

PTSNEWS FIBRE based solutions for tomorrow's products

Sustainable packaging: Paper has it. Research makes it possible.



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Editorial

Dear readers,

This issue is dedicated to the never ending story of packaging. Almost all products will need at least one or more packagings during their life cycle. Whether for fabrication, for transport, for storage, or for durability.

In the past, our aim was to produce a highly functional wrapper or container at the lowest cost. The challenges are much greater now. Regulatory constraints have increased significantly. Apart from the packaging components, a special focus of attention is on recycling and sustained use of resources during the life cycle.

This year, Papiertechnische Stiftung joined the 4evergreen initiative to work together with many global players on coming up with solutions to the challenges of sustainable packaging on a European level. In our current issue you will also find latest news from the areas of packaging development, bio-based adhesives, security labels in textiles, PTS membership in the 4evergreen network, and upcoming PTS events.

And there is a personal matter. This issue contains my last welcoming address in my quality as Director of Papiertechnische Stiftung. So wish to seize this opportunity to extend my special thanks to all co-workers and employees for their great collaboration. And as a matter of course I also express my thanks to all partners, associations, customers, suppliers, service providers and research institutes I had the pleasure to work with during the past five years. Special thanks also to the Board of Trustees who have assisted Papiertechnische Stiftung also in difficult situations during the last few years. Together we have put Papiertechnische Stiftung on the right track. The positive feedback from our research partners and customers fills us with gratitude and pleasure, and encourages us to further improve in the future and create value for the paper making and converting industry.

At the end of September, I will hand over the Director position to Dr. Thorsten Voss who is the perfect successor thanks to his many years of experience and his research background.

So please enjoy the reading. We wish you all the best and, in spite of the third Covid wave, are looking forward to meeting you again in Heidenau.

Clemens Zotlöterer, Director

30th PTS Coating Symposium 2021 *Functional Coating for Fibre Based Packaging*

7th - 8th September 2021 Online Conference

www.coating-symposium.com Programme available online!



Environmentally friendly packaging: Paper has it. Research makes it possible. Market trends call for innovations

The keywords behind the market L trends are clear. It has never been easier to perceive what consumers. supply chains and traders expect of a packaging. And the legislator follows by passing regulations and acts on supply chains, circular economy and packagings. Printed electronics make packagings a key element for the logistics of tomorrow. And digital printing demonstrates how personalization can work in a mass market. This results in a highly dynamic market in which innovations in materials and converting processes are the initial focus. Thanks to innovative converting processes and the use of regrowing raw materials, paper has the potential to open up many new applications. For reaching the required recycling rates of 90%, however, the industry needs innovations and joint standards across supply chains in terms of collection, sorting and use of recovered paper. A robust market cannot be established unless these developments keep pace with the ongoing innovations in materials and converting methods. In the light of this situation, companies need to make investment decisions that help to combine growth strategies and sustainability. And paper-based solutions are more and more the focus of attention.

The paper industry is well-advised to take a holistic approach to sustainability. Although paper can be broadly recycled as a material and can rely on the existence of a well-established collection and sorting infrastructure, the industry should be committed to the principles of circular economy which are avoidance and reuse. In the future, the legislator and the consumer will not accept increasing waste volumes or overuse of resources.

Research creates safe innovation

This scope of uncertainties calls for research and technical infrastructures that allow for early testing and implementation of ideas and innovations. PTS offers the ideal platform for this purpose. Our basic approach as a close-to-industry transfer-oriented research institute is to identify and develop knowledge from fundamental research and application-oriented projects to make the results available to companies along the entire value-added chain for appropriate use.

We develop such knowledge in publicly funded research projects with the aim to make the results accessible to the industry using various knowledge transfer formats. Such formats include training sessions, workshops, measuring and testing services, or the dedicated use of the technical infrastructure of PTS for company-specific research topics.

The pilot paper machine in the Technical Centre (*Technikum*) on the premises of PTS and the various coater units offer an ideal way for companies to produce samples in small batches. Our main approach to paper converting solutions is to enter into cooperation with small and medium-sized enterprises or other research institutes able to test the performance of samples made in the pilot paper machine in a wide variety of application-oriented converting processes. This is how we ensure shortest time to market from the very first idea to final implementation.

A major aspect of this work is to develop test methods for the standardised testing of the use and trading of packaging and for ensuring compliance with statutory requirements.

