well as interested parties from politics and society are cordially invited to exchange and network with other experts from the industry.

**Frank Miletzky** This year's Networking Day is again organised to reflect the entire value chain of paper. We are expecting guests from the supply industry, and more specifically of course our partners from the Paper Technology Research Association (FPT), and people from the papermaking and paper processing industries. This is what PTS is all about – reflecting and serving this supply chain. Eventually, PTS is also an interdisciplinary structure, and this is how we address and approach our research partners from universities and institutes.

[Mr. Voß, you mentioned the new CPTS initiative.](#)

[What is the story behind?](#)

**Thorsten Voß** The pooling of expertise and resources in the region has the potential to create a national beacon for sustainable and recyclable packaging systems. This is where core competencies in natural fibre and plastics engineering as well as in packaging and food technology get in touch with a variety of complementary specialist areas such as materials science, process engineering, mechanical engineering, mechatronics, environmental sciences, agricultural and forestry sciences, as well as economic and ICT sciences. Therefore, the entire “Design for Recycling” spectrum is covered and effectively utilised – from material selection and development, product development, processing methods, manufacture, collection and sorting up to aspects of waste management and recycling of packings and packaging materials. A unique selling point of CPTS is that the associated partners ensure a holistic approach to this subject on all material, technology and added-value levels.

[Which will be the central theme for the Networking Days to come?](#)

**Thorsten Voß** The future Networking Days of PTS will be focused on transformation of the paper industry. PTS is a sector-related institute offering a platform for exchange between experts, researchers, entrepreneurs and any and all interested parties. The purpose of these events is to discuss ideas, share best practices and work together on solutions for the challenges of the future.

**Frank Miletzky** The transformation of our industry will be successful where the best research players are given the opportunity to organise their findings by way of transfer with industrial corporations along the value creation chain while attracting commercial interest from businesses in putting them into practice.

Can visitors still register for the Networking Day?

**Thorsten Voß** Yes, there still is a small number of available places that can be booked via our web site. We are looking forward to seeing you. ●

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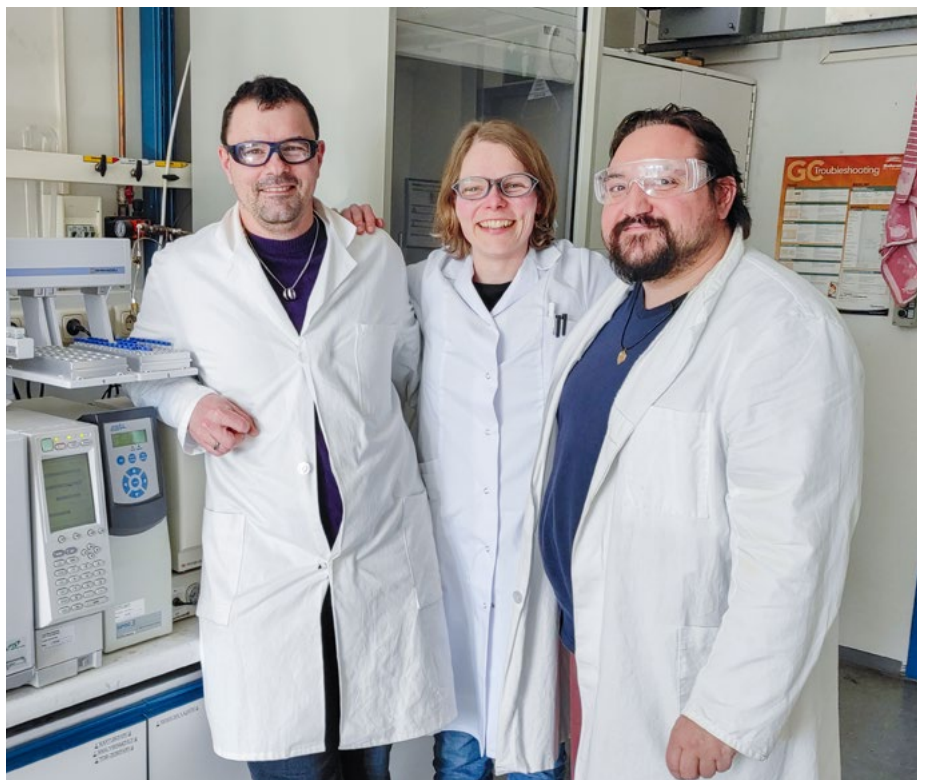
## Let's talk: Our FCM (Food Contact Materials) Team

The regulations regarding food contact materials made of paper and board – a kind of deep space mission. It is the year 2024, and these are the endeavours of the PTS FCM team whose members have been exploring the new worlds and laws of food contact materials for more than 10 years.

**Our FCM (Food Contact Materials) Team consists of three young and motivated colleagues:**

- Max Schneider (graduate environmental chemist),
- Kristin Lieber (state-certified graduate food chemist), and
- Erik Mehlhorn (state-certified graduate food chemist).

We asked them about their day-to-day work, personal highlights and their motivation.



FLTR: Max Schneider, Kristin Lieber, Erik Mehlhorn

What is your first idea when it comes to paper?

**Erik** My first association with paper is its versatile use and its key role in human communication and

culture. But paper is used not only as a writing and printing support, but also for arts, food packaging, hygiene products, furniture and many more purposes. It is fascinating to

see how such a seemingly simple and omnipresent thing like paper plays such an important part in our everyday lives, especially at moments when certain papers are sorely missed as I unfortunately had to experience for myself during Covid times...

### Speaking about shopping – do you generally prefer buying paper-packaged or unpackaged food products?

**Kristin** Where possible, I buy unpackaged food, or I take my own textile bag with me when going to the bakery or to the fruit and vegetable department. Otherwise, I actually prefer buying things packaged in paper, but I get annoyed when a paper packaging contains integrated windows made of plastic film that cannot easily be separated.

**Max** In most cases, I place my own box in the shopping trolley and put the purchased products directly into the box. Any type of packaging has its pros and cons. I try to avoid unnecessary packaging waste (e.g. individually wrapped sweets), but do not normally pay too much attention to the type of outer packaging. I know from my daily work that in most cases you will come across good and tested products. However, I tend to be more cautious about commodities from the Asian region – then, it is most certainly wise to exercise common sense.

### Where do we find your area of responsibility within the papermaking cycle?

**Max** The legal status of a product under food laws should be taken into account from the very first thoughts for a new product design. I have seen more than once that products were already on sale, but could not be certified for food contact safety, because certain relevant aspects

had not been taken into account during the material selection phase. This can quickly become unpleasant and cause lasting damage to the parties concerned. Many things can be clarified in advance by selecting appropriate input materials and having a thorough inspection of the related documents.

However, since our FCM team is mainly looking at potentially critical substances, all phases in the life cycle of a food contact material are relevant to us. Thus, we need to handle the processing and finishing steps as intensively as the outcome of fibre recycling. All these phases have a significant impact on any potential migration of substances to foods.

### What tasks and topics do you deal with in your daily work?

**Erik** I am employed as a project leader with PTS and work on a wide variety of scientific topics within the scope of food law assessments. This includes, among other things, chemical analyses for undesirable substances in papers and boards and their toxicological and legal classification. Another important part of my tasks is to develop methods, set up test plans, evaluate and interpret the recorded data.

### Which is your most important work equipment?

**Kristin** First and foremost the computer, because communicating with customers, evaluating analytical data, writing test reports and running searches are a major part of my daily work. But our three gas chromatographs in the GC lab is also important work equipment for me and my colleagues. We use them, among other things, for analysing non intentionally added substances (NIAS) and determining potential migration of mineral oil constituents e.g. from recycled fibre.

### Is there a specific research project that has marked you more than others?

**Max** I supervised a research project on the testing of baking parchment. I must admit that today I can enjoy even muffins baked in colourful printed liners with a clear conscience. Before the scientific project, I actually had my doubts whether this could really be healthy. Since the project made us bake a large number of “lab cakes”, it certainly has left a lasting impression on many of the other employees of PTS. Over several months, there was a constant scent of cake in the air of the entire floor. We are probably the only scientific laboratory in the immediate neighbourhood with a household baking oven in the lab. For safety reasons, unfortunately, the probably delicious cakes we made and still make in this oven are not suitable for consumption.

### Did you ever have professional/scientific aha moments with an impact on your private life?

**Kristin** For example, the knowledge that there is a very good reason why used paper towels and tissues belong in the residual waste bin and not in the toilet: they are specifically treated for the purpose of not falling apart in a wet condition. Unlike toilet paper, they will not break down or be easily flushed down with the water flow, but tend to accumulate until they block the toilet. This is the reason why toilet paper must pass the so-called flushability test (official name: Determination of disintegration in water according to DIN EN ISO 12625-17:2021-08).

### Is there a PTS event that can be particularly recommended from an FCM perspective?

**Max** Generally, every PTS event is good value for money. I for myself attended the basic papermaking course and was very grateful to get

so deep an insight into the technical processes of our industry that I can use this knowledge in my own work. Since today's packaging is generally supposed to be pack-of-all-trades kind of gadget (pardon my French), I learned a lot about many packaging-relevant aspects during the PTS training events on recyclability and requirements of the SUPD (Single-Use Plastics Directive). As I am passionate about giving talks and enjoy getting involved in the

organisation of events, I also find our own FCM events a great enrichment. We offer both a beginner course "Introduction to conformity work and quality assurance for paper, board and hygiene papers in food contact (FCM)" and an expert conference "PTS Technical Meeting on paper, board and tissue in food contact". We have now also successfully integrated into our training programme more specialised topics, such as wood FCM or requirements for consumer goods

such as non-food packaging, cosmetic articles, tobacco products, toys and furniture made of paper and board . ●



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## TomoBale – High Tech meets Reality

### Project title:

TomoBale – Study on the application potentials of X-ray technology for the improvement and expansion of the inspection of incoming recovered-paper bales

### Project period:

01/05/2021 – 31/07/2023

### Funding programme and code:

IGF 21841 BG

### Research locations:

- Papiertechnische Stiftung (PTS)
- Fraunhofer Institute for Integrated Circuits

### Contact:

- Dr. Patrick Plew
- Dipl.-Phys. Peter Hornberger



The joy was limited among the personnel of the XXL computed tomography scanner in the Fraunhofer ISS in Fürth when a one-cubic-metre bale of recovered paper was lifted onto the testing platform. The place normally reserved for scanning entire vintage cars, aircraft fuselages or historic artefacts was now occupied by an object on the way from waste to resource that lost a few pieces of what may be referred to as rubbish. Nevertheless, the team managed to transform the bale into a full digital twin at a resolution of less than half a millimetre, with the final amount of data being in the terabyte range. Then, it became possible to cut the bale open in any manner whatsoever and to evaluate the objects there by structures and according to their attenuation coefficients (mainly as a function of the atomic number and the material density). You will find a video showing a virtual flight through this bale at [www.ptspapder.de/CT-Flug-Ballen](http://www.ptspapder.de/CT-Flug-Ballen).

Video: Virtual flight through a bale of recovered paper



### Project goals

The goal of the research project was to extend and complement the previously introduced methods for the technical inspection of incoming recovered paper in the form of bales using industrial 3D X-ray computed tomography. Their potential applications were evaluated initially based on synthetic patterns and eventually based on the inspection of real bales. It was shown that the latter could be scanned with sufficient contrast even at a spatial resolution of less than 400 µm. The parameters required for this purpose were optimised, mainly in terms of measuring time. Single and dual energy measurements were included in the evaluations to allow for a higher diversity of results.

### Brief summary of the project findings

The TomoBale research project has shown that moisture has no crucial impact on CT images and thus does not affect the results and therefore





**Fig. 1:** CT section through a bale of grade 1.04 (darker zones: material with high atomic numbers, black: metals, e.g. wiring)

will not impair the studies to follow. Based on this finding, an innovative strategy for the evaluation of CT images was developed. The method includes dividing the total volume of a CT image into smaller volume units. So, it was possible to provide not only a significant reduction in computing time, but also a higher precision in representing the distribution of attenuation coefficients. The identification and quantification of various material grades were examined intensively. One method for the identification of objects with ad non-Gaussian attenuation coefficient curve was successfully applied, in which the Kolmogorov-Smirnov test proved

to be efficient and accurate for the identification of corrugated boards even in a collapsed condition. Moreover, materials with normally distributed attenuation coefficients could be distinguished via maximum and standard deviations of the distributions. Office papers, newspapers and magazines were successfully identified as separate grades. However, it was not possible to distinguish between newspapers and grey, uncoated and unprinted cardboard because of the similarity of their chemical and physical properties. The differentiation capability was significantly improved by the integration of dual energy measurements. The

compensation for base material decomposition (BMZ) further increased the information content of the measurements, especially for the identification of plastics and for estimating the filler content in paper.

The identification of metal parts, also in the real-world bale, proved to be almost unlimited down to the size of a paper clip. In self-made synthetic bales, it was possible to successfully identify CDs, smartphone batteries, textiles, and certain plastic composites. In spite of the progress made, there still are a number of challenges. Machine learning methods integrated in AI applications showed very promising attempts but did not outperform classical approaches.

A comparison between CT measurements of the real-world bale and manual sorting allowed qualitative and quantitative relationships to be established. However, there is a basic difference between the volume-based CT results and the mass-based sorting data. In the end, concepts were developed that outline the application of CT systems in industrial practice. Although the technology is not ready yet for scanning full bale volumes in an acceptable time, it shows a great potential for use in trade and distribution centres, especially for materials and resources traded in the form of bales in the decimetre range. ●

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# Graphite paper-based cathodes in AEM electrocatalysis for CO<sub>2</sub> conversion – EL-Cat project completion

**Project title:**

Anion Exchange Membrane – Electrocatalysis for CO<sub>2</sub>-Conversion into CO

**Project period:**

01/10/2019 – 30/03/2023

**Funding programme and code:**

French-German Joint Call on sustainable energy BMBF-03SF0586C

**Research locations:**

- Papiertechnische Stiftung (PTS)
- Research Centre Jülich
- Université Paris Diderot
- Air Liquide Innovation Campus Frankfurt
- Air Liquide Innovation Campus Paris

**Contact:**

- Michael Rentzsch, Functional Materials Dept.

One major aspect for being able to increasingly utilise more electric forces from renewable energies in substitution for fossil fuels in the chemical industry is technology screening of novel “power-to-X” (PtX) approaches allowing the industry to run chemical reactions based on electromotive conversion.

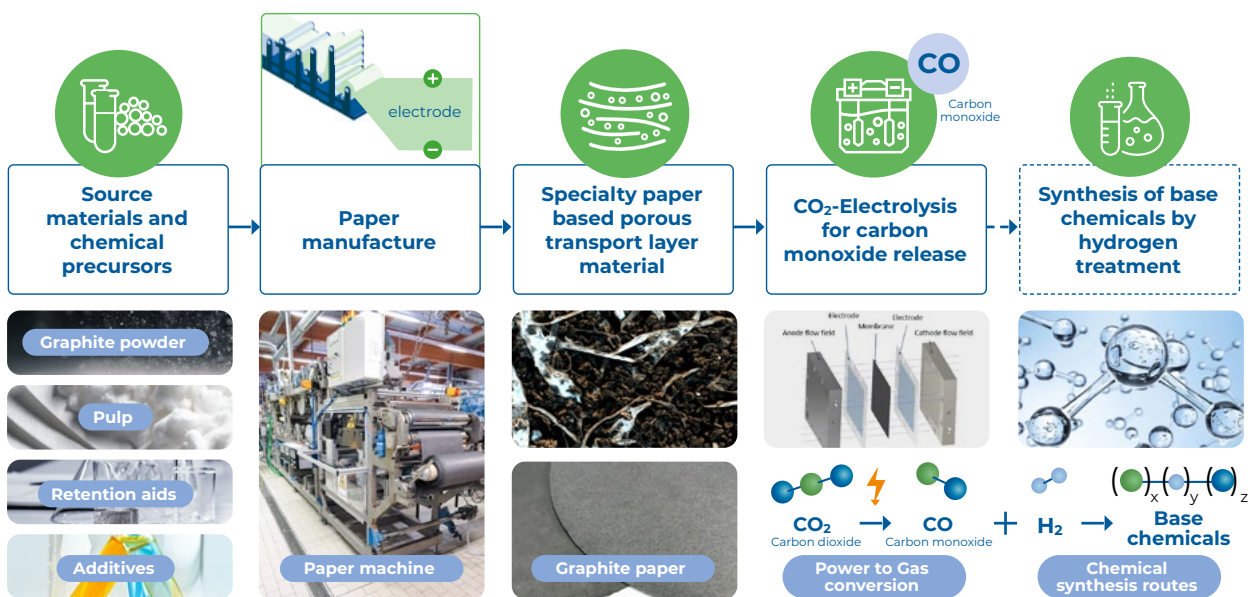
Carbon monoxide is an important source material for basic and platform chemicals such as methanol or formic acid. At present, it is obtained from the oxidation of fossil coal or fossil natural gas.

A main goal of the French-German Joint Call project “EL-CAT”, which was completed in 2023, was to functionally equip the membrane electrode assembly (MEA) for an anion exchange membrane electrocatalysis with novel special paper-based gas diffusion

cathodes free of platinum group metals so as to be able to perform the electrocatalytic PtX reduction of moist CO<sub>2</sub> gas into carbon monoxide in a more performant, more sustainable and more cost-effective manner.

**Improved electrochemical operating performance at reduced manufacturing cost**

The papermaking-type lab-scale manufacture of porous gas transport electrodes showed the integration of the catalyst system in the fibrous suspension (pulp slurry) allowing the manufacturer to do without additional catalytic coating steps which would be otherwise required for gas diffusion layers or anion exchange membranes. Additional sustainability and cost-cutting aspects are the selection of functional pigments of natural origin and a cellulosic fibre matrix of these novel gas diffusion electrodes.



**Fig. 1:** Highly filled specialty paper gas diffusion electrodes for the electrocatalytic conversion of CO<sub>2</sub> into carbon monoxide, base material for subsequent mostly hydrogen-based power-to-X processes

Furthermore, during the course of the project, special electrodes were developed and manufactured by means of highly filled papers on a pilot plant (Fig. 1), which electrodes are characterised by a better cathode performance in AEM electrolyzers as compared with commonly available gas diffusion layers.

In contrast to this, there still are technological challenges in terms of cell integration of the catalyst-coated anion exchange membranes (AEM-CCM) resulting in still unsatisfactory operating time results of the AEM electrocatalysis. Follow-up development concepts for electromotively driven CO production intended to study and raise the paper material and process technology-related performance

increase and cost reduction potentials are being discussed. ●

Michael Rentzsch,  
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[1] I. Stamatelos, M. Rentzsch, C. Lui, F. Bauer, S. Barwe, M. Robert. Electrocatalytic functionalized specialty paper as low cost porous transport layer material in CO<sub>2</sub> electrolysis. ChemCatChem, 2023.

## New challenges for a time-tested and sustainable material system – Development and qualification of vulcanized fibre papers

Volcanic fibre as a material has been in existence since 1855 and is nowadays mainly known as a sealing material and, to lovers of antiques, for objects like the suitcase shown in Figure 1. It is used as a structural component. In the 19th and early 20th centuries, vulcanized fibre, also known as Cottonide or red fibre, was a versatile material for many uses, but lost its importance with the boom of petroleum-based plastics from the 1950s onwards.

Vulcanized fibre is a so-called all-cellulose composite (ACC). This term describes composite materials in which cellulose performs the functions of both the matrix and the fibre reinforcement. They are based on papers made of pulp and cotton (linters and recycled textiles) that are transformed into vulcanized fibre using a parchmentization process, in which the papers pass through

sulphuric acid or zinc chloride containing parchmentization baths. This results in dissolution of a portion of the cellulose which will then be embedded between the fibres thereby producing this composite material.

Component parts made of vulcanized fibre show an excellent potential for being used as a biobased and biodegradable alternative product in substitution for plastic component parts while offering very good mechanical properties. The increasing demand for sustainable alternatives to plastic materials caused various research groups and industrial players to shift the focus back to vulcanized fibre. This material might be used as sills, duct housings, structural parts in automotive engineering.