We are a non-profit organisation and an important contact for both associations and inspection bodies in terms of the marketing of paper-based packaging. This builds trust and security among

Trends in packaging

- **Sustainability:** Megatrends in the packaging industry
- Conformity: Increasing requirements in trade and consumer safety
- Food waste: smart packaging solutions can help
- Product safety: full traceability and antifalsification security are in demand
- Digital printing: from niche to mass production
- **Printed Electronics** the mobile revolution from QR codes to interactive packaging solutions

Fibre Packaging @ PTS



- Packaging design, end-of-life concepts, simulation/modelling
- Material selection, paper manufacture, moulded pulp
- Shaping, printing, traceability

Varied dispersion coatings, modern application systems, barrier functionalities for optimal

- product safety Recyclability assessment, food safety,
- specification matching

market players. We provide companies with support in packaging design to close the loop and make sure the requirements, especially in terms of recyclability, are met. For this purpose, PTS works on the harmonisation and updating of test methods both on a national and international level for broadest possible practical implementation. Last but not least, the stock preparation installations in the Technical Centre of PTS allow for dedicated trials to produce recyclabilities based on the performance specifications of the packaging recycling systems known as Dual Systems in Germany.

Many problems and technical solutions need to be examined in more detail, requiring a systematic development of relevant knowledge and evaluation of the economic benefits.

Barrier coatings: recyclable and bio-based for better competitiveness of paper

PTS Research Projects

Project period:

from 2018-04-01 to 2020-12-31 Moisture and water content regulating active packaging

Project period:

from 2020-09-01 to 2022-08-31 Lignin modification by reactive extrusion for bio-based paper coatings

Project period:

from 2020-10-01 to 2022-09-30 Coatings for imparting regenerative superhydrophobic properties to paper products

Project period: from 2020-12-01 to 2022-11-30 Flavour barrier of packaging papers

The application potentials of paper have been significantly increased during the past few years, especially thanks to innovations in the area of barrier coatings. The main focus of PTS in this field is on using renewa-



ble resources in the formulations for dispersion coatings and adhesives for their use in industry-scale coating systems. That is not limited to coating colour formulation but goes far beyond. Often, renewable resources are not readily film-forming materials or provide a restricted water vapour barrier as a result of their hydrophilic properties. Basically, the aim is to encourage and foster the development of materials for novel packaging concepts in a circular economy. For this purpose, it is necessary to use innovative approaches to the integration of raw materials such as starch or lignin and to examine their bonding to the paper surface. Interdisciplinary cooperation with other research institutes enables us to integrate specific knowledge from other industries in the papermaking and converting business. For example, PTS is working on self-healing surfaces intended to prevent converting operations from causing damage to the barrier effect. However, all concepts will work only if the coating does not jeopardise the recyclability of the product.

Match-making in converting: process and material brought together

PTS Research Projects

Project period: from 2021-06-01 to 2023-05-31 **Creasing of corrugated board**

Project period: from 2018-01-01 to 2020-10-31 Evaluation of damage to corrugated board

Project period: from 2019-07-01 to 2021-11-30 **Bending resistance**

Project period: from 2021-06-01 to 2022-05-31 **Conception of recyclable bio-based coatings for paper packaging**

Project period: from 2019-01-01 to 2020-12-31 **Paper laser melting**



Project period: from 2020-12-01 to 2022-11-30 Prediction of formability of paper-based materials

Project period: from 2021-04-01 to 2023-09-30 Manufacture of bio-based hotmelts

Opening up new markets, however, also implies adjusting paper materials to established or innovative converting processes. This is the only way for a material to become a product and requires a comprehensive scientific understanding of paper and board. In order to bring this knowledge to industrial use, PTS does research on test methods to ensure the measurability of various material parameters and relevant environment conditions in a first step, because conventional methods reach their limits. At present, efficient material-saving packaging concepts are prevented by the fact that there is still a lack of material models for the integral modelling of plastic bending and folding of paper and board. Many of the pending problems can be solved with the help of numeric simulation. The challenge is to bring the results to industrial use. Simulation software is an expensive investment and guite often there is not enough benefit for a company to build its

own capacities. Therefore, PTS is working on web-based platforms where companies can use the material data available to them to model complex problems in a simple way.