A flawless transformation of the material into component parts, such as the cups shown in Figure 2, is still a

### Project title:

Material and forming process-specific development for the manufacture of biobased high-duty all-cellulose composite parts with complex geometries (*PergaForm*)

### Project period:

01/10/2023 – 30/09/2025

### Project type/sponsor:

IGF project No. 23150 BG

### Research locations:

- Papiertechnische Stiftung (PTS), Dr. Cornell Wüstner, Michael Rentzsch, Mandy Thomas
- Fraunhofer Institute for Machine Tools and Forming Technology (IWU), Dr.-Ing. Sven Winter, Tobias Breitfeld
- Technical University of Dortmund – Chair of Materials Test Engineering (WPT), Prof. Dr.-Ing. habil. Frank Walther, Dr.-Ing. Ronja Scholz, Alexander Delp

huge challenge at the moment. This is exactly where the “PergaForm” project comes in, focused on improving the formability or thermoformability of vulcanized fibre. The part of PTS is the material-specific further development of vulcanized fibre base papers which are parchmented by the associated project committee (Vulkanfiber-Fabrik Ernst Krüger GmbH & Co., Sachsenröder GmbH & Co. KG). The part of Fraunhofer IWU is the process-specific improvement of forming processes, and the responsibility of the Chair of Materials Test Engineering (WPT) of TU Dortmund is the characterization of the vulcanized fibre and the formed parts. The three research entities wish to work together on the revival of this time-tested and sustainable ACC material in a variety of different applications. ●

Cornell Wüstner,  
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[i] Scholz, R.; Langhansl, M.; Zollfrank, C.; Walther, F.: Humidity-sensing material Cottonid – Microstructural tuning for improved actuation and fatigue

performance. *Frontiers in Materials* 7, 156 (2020), 1-10. <https://doi.org/10.3389/fmats.2020.00156>



Fig. 1: Suitcase made of volcanic fibre

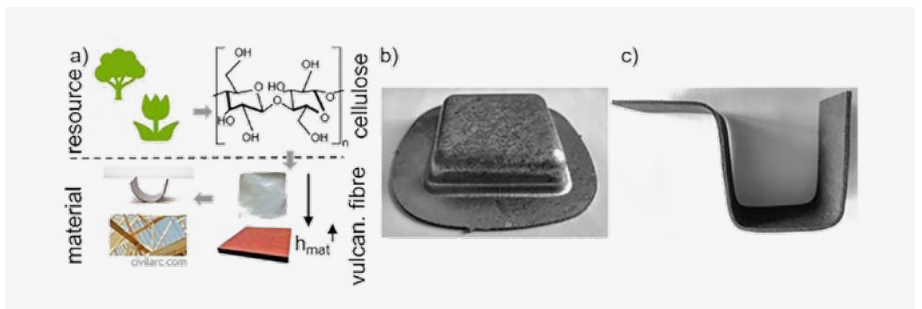


Fig. 2: a) from the cellulosic resource to the vulcanized fibre material; b) cup thermoformed with moisture (> 20 %) at Fraunhofer IWU; c) vulcanized fibre profile bent at IWU.

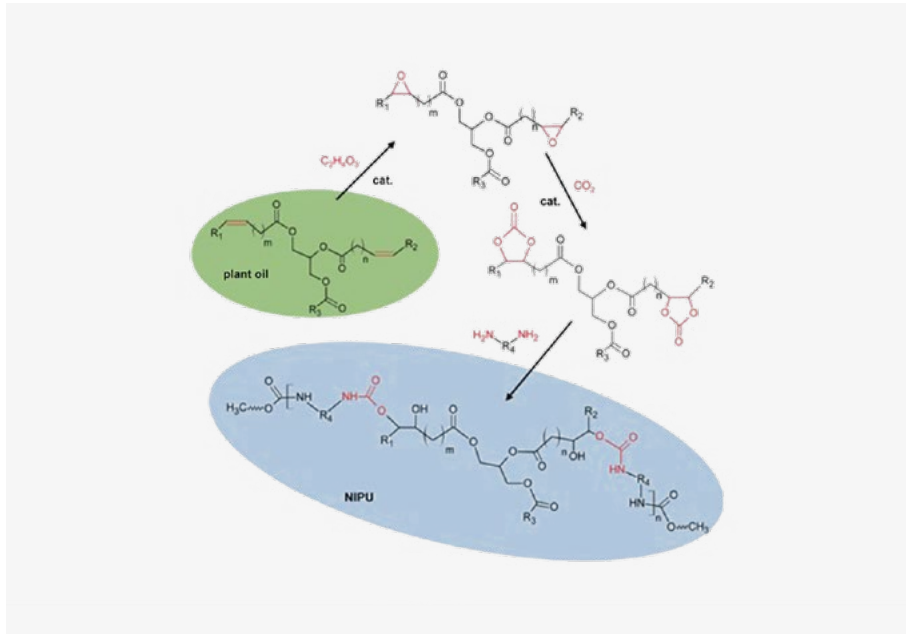
## Start of “maNIPUlate” IGF project – Development of polyurethane dispersions with better sustainability for paper coatings

Polyurethane (PU) is a versatile material in many applications, which can be used for making both soft foams and very strong and stiff component parts. Among the many potential applications, the use of aqueous polyurethane dispersions for surface coating purposes is a relatively recent area with growing demand.<sup>[1]</sup> Possible applications are PU-coated top-quality textiles, floor coverings, machine parts subject to high mechanical stress, or paints in the automotive sector. Also,

the paper industry uses such PU dispersions, for example for soft-touch decorative coatings or barrier coatings. However, the isocyanates used for the synthesis are posing problems because of their high toxicity, especially in the area of food contact materials.<sup>[2]</sup> Therefore, the new substance group of non-isocyanate polyurethanes (NIPUs) is very promising. Not only can they replace the toxic and potentially carcinogenic isocyanates, but they can in part be made of biomaterials.

Together with the Institute of Plant and Wood Chemistry of TU Dresden within the maNIPUlate project, PTS is working on the development of aqueous NIPU dispersion coatings to be used on paper-based materials. In this case, unlike classical polyurethanes, which are obtained by the reaction of diisocyanates with polyvalent alcohols (polyols), the polyurethane bond forms by the reaction of amines with cyclic carbonates. The base materials for the polymerization are diamines, on the





**Fig. 1:** Modification of plant oils with unsaturated fatty acids. In a first step, the unsaturated bonds of the fatty acids react with peroxy acetic acid, catalysed by phosphoric acid.<sup>[4]</sup> This is followed by the carbonation of the newly formed epoxy groups in which cyclic carbonates are formed by the reaction with carbon dioxide. Here, tetra-n-butyl ammonium bromide (TBAB) is used as the catalyst.<sup>[5]</sup> The final step is polymerization based on the reaction of the cyclic carbonates with diamines.

one hand, and plant oils, on the other, whose unsaturated fatty acids are first of all epoxidized and then carbonated (see Figure 1).<sup>[3]</sup>

In addition to the support provided for the selection of raw materials in the characterization and optimization of the dispersions, the main focus of the work performed at PTS is placed on the application of the coating onto the paper substrate from the laboratory scale to the pilot scale, functional analyses of the coated papers, and their processibility and recyclability. The use of biodegradable materials, such as modified plant oils, offers a biodegradability potential that should be studied as well.

The project results are of benefit mainly to companies in the fields of paper conversion, packaging manufacture, and production of coatings. Representatives of these industries support the project in the project committee.

After completion of the project, the newly developed technology can be easily adopted in the transfer companies. Epoxidized plant oils are already commercially available and can be functionalized further by conventional laboratory equipment. Paper converters will presumably need no additional investments for the treatment of stable, water-based dispersions, because the required coating and drying equipment is generally already in place. Therefore, the market entry of the new NIPU coatings on paper for secondary packaging and graphic papers can in fact take place directly after the end of the project. ●

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#### References:

- [1] A. Das, P. Mahanwar, „A brief discussion on advances in polyurethane applications“, *Adv. Ind. Eng. Polym. Res.*, vol. 3, no. 3, pp. 93-101, 2020

#### Project title:

Aqueous non-isocyanate polyurethane dispersions from plant oils for biobased paper coatings – “maNIPulate”

#### Project period:

03.2024 – 02.2026

#### Funding programme and code:

Joint Industrial Research (IGF)  
IGF 01IF23205

#### Research locations:

- Papiertechnische Stiftung (PTS)
- Technical University of Dresden (TUD), Institute of Plant and Wood Chemistry

#### Contact:

- Dr. Tobias Pietsch (PTS)
- Dr. Thomas Elschner (TUD)



[2] B. Nohra, L. Candy, J.-F. Blanco; C. Guerin, Y. Raoul, Z. Mouloungui, „From Petrochemical Polyurethanes to Biobased Polyhydroxyurethanes“ *Macromolecules*, vol. 46, pp. 3771-3792, 2013

[3] W. Zhang, T. Wang, Z. Zheng, R. L. Quirino, F. Xie, Y. Li, C. Zhang, „Plant oil-based non-isocyanate waterborne poly(hydroxyl urethane)s“, *Chem. Eng. J.*, vol. 452, no. 1, 138965, 2023

[4] T. W. Gindly, D. Swen, J. T. Scanlan, „Epoxidation of Unsaturated Fatty Materials with Peracetic Acid in Glacial Acetic Acid Solution“, *J. Am. Chem. Soc.*, vol. 67, no. 3, pp. 412-414, 1945

[5] R. Lehnen, „Vorhaben: Mehrcyclische organische Carbonate als Vernetzer für biobasierte und formaldehydfreie Klebstoffe (CycloCarb)“ 2019. [Online]. <https://www.fnr.de/index.php?id=11150&fkz=22027014>. [Zugriff am 15. März 2024]

# Control of the cooking process by fibre-based active microwave packs (MicrowavePack)

## Project title:

Control of the cooking process by fibre-based active microwave packs (Short title: MicrowavePack)

## Project period:

01/06/2023 – 31/05/2025

## Funding code:

KK5538301BU3 + KK5244403BU3

## Project consortium:

- Papiertechnische Stiftung (PTS), project leaders: Dr. Markus Kleebauer, Dr. Tobias Pietsch
- pacocon Sustainability Concepts GmbH, project leader: Peter Désilets
- Danish Technological Institute DTI, project leader: Dr. Alexander Leo Bardenstein

## Funded by:

- Central innovation programme for SMEs (ZIM)



## Motivation

About three quarters of all private households in Germany have a microwave oven. Food preparation in the microwave oven offers certain advantages over traditional baking ovens in terms of energy consumption (reduction by up to 90%), cooking time (up to 50% shorter), and convenience (simple time-based cooking control).

Pizzas and hamburgers are trend products out of the deep freezer (DF). The average pizza consumption in Germany is approximately 13 DF pizzas per capita, most of which are

prepared at home in the baking oven. The preparation time might even be shorter in the microwave oven and, according to the project partner pacocon, which is among the leading agencies for packaging design and sustainability in the German-speaking (DACH) area, might allow the number of deep-frozen pizzas to be further increased in the future.

It therefore made sense to launch a project for the development of microwave-suitable packaging for deep-frozen pizzas and to couple this project with another trend, which is the trend towards fibre-based packaging.

## Project goals

The goal of the project is to develop an ecologically advantageous microwave-suitable pizza packaging using fibre-based materials. For this purpose, it is necessary to cope with a number of challenges and come up with solutions for goal conflicts. In addition to its suitability for the microwave oven, the packaging to be developed should take an active part in the cooking process. It should be able to absorb part of the microwave radiation and direct heat to the surface of the pizza being prepared. The result should be a baked pizza as crispy as possible with a crunchy base and delicate topping. The big challenge of the project will be to implement said packaging function with appropriate materials, a food-compliant design and good recyclability of the fibre portion.

## Project consortium and assignment of tasks

Apart from PTS, the parties involved in the project are the previously

mentioned pacocon Sustainability Concepts GmbH for sustainable packaging concepts and the Danish Technology Institute (DTI).

The main task of PTS will be the development of fibre-based materials, inclusive of the functional coatings provided for this purpose using not only the laboratory equipment, but also the pilot papermaking and coating machines.

Based on the knowledge of the market, pacocon develops customer-oriented packaging solutions and evaluates their sustainability by using both market research instruments and sophisticated design studies and functional samples produced in small series.

DTI can look back on several successfully developed microwave packaging products. They include packaging for pizzas, hamburgers and spring rolls. The institute is equipped with measuring stations for determining the absorption of microwave radiation, which will be used also for this project.

## General approach and first steps

After a screening phase, suitable absorbers were embedded on a lab-scale in the fibre matrix and, in parallel, in coatings. The first development steps are about producing paper-based materials that can be quickly and properly heated up in the microwave oven. This is the only way to direct the microwave energy in a targeted manner also to the surface of a pizza.

Later development steps will be focused on optimizing the papers

and coatings so as to provide useful solutions for any of the requirements for the envisaged packaging within the scope of design. Especially, this includes obtaining a high content in recyclable fibres and meeting the food-law requirements.

The solutions such developed are planned to undergo suitability tests based on test packs. For the test packs, larger amounts of paper are to be manufactured and coated on

the PTS pilot plants and then further processed with manual and semi-automatic methods. This will be flanked by design and market studies as well as sustainability assessments to be used for subsequent marketing.

### Outlook

The project with the short name MicrowavePack is supposed to further increase the appeal of fibre-based packaging for microwave ovens. The project consortium – at present

very busy with the development work – is planning to come up with further publications and activities in order to keep potential interested parties informed about the ongoing developments. ●

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## SeaweedPack – Innovative packaging material based on brown algae

Cooperation between Papiertechnische Stiftung and the start-up mujō within the scope of a project under the funding programme SME Innovative Bioeconomy of the German Federal Ministry of Education and Research (BMBF).



**Fig. 1:** Kelp forest, Ardtoe Kelp (*Laminaria digitata*), also known as tangle [[https://de.wikipedia.org/wiki/Laminaria#/media/Datei:Kelp\\_forest,\\_Ardtoe\\_-\\_geograph.org.uk\\_-\\_501243.jpg](https://de.wikipedia.org/wiki/Laminaria#/media/Datei:Kelp_forest,_Ardtoe_-_geograph.org.uk_-_501243.jpg)]

In a world that is increasingly faced with the challenges of climate change and environmental pollution, it is crucial for the packaging industry to develop innovative solutions that are both ecologically friendly and efficient. This situation calls for close cooperation between different industries and for the use of new technologies.

Humanity's biggest challenge until the middle of the 21st century will be to limit and contain man-made climate change. To maintain our standard of living and preserve the living environment and thus the biodiversity on our planet, it will be necessary to effect a stringent transformation in our current way of life and economic activity. The key to achieving the Paris Climate Change Agreement long-term goal of limiting the global

**Project title:**  
SeaweedPack – Development of a biobased and biodegradable barrier systems based on brown seaweed polymers for application in film and paper packaging

**Project period:**  
01/05/2023 – 31/10/2025

**Funding programme and code:**  
KMU-i-BÖ04, FKZ: 031B1394A,B

**Project consortium:**

- Papiertechnische Stiftung (PTS)
- mujō

**Contact:**

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- Birgit Kießler



temperature increase to 1.5 °C by 2050 is to move away from fossil resources while increasing the use of renewable resources, i.e. to gradually build up a bioeconomy.



**Fig. 2:** Transparent alginate packaging for dry bath additives

The material class of plastics is of special importance under this aspect: More than 400 million tonnes of plastics are produced worldwide every year (4.4 million tonnes in Germany alone in 2020<sup>[1]</sup>), and the packaging industry accounts for one third thereof<sup>[2]</sup>. The specific problem is the unfavourable synergy of single use by design, fossil resource base, missorting (littering) and persistence of the applied plastics in terrestrial and aquatic ecosystems.

It is here that the research project “SeaweedPack – Development of a biobased and biodegradable barrier systems based on brown seaweed polymers for application in



**Fig. 4:** Printed alginate film sample



**Fig. 3:** Alginate film with biological filler additive

film and paper packaging” comes into play in the spirit of the UN sustainability development goals SDG 12 “Responsible consumption and production”, 13 “Climate action” and 14 “Life below water” to come up with a 100% biobased and biodegradable packaging material that is also compatible with the Single-Use Plastics Directive of the EU<sup>[3]</sup>.

The planned research project will be processed by mujō on the business side and Papiertechnische Stiftung (PTS) on the research side.

The corporation mujō lab OHG is a start-up founded in 2021 with the vision of a “packaging living just as

long as it is needed”. mujō’s part of the project is the development, production and sale of biodegradable, recyclable, seaweed-based packaging materials. The materials to be developed together with PTS are intended for sale in reels to B2B customers (manufacturers of consumer goods and packaging products) where they will be converted into packaging items and filled.

During the past few years, PTS has developed from a mere pulp and paper institute into a research institute for fibre-based high-performance materials and sustainable packaging solutions. Today’s focus within PTS lies on creation of new functions for packaging, paper and fibre surfaces, improvement of the printability of papers, and especially biobased barrier solutions. The boundaries between the material classes of foil, film and paper have become fluid, because the envisaged final packaging product is often a composite of several classes.



**Fig. 5:** Alginate film residues leaving the composting plant

The goal of the 30-month-long research project is to develop coating materials based on brown seaweed polymers for both film/foil production and paper coating applications. For this purpose, a new material concept is generated that



takes into account a broad range of requirements for the packaging of foods and consumer goods and is in line with existing recycling systems.

Oxygen, mineral oil and water vapour barrier characteristics are addressed as well as relevant mechanical properties. A complementary goal is to develop a safe and reliable continuous forming plant concept for the new polymer formulations. The project lays the foundation for the market launch of innovative bioeconomic alginate-based packaging products while providing an opportunity for follow-up research approaches regarding all aspects of material and process optimization, but

also the treatment and recyclability of the new materials. ●

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[1] Federal Statistical Office, Plastic packaging: Production by packaging groups until 2020, Wiesbaden, 2021, <https://de.statista.com/statistik/daten/studie/156492/umfrage/produktionsmenge-von-kunststoffverpackungen-in-deutschland>

[2] BUND, Plastics Atlas, Berlin, 2019, 15, [https://www.bund.net/fileadmin/user\\_upload\\_bund/publikationen/chemie/chemie\\_plastikatlas\\_2019.pdf](https://www.bund.net/fileadmin/user_upload_bund/publikationen/chemie/chemie_plastikatlas_2019.pdf)

[3] European Commission, Brussels, 2019, <https://eur-lex.europa.eu/legal-content/DE/TXT/HTML/?uri=CELEX:32019L0904&from=EN>; Single-use packaging products must be substituted with alternatives where available. The stringent bans of single-use plastics include both mineral oil-based polymers and biobased, chemically modified polymers (such as PLA, modified starch). As the alginate biopolymer is not chemically modified by mujō during the manufacture of the material, it is not governed by the SUPD.