Marketing of packagings: approved test methods are a must

PTS Research Projects

Project period: from 2019-02-01 to 2021-05-31 **Performance test for paper in food contact during baking**

Project period: from 2021-04-01 to 2023-03-31 Tamper-proof security labels

Before being admitted to the market, a packaging needs to meet a multitude of requirements beyond the actual security function. These requirements include compliance with statutory regulations, e.g. in terms of approved substances and migration to the packaged good, or in terms of resistance to ageing. In frequent cases, paper-based materials must furnish proof of suitability for certain applications. Various printing or marking methods are used to ensure full traceability, e.g. for folding boxes. The printing process and the paper or board material need to be properly matched to guarantee for permanent functional integration in the packaging. New challenges consist in furnishing proof that an envisaged tamper-proof and anti-falsification security feature for a paper-based packaging can be actually achieved. The EU Reg. 2016/161 places high demands on the durability of medicinal products for human use. Manufacturers of folding boxes and labels for pharmaceutical packagings are now faced with a significant problem, which is to furnish appropriate proof that the packaging meets the defined requirements. The known standards cannot be applied here. PTS is working on test methods that will enable papermakers and paper converters as well as the persons responsible for marketing to fulfil their statutory requirements and thus ensures smooth movement of goods.

Recovery of a paper-based packaging: it is not as simple as it may seem!

PTS Research Projects

Project period: from 2018-01-01 to 2020-03-31 Recyclability of paper-based packaging

Project period:

from 2021-06-01 to 2022-05-31 Conception of recyclable biobased coatings for paper packaging

Project period: from 2021-10-01 to 2023-09-31 Recycling of post-consumer packagings

Today's paper packaging recycling rates are very high already and thus an ideal prerequisite for meeting the demand for sustainable packaging solutions. So many product developers have discovered paper as a packaging material. Unfortunately, every paper package cannot automatically be put in the paper recycling bin. Residual deposits of the packaged good or differing laminates cannot readily be reused in papermaking. On the other hand, they can be a useful raw material offering a high value-added potential in paper manufacture if properly identified and prepared for reuse. And material reuse will of course increase the recycling rate which is to reach 90% for paper and board as of 2022 in accordance with the German Packaging Act (VerpackG). Paper mills are now faced with uncertainties as to which materials are suitable for reuse within the scope of current or future stock preparation concepts. Therefore, PTS is looking into residual deposits adhering to used packagings and also into the impact of packaging coatings on the recycling process in order to the determine and assess their potential for disturbing the paper recovery cycle. This research follows up on previous projects covering the dissolution behaviour of paper and composite materials. PTS researchers were able to build a very first model showing the behaviour of two-sided coated papers during dissolution in the pulper.

This PTS News issue presents a good opportunity to outline some of the basic elements of this broadly designed approach to packaging. Please know that the following is just a glimpse of the manifold activities by PTS in the field of packaging. Apart from the research topics already mentioned, we are active members of different bodies and networks to give knowledge-based advice to companies or authorities and to design a sustainable paper cycle together.

This includes co-working with other European inspection bodies on a harmonised test method for bench-scale recyclability assessment which was presented jointly with CEPI at the end of 2020. This test method forms the basis for the assessment of a range of different packaging materials within the 4evergreen Alliance. At the same time, there is an open approach to building an assessment scheme by integrating empirical values from pilot-scale investigations or industrial practice. If you wish to know more about our work, you are welcome also to use one of our many offers in training courses or workshops.







How to predict the three-dimensional formability of papers

packaging's geometry is one of the Amajor design factors for creating a highest possible identification effect for a product or brand. Thanks to comprehensive research during the past few years, it has become possible to expand the limits of paper as a material in three-dimensional forming methods, such as deep-drawing or hydroforming, to such an extent that packaging products at high forming degrees can be produced in very good qualities thereby boosting the availability of a promising alternative to thermoformed plastic trays.

However, a remaining impediment to broader application on an industrial scale is that a paper's suitability for 3D forming processes is not standardised and cannot be predicted on the basis of conventional material parameters, and this makes it significantly harder for paper converters and packagers to select the appropriate material.

This was the motivation for PTS to enter into cooperation with Steinbeis University and TU Darmstadt (PtU) for a joint project known as "UniVorsUm". This cooperation brings together the German-wide 3D paper forming expertise in material development and process development for both deep-drawing and hydroforming of papers.

The UniVorsUm project pursues the goal to develop a solution for standardising and predicting the formability of papers

Fig. 1: Flowchart for modelling the forming quality

and paper-related materials in 3D forming processes with both rigid and flexible holding-down devices by defining the essential material properties. A first subgoal is to develop a new testing strategy as well as associated parameters in order to be able to attribute effects and defects to the underlying deformations or material impairments (acceptable to a reduced extent, but undesirable to a large extent) in the 3D forming process. Another sub-goal is to identify test scenarios and test conditions (near-process conditions) that are indicative of the formability of materials. The well-aimed combination of the input variables and output variables will then serve to predict the forming limits. Finally, the test methodology for the various deep-drawing and hydroforming variants of the 3D forming process is to be harmonised to provide a standard that characterises a paper material by its forming quality.

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Project title:

» Development of a universal method for predicting the formability of paper-based materials in deep-drawing and hydroforming (UniVorsUm)

Project period:

» 2020/12/01-2022/11/31

Project sponsor: » IGF 21513 BG

Research locations:

- » TU Darmstadt. Institute for **Production Engineering and** Forming Machines (PtU),
- » Steinbeis Hochschule
- » Papiertechnische Stiftung (PTS)

Project leader:

- » Dr. Martin Zahel
- » Benjamin Hiller









Fig. 2: Exemplary formed part and hydroforming

Manufacture of bio-based hotmelt adhesives based on polysaccharides and their application in paper and board packagings (BioGlyk)

he packaging market in Germany is a continuously growing market in which paper products play a key role. The requirement of having a full-scale ecologically reasonable alternative to plastic packagings, inclusive of adhesives, can be fulfilled by a hotmelt that is based on renewable raw materials. Previous attempts always failed because of low thermal stabilities and harmful substances. Especially for small and medium enterprises (SME) with a lesser degree of technical equipment, this has so far been a critical obstacle to market access. To this end, PTS entered into cooperation with the Leibniz Institute for Polymer Research (IPF) as of 01/04/2021 for the IGF project "BioGlyk". The planned research project is aimed at producing a thermostable hotmelt adhesive for paper and board packaging while replacing fossil resources by bio-based components on the basis of polysaccharides. Comprehensive characterisations of both the individual components and the interacting mechanisms in the compound form the basis for an optimally matched adhesive formulation. The hotmelt adhesive is intended for application in packaging products that can also be used in the food sector. The basis polymer will be a starch ester made by reactive extrusion. Additional starch is also intended to be introduced in the hotmelt as a functional filler with colloidal starch particles of variable size. Furthermore, the starch particles can be functionalised as needed, e.g. through a protective coating against excessively high thermal loads. The results are to be compared with the use of thermoplastic starch. The hotmelt formulation such developed is planned to be produced on a kilogramme scale for application testing. Thanks to the ecological research approach to making consumer goods and packaging products from ho-

listic bio-based materials, good market entry opportunities are expected especially for SMEs to launch new hotmelt adhesives.

Birgit Kießler,

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Project title: » Manufacture of bio-based

wantacture of bio-based hotmelt adhesives based on polysaccharides and their application in paper and board packagings

Project period:

» 01/04/2021 - 30/09/2023

Project sponsor:

» IGF project 21788 BG

Research locations:

- » Papiertechnische Stiftung, PTS Heidenau, Birgit Kießler/ Dr. Alexander Feldner
- » Leibniz-Institut f
 ür Polymerforschung Dresden e.V., Dr. Dana Schwarz



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Security labels Manufacture of functional labels in the product return business of online-traded textiles

The increasing volume of on-L line-traded products results in a higher number of product returns. The return rates are variable, depending on the type of products ordered, and are particularly high in "fashion and accessories". 53.6% of the customers do not plan for returns when ordering, 27.6% order several articles in different sizes and colours for comparison to make a final decision. The share of customers ordering an article with the intention to return it is 18.8%. A typical example in Germany is the ordering of traditional Bavarian leather trousers and dirndl dresses for the Oktoberfest beer festival and their planned return after the festival. This meets the definition of unreasonable and excessive wearing of online-ordered textile articles. This abusive use of partly free returns by customers is increasing more and more. Based on the annual turnover on online sales in Germany and the turnover in fashion and accessories in the amount of EUR 11.1 billion with a return rate of 7%, the calculated annual loss incurred by abusive returns is EUR 397 million. Only about 79% of the returned articles can be resold to customers as an A quality. The remaining articles are impaired and cannot be refreshed at reasonable cost or at all. The cost of examination,

identification and aftertreatment (washing, pressing etc.) is about EUR 10 for each returned article. In addition to the aforementioned direct costs, there are enormous extra costs for transport, handling, unpacking and, where need may arise, disposal. Also, personnel costs need to be considered, because the examination of returns is performed by specially trained staff only.