## ACETAL – Development of biobased alternatives for increasing paper strengths

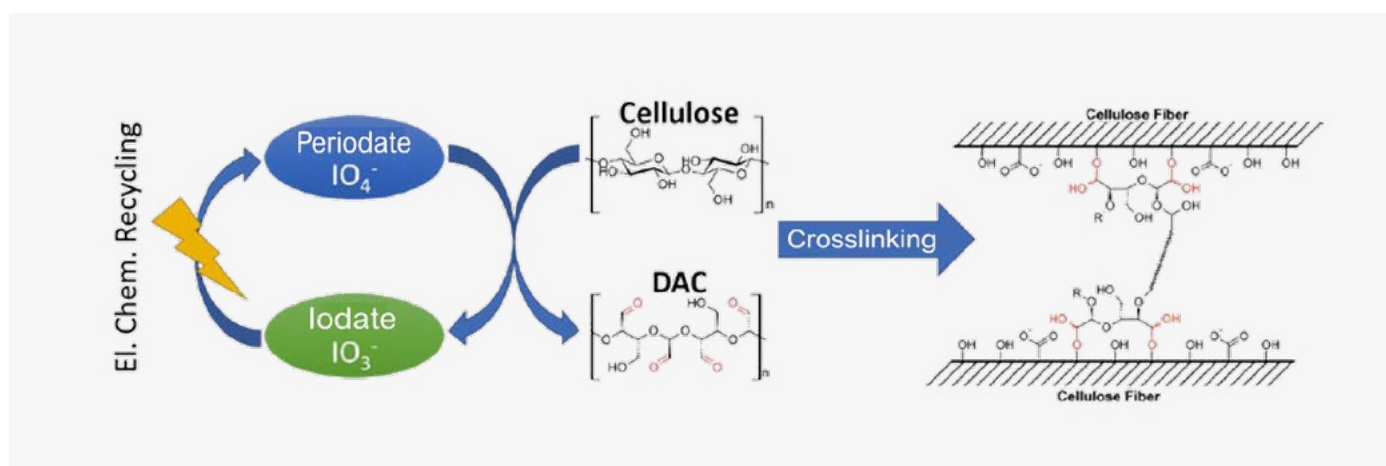


Fig. 1: Schematic view of the synthesis and application of DAC

Wet strength – the ability of papers to retain their tensile strength also in a wet condition is an important property for a variety of different paper products such as decorative papers, security papers and, in particular, hygiene papers. The standard approach to impart wet strength to papers is to add wet-strength agents

during production, i.e. polymers chemically cross-linking the cellulosic fibres thereby maintaining the tensile strength in a wet condition. A distinction between permanent and temporary wet-strength additives can be made. The latter form labile bonds between the cellulosic fibres that can be re-hydrated in the wet condition

such that the cross-link weakens over time under the influence of water. Papers containing such additives have good tensile strength in contact with water but can be disintegrated and recycled by classical means. At present, mainly petroleum-based polymers such as glyoxylated polyacrylamide (g-PAM), which include free aldehyde

**Project title:**

Development of bio-based wet-strength additives as an effective way to substitute conventional additives in papermaking

**Project period:**

01/04/2021 – 30/09/2023

**Funding programme and code:**

INNO-KOM, IK-MF200135

**Project consortium:**

Papiertechnische Stiftung (PTS)

**Contact:**

Gerrit Schaper



groups, are used to provide temporary cross-linkage of cellulose. Apart from the petrochemical polymer basis, the use of g-PAM is problematic in terms of the harmful character of glyoxal and the poor storage stability due to the occurrence of self-crosslinking effects. The research work by PTS within the scope of the recently completed research project “ACETAL” with the aim to replace such problematic chemicals in the paper industry was directed at the development of biobased wet-strength additives on a cellulosic basis.

**Biobased alternatives to wet-strength agents**

Dialdehyde cellulose (DAC) can be synthesized by reacting cellulose with periodate. During the reaction, the ring structure of the glucose units of the cellulose is selectively broken up by oxidative cleavage on one side (refer to Figure 1). Said cleavage causes the resultant DAC to be soluble in hot water, on the one hand, while the

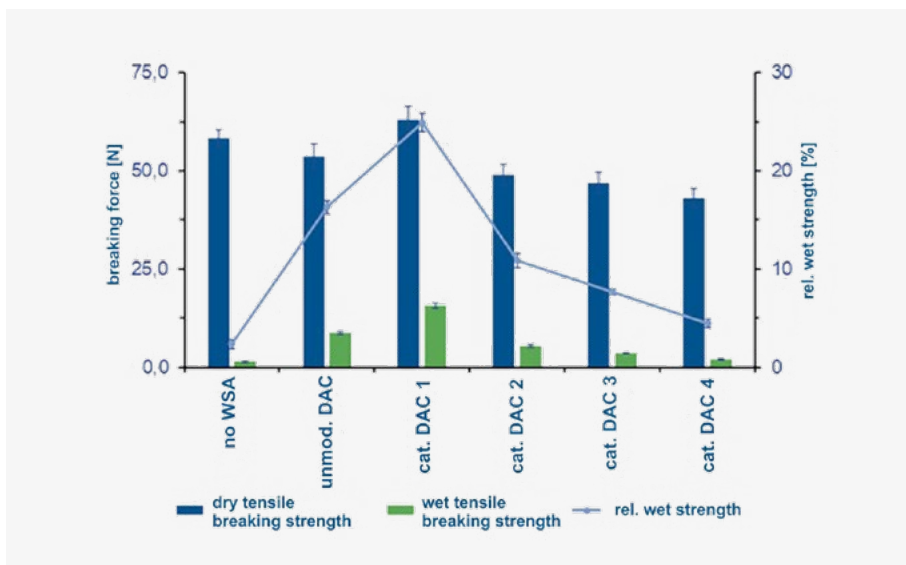


Fig. 2: Wet-strength effect of synthesized cationic DACs

DAC aldehyde groups thus obtained are able to cross-link cellulosic fibres by forming hemiacetals, on the other. Thus, DAC is a potential candidate for the substitution of g-PAM in papermaking.

**Electrochemically assisted synthesis of DAC**

The scope of the research project enabled PTS to enlarge and optimize its previous expertise in terms of the synthesis of DAC and the optimization of DACs with high oxidation degrees >75%. For low-cost commercial production of DAC, however, it is imperative to recover the reaction chemical. Therefore, the electrochemical recovery of periodate in the continuous-flow electrolysis reactor was studied. Important knowledge components for the detection and quantification as well as the electrochemical oxidation and recovery of the (per)iodate could thus be obtained. Eventually, it was possible to recover pure periodate from the DAC reaction mixture and re-use it for the oxidation of cellulose.

**Use of DAC of as temporary wet-strength agent**

A number of cationic DACs with variable cationic charge were

synthesized from highly oxidized DAC and examined for their wet-strength effect in paper products. Relative wet strengths of >25% were obtained as a function of cationization. Subsequent disintegration and recycling experiments showed that the bonded DAC could be fully removed from the fibres and that papers containing such DACs are fully recyclable.

**Retrospection and outlook**

The scope of the ACETAL research project enabled PTS to significantly increase its previous expertise in the field of the synthesis and papermaking use of biobased additives. The wet-strength additives such synthesized showed a strengthening effect on par with commercially established products with full recyclability. Moreover, the project provided the *proof of concept* for the establishment of an electrochemically assisted circular process for the low-cost synthesis of DAC. Overall, this takes us one step closer to the industrial production of DAC and the substitution of petrochemical additives in papermaking. ●

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# Successful expansion of the scope of accreditation

Early this year, Papiertechnische Stiftung (PTS) passed with success the control audit performed by DAkkS as part of the accreditation under **DIN EN ISO/IEC 17025**.



**Fig. 1:** During the audit in the materials test lab

This standard lays down general requirements for the expertise, impartiality and uniform mode of operation of laboratories. Recognition as an accredited laboratory marks a commitment not only to compliance with stringent quality standards, but also to continuous improvement and innovation in the laboratory area.

We are particularly proud of this year's expansion of the accreditation in the field of food safety conformity assessments. The accreditation now includes total migration in food simulant E (Tenax®) according to ÖNORM A 1123 (*Paper and board intended to come into contact with foodstuffs – Determination of overall*

*gas phase migration of paper and board using modified polyphenylene oxides (MPPO) as a simulant for paper and board without direct food contact*).

Total migration in Tenax® is used as a criterion of inertness of the material. According to the recommendations given in the Council of Europe Resolution CM/Res (2020)9, the maximum permitted amount of migrated substances in the simulant used is 10 mg per square decimetre of sample.

In addition to total migration, the following methods were newly added to the scope of accreditation:

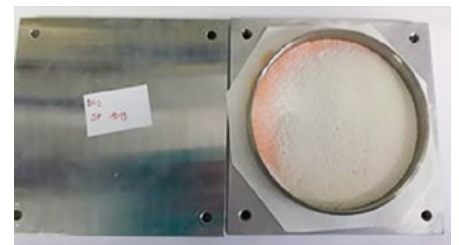
- Laser codability according to the PTS Method PTS-DF 105:2023
- Mullen bursting strength (paper) according to DIN EN ISO 2758:2014-12
- Tensile strength after immersion water according to DIN ISO 3781:2012-07

We are looking forward to testing your samples for said parameters in the accredited laboratory area in the future. ●

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**Fig. 2:** Migration cell made of glass (one-sided contact)



**Fig. 3:** Migration cell made of steel (one-sided contact)



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# Adhesive strength test – The upgraded corrugated-board adhesion tester (WKM)

Within the scope of the FNR project BioWellKleb (FKZ: 2221HV095A, LFZ: 05/2022-06/2025), the corrugated-board adhesion tester (WKM) developed by PTS in the 1970s was thoroughly upgraded by the mechanical engineering Uwe Weckend Maschinenbau corporation in cooperation with HIB I-Automation GmbH.

Apart from PC-assisted control and data acquisition inclusive of computer software, the upgrading work included the basic renewal of the pneumatic system, electronic system and mechanical parts, as well as the installation of a new load cell and of relevant safety devices such as a light barrier and an emergency stop button.

In addition to testing apparatuses for measuring the adhesive force of self-adherent materials (e.g. adhesion peel and release tester AR-2000 from ChemInstruments Inc. for the FINAT test methods FTM1 to FTM4) and for strength measurements at factory edges of packaging products, PTS now has a measuring station for testing the glued joints of corrugated board base papers using starch adhesives under defined conditions.

Figure 1 shows the upgraded WKM and a schematic view of the tester illustrating the mode of operation. The method is based on two separately heatable pressing jaws having surfaces that are plane-parallel to each other. The papers to be tested (e.g. liner and fluting) are clamped over the pressing jaws by means of clamping elements. Prior to the test, a defined amount of adhesive is applied onto the centre of the lower paper strip with a metering pipette.

Then, the pressing jaws are pressed against one another with a defined, freely selectable force and then separated after a predetermined pressing time; the pressing times may be very short ( $\geq 100$  ms). Immediately after gluing, the release force is measured via the load cell of the upper draw cylinder upon release of the pressure. The evaluation is the maximum release force, measured in Newtons, which is referred to as the peel force and represents a characteristic value for the adhesive strength of a glued joint. So, the curing behaviour of adhesives can be tested on a comparative basis by varying the substrate, the pressing time, the pressing force and the amount applied. ●

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You have further questions about the test method? Don't hesitate to contact the Functional Surfaces Department in the Fibres & Composites Division:  
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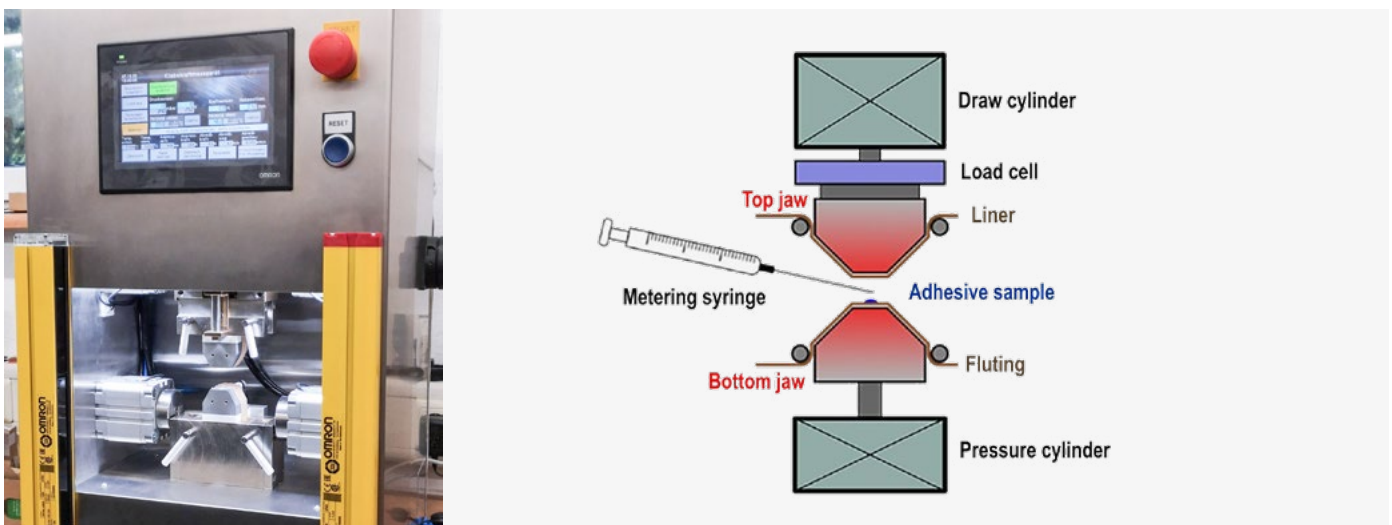
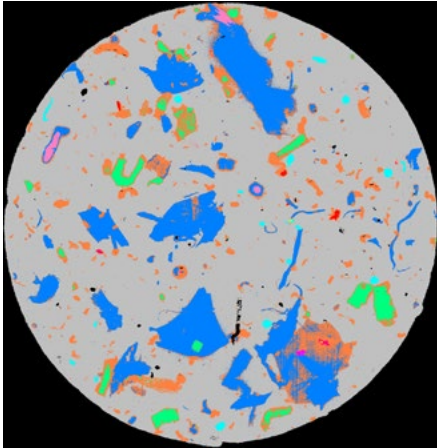


Fig. 1: Upgraded corrugated-board adhesion tester (left) and schematic diagram of the function (right).



# Second DOMAS NIR measuring system for quick quantification of stickies and non-stickies in papers has been delivered



**Fig. 1:** Application of the methodology for sheets from the recycling testing area with colour-coded substance classes

## New DOMAS NIR measuring system revolutionizes the quick quantification of stickies and non-stickies in papers

With an innovative design that meets highest quality standards, the PTS development team presents a ground-breaking NIR-based test apparatus now also in use in the paper laboratory of the renowned Steinbeis Papier GmbH in Glückstadt. This new system enables laboratory technicians to analyse a significantly higher number of sticky samples during a shorter period, because there is no longer a need for time-consuming sample preparation. This ensures a considerable increase in the statistical certainty of the measurements. Moreover, the innovative measuring method allows not only the detection of stickies, but also the accurate determination of non-sticky plastic particles in terms of number and size. Additionally, the system delivers a detailed classification for different substance groups based on the

chemical composition of the particles. By introducing this highly advanced measuring system, the Steinbeis Papier corporation underlines its commitment to meeting highest quality standards.

### Standardisation

The development process for the measuring system in its small series followed the guidelines of DIN SPEC 6754 thereby ensuring that the requirements regarding the substances to be identified and the substance classes as well as the presentation of the results by specified size classes are met. The smallest of the size classes is an equivalent circular diameter of 100 µm. Conversion into an ISO standard is currently in the final phase and will

presumably be completed during the second quarter of 2024.

### Summary and outlook

We thank Steinbeis Papier corporation for placing their trust in us and together we are pleased about the successful integration of the measuring system in the internal workflow. The paper industry will profit from the manifold measuring possibilities, especially because any ideas and suggestions for improving the system and making the results more meaningful will be directly forwarded to all customers.

### Overview of the features of the DOMAS NIR camera system:

The near-infrared measuring system offers a high measuring precision



**Fig. 2:** Commissioning of the DOMAS system at Steinbeis Papier in Glückstadt (FLTR: Dr. Frank Wenig, Björn Zimmermann (PTS), Tamas Kordsachia, Mirna Bekic, Maren Holler, Steffen Kloppenburg)

along with a high spatial resolution and a wide range of applications in comparison with conventional methods:

- Reliable detection of stickies and further non-sticky contaminants;
- Faster measurements because

time-consuming sample preparations are no longer needed as compared with conventional methods;

- Less workload and lower cost;
- Possibility of determining the chemical composition of stickies and

non-sticky contaminants (refer to Fig. 1);

- Adaptability to a variety of applications. ●

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## Papermaking for the little ones: a big deal!

How impressive to look at: being a little child standing in front of the basically small pilot paper machine of PTS and watching papermakers “do their thing” by forming fibrous “pulp” into real colouring paper.



Fig. 1: In close touch with the giant paper reel

In the past, young researchers at a primary school age had already taken the opportunity to get in closer touch with the paper technology. In autumn 2023, our Technical Centre opened its doors for a kindergarten group (knowledge-hungry mini-researchers between 3 and 7 years old). They had already tried the making of handmade paper from shredded copy paper in their daycare centre and now wanted to explore how a paper machine works. After a very illustrative introduction to the paper cycle, they were given time to look round the paper machine at standstill. Many details were explained, many questions asked and answered in a child-oriented manner. Then things got loud. The little ones were well protected by their ear plugs. Standing next to the headbox with wide eyes, they could

watch how the pulp slurry from the pulper entered the machine to form a paper web to be wound up onto a small reel at the end of the machine. The children could also watch the making of handsheets. But the most impressive thing for the small children was to cuddle with the giant paper reel.

Thus, PTS has many highlights to discover and try out – from making handmade paper in vats and three-dimensional figurines out of corrugated board to the demonstration of the pilot plant. Soaking up knowledge can be fun! ●

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Fig. 2: Making handsheets





Fig. 3: Explanations at the headbox of the paper machine

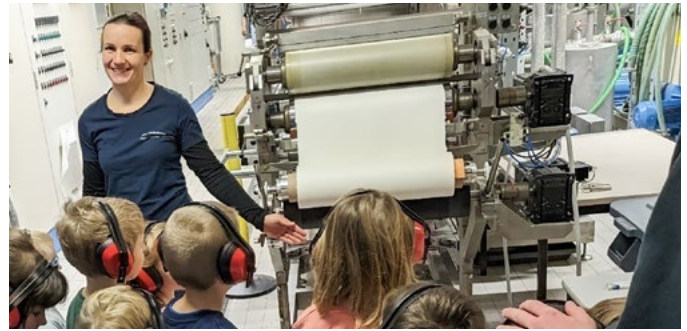


Fig. 4: The paper is wound up to form a reel at the end of the paper machine

## PTS support for regional initiatives



Fig. 1: Reading time in the children's hospital

During Christmas time, we, PTS, were allowed to visit the children's hospital of the Dresden University Hospital complex to meet and get to know Christin and Frida from the welfare association "IntensivZeit". Our colleague



Fig. 2: Frida, Christin (IntensivZeit), Debora (PTS)

Nadine Firl handed over a cheque as a very personal thank-you for the valuable work that is being done here.

The association, which was founded in 2020, accompanies seriously ill children, and their families, during and after their stay in the intensive

care unit. Smaller and larger actions and events, for example a daily reading hour in the Advent season, are organised by the volunteers of the IntensivZeit association to make everyday life more bearable for the young patients.

Every year anew, we are happy to have the opportunity to support local

initiatives with a small donation. The second tranche of our Christmas commitment was given to the Christian Youth Welfare Association CJD (Christliches Jugenddorfwerk Deutschland e.V.) in Heidenau. This place of learning in the immediate vicinity of PTS provides vocational orientation to disadvantaged young people in three major service areas (catering & housekeeping, technology,

green) with the aim to open up new perspectives for their future life and career. We have already been able to see for ourselves the great catering service of the training centre and are looking forward to further neighbourly cooperation. ●

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Fig. 3: Thorsten Voß, Steffen Schramm (PTS), Diana Röder, Jörg Renger (CJD)

## Paper for Power – Clean Hydrogen Convention 2023

Together with colleagues from the associated industrial and research project partners Felix Schoeller Holding GmbH and Co. KG, Phoenix Non Woven GmbH & Co. KG, Fraunhofer Institute for Manufacturing Technology and Advance Materials, as well as AMBARtec AG, PTS presented the materials and findings from paper-based demonstrators for gas diffusion layer applications in electrolyzers and fuel cells on the first Clean Hydrogen Convention held in Dresden on 25 and 26 October 2023.

More than 70 international exhibitors participated in an international trade fair accompanying the technical and political congress on the subject of hydrogen in Saxony and the world. Both the materials for paper-based gas diffusion layers and the storage technology from the trade fair partner

AMBARtec generated a great deal of interest in innovative developments from Saxony for the energy transition, Fig. 1.