We want to help reduce said losses in the millions in online-traded fashion and accessories. To do so, we designed three different demonstrators. Within the scope of the project presented here, the production of self-adhesive labels having a functional layer structure and an integrated indicator system for the detection of improper use of online-traded textile articles was performed under the conditions and according to the guidelines of SMEs for premium textile producers and traders. Specific physical and/or chemical influencing factors emanating from the human wearer are transported within the label, based on the purposeful use of the diffusion parameters in the layered structure, to the effective site of the indicator system to trigger a colour response, which allows for visual evaluation and final proof. The label can be readily used and easily replaced.

Project title:

» Manufacture of functional labels in the product return business of online-traded textiles

Project period:

» 01/08/2020 - 31/07/2022

Project type:

» Euronorm INNO-KOM MF 200033

Research locations:

 » Papiertechnische Stiftung PTS; Dept.: Functional Surfaces Dr. Yvonne Jüttke, Anke Steinberg; Sales: Jörg Hempel

The main focus is on:

- identification of specific influencing factors of the human body:
 - » physical factors such as heat, moisture, etc.
 - » chemical factors such as salts, proteins, etc.
 - » mechanical factors such as compressive load, friction, etc.
- visualization of signs of excessive wearing of textiles, e.g. time-delayed change in colour (colour matrix) by a matched indicator system that responds to influ-



Fig. 1: Schematic view of the paper-based label with functional layer structure and designed diffusion path of the indicator system (left). Enlarged view of the layers 1 - 3 with the effective indicator system and colour change (right).



Fig. 2: Human skin with the various influencing factors in men and women (left) and their breakdown in mechanical, physical and chemical parameters (right).

encing factors or external effects such as pH, pressure, temperature, time, etc..

- the conceptual model design of the label with functional layer structure for induced and time-controlled stimulus transmission to the indicator.
- easy and reliable detection of signs of abusive wearing by simple visual examination and thus reduction in loss from abusive product returns. The label is specifically adapted to and integrated in the textiles (dress, trousers, costume, shoes, etc.).

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Fig. 3: Illustration of a possible examination procedure: a change in colour and thus abusive wearing can be detected quickly and easily.







Combined paper and textile technology opens up new perspectives for lightweight construction

 $B^{\rm y}_{\rm shall}$ be reduced by 55% as compared to 1990 levels [1]. Urgent action is required to achieve this goal, especially in the energy, industry, buildings, transports and agriculture areas. For this purpose, it is necessary to cut down on fossil fuel use and substitute electric mobility solutions for conventional powertrains. Also, a sustained reduction in energy usage for the manufacture and use of products is indispensable. So new functional materials and lightweight construction technologies, such as in aircraft construction, will allow significant reductions in energy consumption and carbon emissions.

As well as various metallic lightweight construction materials, there is a wide variety of fibre composites such as glass quired mechanical properties of the component can be achieved using sandwich construction designs as already common in automobile construction, aviation and building industry. A sandwich composite is formed with two tension-resistant cover layers and a compression and tension-resistant low-density core. At present, the cores (mostly folded or honeycomb cores) are produced in an expensive and time-consuming process and are bonded by adhesives only. They are highly susceptible to delamination due to critical short-time loads and alternating loads (vibrations), and the load-carrying capacity of the sandwich panel can be minimized over a longer period. Alternative materials, such as textile spacing structures, have an excellent delamination resistance thanks to the fibre-based locking design of the layers. However,



Fig. 1: Schematic view of the process steps for producing the HyPerWeave structure with the development priorities of the co-working research institutes [left]; graphical representation of the paper/textile weave [right] ©ITM

and carbon-reinforced plastics (CRP) that show a high potential for lightweight construction applications but a very energy-intensive production, especially in case of carbon. So in the light of the goal to reduce carbon emissions across all industries, the use of glass and natural fibres for reinforcement is worthwhile, because a reduction in CO_2 emissions by up to 85% in comparison to pure CRP is feasible, depending on the type of component [2]. In spite of the comparably low fibre rigidities and strengths, the resaid sandwich-style textile structures do not provide the required shearing strength.