We thank our partners, the organisational team of the hydrogen association HZwo e.V., and, last

but not least, the PTS Academy for the pleasant time together at the trade fair and for the co-operative atmosphere towards interested trade fair participants. ●

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Fig. 1: Impressions from the Clean Hydrogen Convention 2023, joint stand on Paper for Power



# Encouraging civic engagement in the Saxon Switzerland / East Erzgebirge Mountains District: “Social village development – we are in”



[www.landschaftzukunftev.de/verein-aktuelles/preisverleihung](http://www.landschaftzukunftev.de/verein-aktuelles/preisverleihung)



wide variety of different holistic rural development initiatives together with its partners, was entrusted with the evaluation of the projects and the organisation of the prize awarding ceremony.

*“The competition is intended to focus the attention on the many initiatives in the countryside striving for better social cohesion. We would be delighted if this honour motivated even more people in the district to do the same and follow the motto “Imitation urgently desired”,* said Mr. Geisler, the head of the administrative district.

“In our villages and towns, the demographic change can be felt more intensely than anywhere else”, explained Michael Geisler, a District Administrator. “It would almost be impossible to keep up many offers and assistance services for an ageing society in rural regions without the impressive civic involvement of a large number of volunteers. I am delighted that so many ideas and initiatives have come together for us to praise their drive and energy.”

The competition “Social village development – we are in” was looking for people who love country life and are committed to their village and the people in it. People with special ideas for how to live together and help one another with a special focus on housing, care, health promotion, education, and culture. The association “Landschaf(f)t Zukunft e.V.”, which has been sponsoring and supporting a

Franziska Gebauer, who is a member of the association, took part with a project for the acquisition of new digital equipment for a medium-assisted museum guide system in the show plant of Neumannmühle e.V.



Steffen Schramm took part with a joint project of the Biela valley country life association “Ländliches Leben im BielaTal e.V.”, the local fire brigade and several private persons for changing a traffic island into a community centre. Both initiatives were awarded prize money enabling them to start implementing new ideas. ●

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## Science Project Week of the Martin Andersen Nexö Grammar School in Dresden

During the week from the 26th of February to the 1st of March, PTS was the supervising partner of the Science Project Week of the maths and science-oriented Martin Andersen Nexö Grammar School in Dresden.

The goal of the annual project week is, on the one hand, to give the students an insight into different research institutes and into the daily work tasks in science, and, on the other, to give them an opportunity to run their first tests and trials.

During the first three days, our staff taught the students first basic knowledge of paper manufacture. Special focus was placed on studying the influence of moisture on the

behaviour of paper as a material. This subject was not only covered theoretically, but also put into laboratory practice, such as production of sample material, characterization of the samples, or tensile testing with wet/dry comparisons.

Then, the students were allowed to do their own laboratory work – from experimental design and assisted experiments to the evaluation of results.

On Friday, the students finally came together with their supervisors in one of the many lecture theatres of the Technical University of Dresden for mutual exchange. There, each of the student groups gave an independently prepared presentation about their supervising partner and their tests and test results.

We wish to express our sincere thanks to our dedicated employees for their support and wish all the best to the future scientists from the “Manos” school. ●

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## PTS at the Science Festival SPIN 2030

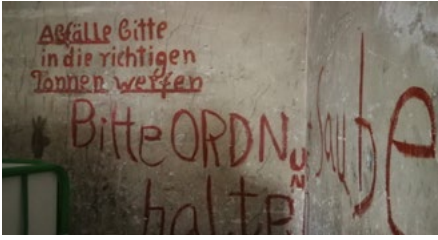
A central goal of PTS is to inspire young and old with enthusiasm for paper, fibre and science to help shape a successful future. We want children to watch paper come to life, win over young people for sustainability and arouse the curiosity of grown-ups. On the 8th and 9th of March this year, PTS was offered such an occasion within the scope of the Science Festival “SPIN 2030” funded by the Saxon Ministry of Economic Affairs.

The Technical Collections of the city of Dresden opened their doors for what is known as “Saxony – the Land of Science” with more than 50 exhibitors and a huge number of big and small researchers and explorers. The focus was placed on the most urgent challenges of humanity – inclusive of the themes of resources and material research. No wonder we as a forward-looking and future-oriented research institute felt

addressed and were one of the groups at the forefront.

Together with our partners from the Saxon Industrial Research Association (SIG), the Institute of Wood Technology in Dresden (IHD), the Plastics Centre in Leipzig (KUZ), the Institute of Lightweight Engineering and Polymer Technology in Dresden (ILK) and the Institute for Innovative Technologies (ITW e. V.)





in Chemnitz, we had the opportunity to contribute to the wealth of presentations covering the full scope and performance of the university and non-university research landscape of all Saxony.



Under the headline “Rubbish is Resource”, our stand welcomed all and any persons interested in testing their waste sorting knowledge. Blue, Yellow, Black, Brown. Paper towels, wood,

bakery bags and tea bag – which of the bins is the right one to ensure they return into the cycle for re-use.

We were delighted to see the crowds at our desk and impressed both by the general interest in recycling and the expertise of the youngest trade fair visitors. All in all, a huge success! ●

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## 20th Meeting of the Saxon Transfer Network

Last year, futureSAX held its semi-annual meeting of the Saxon Transfer Network with PTS being on site as a partner. The focus was on financing and structuring the transfer of knowledge in the context of non-university research institutes and university research.

“Transfer must be designed in a structured, proactive and targeted manner to ensure an efficient utilization of research results”, said Michael Kelber (Senior Project Manager for Technology Transfer at futureSAX and co-organizer of the

meeting) in terms of the background of this series of events.

This time, the network partners were convened at the premises of FILK Freiberg Institute gGmbH. To kick off the event, all participants were allowed a look behind the scenes and given a guided tour through the Technical Centre and the in-house tannery to learn more about the work of FILK.

This was followed by keynote speeches by representatives of the Saxon Industrial Research Association of Dresden, the Fraunhofer Institute for Machine Tools and Forming Technology (IWU) of Chemnitz and the Technical University & Mining Academy of Freiberg who spoke about

their experience, the challenges and the tasks associated with transfer staff deployment. Two workshops were held by Saxony 5 and the Helmholtz Centre Dresden-Rossendorf, respectively, to explore the financing and structuring topics in greater depth. The successful event concluded with a cosy get-together at a delicious buffet.

Michael Kelber summarized, “The open and familiar relationship between network members is a key element for making the transfer work in Saxony – both for business and for society. ●

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## Training of the lab personnel from Hamburger Rieger GmbH, Spremberg Paper Mill



Are you interested in training units custom-tailored to your specific needs?

Then don't hesitate to contact us at:  
[ptsacademy@ptspaper.de](mailto:ptsacademy@ptspaper.de)



In the middle of January, during a revision of their paper machine, the laboratory personnel of the Spremberg paper mill stayed for three days in Heidenau, split up in several groups, to follow advanced training sessions in the field of material testing. They included standard methods of physical testing of paper as well as more specific test methods.

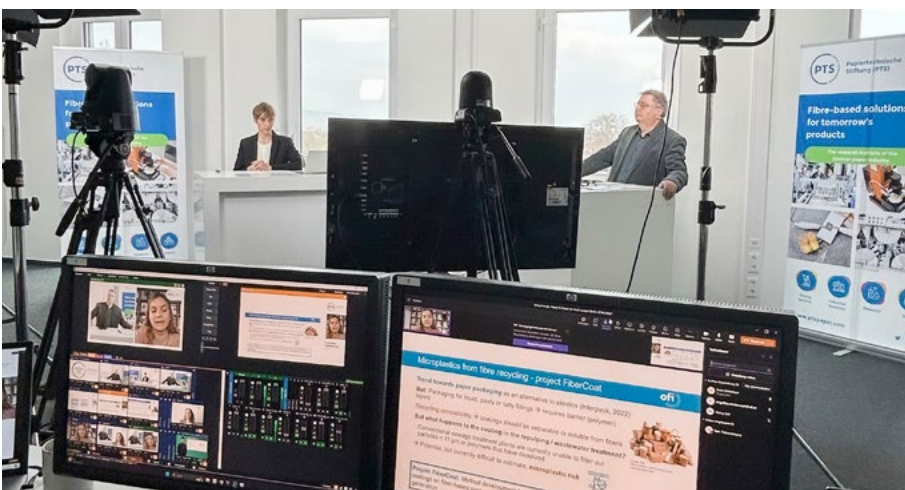
PTS has for many years performed the annual training in laboratory work for Hamburger Rieger. The

training sessions cover a wide variety of subjects that are designed not only to consolidate the day-to-day work of

the laboratory employees, but also to help them keep eyes on the bigger picture. The training units are given as needed, partly on the Spremberg site, partly in our premises in Heidenau, and customised in coordination with the laboratory manager, Mr. Peter Leinert. ●

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## Follow-up on the PTS Conference on “Paper & Board for Food Contact“, 6 and 7 March 2024 – Highlights



This year, the conference was again held in the well-established format of an English-speaking on-line session as introduced during the Covid pandemic – our informative PTS Conference “Paper & Board for Food Contact“. The tried and tested format make it possible also for international guests to attend the conference. Our moderation team, i.e. Dr. Antje Harling, Dr. Markus Kleebauer and Max Schneider, led through the varied programme.



Renowned international speakers from scientific institutes, public authorities and industries provided updates and impetus for a variety of topics surrounding the theme of papers in food contact. Accordingly, the presentations were followed by intense discussions.

### **„Current food safety topics and developed guidance within the carton sector“,**

Jan Cardon, European Carton Makers Association (ECMA)

Jan Cardon began with an overview showing which ECMA guidelines for ensuring the disclosure of information have already been published and how they can be used to produce safe materials and articles intended to come into contact with food. In his presentation he showed clearly that the disclosure of information on controlled, intentionally added substances (IAS) was already working well. As to IAS without fixed limit values (non-listed substances, NLS), suppliers disclose self-derived limits sporadically only. Mostly no information whatsoever is disclosed for non-intentionally added substances (NIAS), which may form as a reaction or composition product or may be impurities contained in the raw materials. Therefore, his request is to establish clearly separate lists for IAS (listed and non-listed), NIAS and dual-use substances in the conformity documents.

### **„Recent developments in FCM Law on European and national level“,**

Dr. Stefan Merkel, Federal Ministry of Food and Agriculture (BMEL)  
Stefan Merkel reported on the developments on EU level, specifically on the regulation of bisphenol A and the changes to the Plastics Regulation 10/2011. In the second part of his presentation, he covered the Twenty-First and the Twenty-Second Regulations amending the German

Consumer Goods Ordinance (BdGgstV). In terms of the Printing Ink Ordinance (Twenty-First amendment), he pointed out that the BMEL ministry was coordinating initiatives for cost sharing in the preparation of dossiers for the entry of substances in Schedule 14 to the Consumer Goods Ordinance.

### **„Global FCM Compliance Rules“,** Dr. Bernhard Fritz, Institutional and Industrial Consulting

In the next presentation, Dr. Bernhard Fritz gave a comprehensive overview of the regulatory work outside the EU. He outlined which non-EU countries were also following the positivist approach selected by the European Union. This applies in particular to Switzerland, China, the Mercosur member states, Japan and Korea. Said countries use positive lists of substances that can be safely used in paper and board-based food contact products. In contrast therewith, the FDA in the USA uses the case-by-case approach in which the safety of a food-contact material or article must be decided for each individual case.

### **„Single Use Plastics Directive – Implementation and Development in Germany“,**

Karsten Hunger, Industrieverband Papier- und Folienverpackung e.V. (IPV)

In his presentation, Karsten Hunger gave a clearly structured overview of how the European Single-Use Plastics Directive (SUPD) was implemented in various German laws and regulations (Ordinance on the ban of certain single-use plastics [EWKVerbotsV], Act on the Single-Use Plastics Fund [EWKFondsG], Ordinance on the Properties and Labelling of Single-Use Plastics [EWKKennzV]) and pointed out vagueness problems surrounding its implementation. The implementation of the SUPD on a national level will lead to another

legal patchwork situation in Europe. That is the reason why the Packaging and Packaging Waste Regulation (PPWR), initially planned as a Directive initiative, finally became a regulation. In the final part of his presentation, he indicated existing/potential overlaps and points of collision between the PPWR and the SPUD. Among other things, he mentioned potentially excessive labelling obligations.

### **„Mineral oil hydrocarbons – Recent developments in EU and Germany“,**

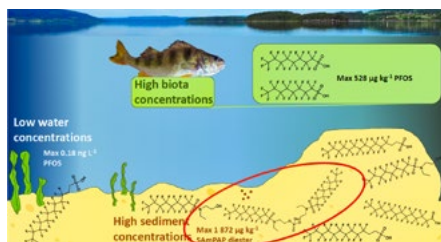
Christina Reinwaldt, Saxon State Ministry of Social Affairs and Social Cohesion

Ms. Christina Reinwaldt presented the current developments regarding the assessment of mineral oil contaminants in foods. Based on comparative data she showed very clearly the significant reduction achieved in mineral oil contamination of selected food categories over the past 15 years in Germany. Also, she presented the benchmark level of the German Food Association in comparison with the guide values proposed by the European Commission for the establishment of a potential monitoring, pointing out existing differences between the different food categories.

### **„News on microplastics: reg. 2023/2055, testing procedures and research projects“,**

Angelika Włodarczyk, Austrian Research and Testing Institute (OFI)

In her comprehensive presentation on microplastics, Angelika Włodarczyk outlined the key elements of the Regulation 2023/2055 and then presented the “microplastics@food” project carried out at the OFI in which the microplastic contamination of simple foods, such as salt or mineral water, or of food surfaces were determined. The project resulted in a set of actions



**Fig. 1:** Schematic view of PFAS contamination in the Norwegian Lake Tyrifjorden [Source: Presentation “Recycling of Paper, Cardboard and its PFAS in Norway” by Håkon Austad Langberg (NGI) at the PTS Conference on 07/03/2024]

aimed at reducing microplastics in foods. For the future, OTI plans to run a MICROPLEXFOOD project to test also more complex food matrices for microplastic entry pathways.

### “Recycling of Paper, Cardboard and its PFAS in Norway”, Håkon Austad Langberg, Norwegian Geotechnical Institute (NGI)

The introductory topic of Håkon Austad Langberg’s presentation was the contamination of Lake Tyrifjorden with per- and polyfluoroalkyl substances (PFAS) found in the wildlife and sediment of the lake and attributable to a paper mill located next to the lake. He based his presentation on research data showing that the contamination in particular with SAM-PAP diesters could be originated in the effluent and rejects from paper recycling plants.

### „Project of German Environment Agency (UBA) 12/2022-11/2025: PFAS mass balance in paper mills using recovered paper as raw materials: preliminary results on theoretical input sources for different PFAS“,

Almut Reichard, German Environment Agency (UBA) and Max Schneider, PTS Heidenau  
In line with the previous presentation, Almut Reichard and Max Schneider presented together

the UVA-initiated project on the identification of PFAS inputs and sinks in the paper cycle. They explained previously collected data on the use of PFAS taken from literature and from a survey among paper manufacturers and outlined the sampling concept for the identification of possible input and output pathways for PFAS into paper, but also into the environment.

### „Guidance on testing conditions for paper and board kitchenware“, Dr. Eddo Hoekstra, European Union Reference Laboratory for Food Contact Materials (EURL-FCM)

After a brief introduction to the structure and tasks of the European reference laboratories, Eddo Hoekstra covered the application of the JRC Guideline on testing conditions for kitchenware especially for paper and board. The presentation was followed by a lively discussion regarding e.g. the selection of the “correct” surface/volume ratio for the evaluation of migration from paper.

### „Results from an official control laboratory for monitoring FCMs made of paper and board“, Lydia Richter, Chemical and Veterinary Investigation Office (CVUA Stuttgart)

The presentation by Lydia Richter continued with analytical chemistry. She explained which method adjustments were or should be made in view of the further development of analytical options for the determination of chlorine propanols and bisphenols. She emphasized the significant analytical impact of the pH value for 3-MCPD and 1,2-DCP. For BPA and BPS, she showed how comparative studies on the real foodstuff are useful to find a food simulant that is more suitable for migration testing than the cold-water extract.

### „Residual food contamination on paper and board-FCM and its influence on recyclability“,

Marie Geißler, PTS Heidenau

Marie Geißler invited the audience to follow the path of a packaging paper from the consumer back to the paper mill. Her explanations clearly showed the considerable impacts e.g. barrier coatings and adherent food residues have on the recyclability of food packaging. As a result, stickies might penetrate into the fibrous material and cause microbiological contamination. The PTS project ReCoVer is designed to assess the influence of different types and residual amounts of food on the recycling process.

### „PLAFCO – all cellulosic fiber composite material“,

Prof. Dr.-Ing. Jukka Valkama, Baden-Württemberg Cooperative State University (DHBW) and Nils Press, Junitec GmbH

Prof. Dr.-Ing. Jukka Valkama presented his self-developed paper material PLAFCO made of nothing but cellulosic fibre. In his presentation he showed that, in contrast with the manufacture of parchment paper, cellulose dissolved by urea penetrates into and fills the voids of the cellulose matrix. This new material makes it possible to obtain excellent strength properties and many other technologically valuable characteristics. At the end of the presentation, Nils Press gave a brief overview of the pilot plant for PLAFCO manufacture. The following discussion clearly showed the potential of the presented material but made also clear that it has not yet reached the “nobility” status of a safe food contact material. ●

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# Events 2024

Registration & information:  
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May	<b>Corrugated Board Symposium</b> · Symposium · 07 – 08/05/2024 · Heidenau	🇩🇪 ★
	<b>PTS Network Day 2024 “We for Paper”</b> · Conference · 28/05/2024 · Heidenau	🇩🇪 ★
Jun	<b>Introduction to conformity work and quality assurance for paper, board and tissue for foods including new challenges such as legislation on single-use plastics   PPWR &amp; Co.</b> Seminar · 11/06/2024 · Online	🇩🇪
	<b>Recycling of paper and board packaging</b> Seminar · 12 – 13/06/2024 · Online	🇩🇪
	<b>Products made of paper – which are the requirements for non-food packaging, toys, tobacco and the like?</b> Seminar · 14/06/2024 · Online	🇩🇪
Sep	<b>Paper manufacture at a glance</b> · Introductory Seminar · 10–11/09/2024 · Heidenau	🇩🇪
Oct	<b>Recyclability of paper &amp; board based packaging</b> · Seminar · 01 – 02/10/2024 · Online	🇬🇧
Nov	<b>Testing of paper, board, corrugated board and packaging</b> Seminar · 04 – 07/11/2024 · Heidenau	🇩🇪
	<b>Selection and assessment of recovered paper</b> Workshop · 12 – 13/11/2024 · Heidenau	🇩🇪
Dec	<b>Fibre Symposium 2024</b> · Symposium · 04 – 05/12/24 · Dresden	🇩🇪 ★

## PTS Winter Party

The annual PTS Winter Party took place on the 18th of January 2024. PTS Director Dr. Thorsten Voß began by summarising the highlights of the prior year – such as the successful completion of the PTS reconstruction works and the company anniversaries – and thanked all employees for their commitment and excellent work in the past year.

In order to bring the team closer together in times of mobile working, this was followed by a solve-a-mystery game in which the task was to form investigative teams to solve a tragic crime and identify the perpetrator.

Thanks to black light, attentive observation and teamwork, the thrilling mysteries were solved, and the guilty party unmasked.

After the detective work, there was time for all colleagues to enjoy the buffet, dance the night away in the kitchen transformed into a ballroom, relive childhood memories with Mario Kart, help themselves to sweet treats at the Candy Bar, or capture new memories in the photo box.

The PTS Winter Party was a successful gathering not only for celebrating the previous year but also for strengthening team spirit and giving employees an unforgettable time. Many thanks to the entire PTS team for this wonderful evening, and special thanks to Celine



Farr, Debora Zahel, and Lea Stelzig for having prepared the party with so much loving care. ●

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