So the goal of the project HyPerWeave (Hybrid High Performance Paper Weaves), which is being worked on in cooperation with the Institute for Textile Machines and High-Performance Material Technology (ITM) of TU Dresden, is to specifically develop an economical production process for sustainable high-performance panels based on

Project title:

» "Development of integrally woven paper/textile sandwich structures for lightweight panels" (Hybrid High Performance Paper Weaves – HyPerWeave)

Project period:

» 01/05/2021 - 31/10/2023

Project type:

» IGF-Vorhaben Nr. 21856 BR

Research locations:

- » Papiertechnische Stiftung (PTS), Functional Materials Dept.
 Dr. Stefan Knohl, Dr. Cornell
 Wüstner, and Maria Carmesin
- » Technical University of Dresden, Institute of Textile Machinery and High Performance Material Technology (ITM), Dr.-Ing Gerald Hoffmann and Michael Vorhof

[1] German federal government: Climate Protection Programme 2030 of the federal government implementing the Climate Protection Plan 2050, https://www.bmu.de/fi eadmin/Daten_BMU/ Download_PDF/Klimaschutz/klimaschutzprogramm_2030_umsetzung_klimaschutzplan.pdf, (15/07/2020).

[2] Beus, N.; Carus, M.; Barth, M.: Carbon Footprint and Sustainability of Different Natural Fibres for Biocomposites and Insulation Material. Hürth: nova-Institut GmbH, April 2019.

available technologies (natural-fibre reinforcement, paper sandwich construction, distance weaving). This is made possible by combining the mechanically favourable arrangement of spatially folded paper surfaces with the positive textile-style engagement of all sub-components (see Figure 1). The final fixation and consolidation of the HyPerWeave panels is a product-specific operation using high-performance materials (thermoplastics, thermosetting resin) or entirely ecological (e.g. starch-based).

Within the project, the specific development of the innovative hybrid paper/ textile sandwich materials for lightweight panels is guaranteed by a high number of accompanying simulations along the process steps aimed at the desired material properties. The paper is spatially folded thereby imparting a high structural shearing and bending resistance to the future panels. The material base is made up of new cellulose-based special papers that are incorporated on a fibre basis in between the woven top and bottom layers using a further-developed new weaving method. In terms of flammability and fire protection, PTS is developing a new method for imparting inherent flame-retardant properties to cellulose-based special papers in order to achieve the Class B2 flammability rating according to DIN 4102 or better. Papers are developed by combining various fibrous materials (e.g. pulp and glass), additives (e.g. wetstrength, binding and retention agents), and flame-retardants (solid organic materials on P-N basis) then to be analysed and evaluated under papermaking aspects. The method is implemented on the basis of a special paper predominantly made of renewable resources (pulp) and a high-performance paper based on mineral fibres (glass). The paper variants such developed must be shaped into strips suitable for weaving, and this requires testing for laser and mechanical processibility (cutting, creasing).

ITM is working on a new weaving method in which the innovative papers are spatially folded and woven by warp and weft into a spacing structure such that the top and bottom layers and the fibre-based core are coupled with one another in a positive form-fit design. Also, a new material feed, shed formation and fabric guide for the weaving process are being developed and implemented in terms of design and technology. All development steps are based on geometric structures ensuring that the paper folding operation is properly adapted to relevant mechanical load scenarios, and use simulations to develop different weave variants.

The newly developed special papers (based on pulp fibre) and high-perfor-

mance papers (based on glass fibre) are used to realise different functional patterns. Finally, the project team will, in consultation with industrial actors, develop two demonstrators suitable for different applications scenarios (furniture construction using special paper, and lightweight panels for aviation using high-performance paper).

In comparison with conventional sandwich structures, the resultant new Hy-PerWeave panels will have a significantly improved resistance to delamination and a high resistance to damage. The process chain for panel manufacture will be significantly shorter, eliminating the need for subsequent fireproofing and bonding steps. Thanks to the newly developed special papers made from a pulp and glass composition that can be individually adjusted to a broad spectrum of properties, and thanks to a wide variety of fabric structures, the HyPerWeave panels can be used for a wide range of different applications. The planned development of the paper/textile composite is expected to open up new fields of application in automobile construction (battery compartments, bodies, etc.), aviation (panels, containers, guide elements, etc.), furniture construction (office and shop furniture, etc.) and building industry (flooring, partition walls, etc.).

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Applications for specialty papers in batteries, electronics, fuel and electrolytic cells

Innovation New products New markets



Properties

- » Targeted adjustment of porosity, smoothness and surface structure
- » Coating as matrix for functional components



Coating

- Advanced coating technologies in single sheet mode and in reel mode:
- Curtain coating
- Spray coating
- Film pressing

Processing

- » Special processing according to customer requirements
- Generation of different wave profiles through folding geometries
- » Production of cores or winding bodies

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Manufacture of temporary wet-strength (TWS) papermaking additives based on renewable resources (ACETAL)



With this project launched on the 1st of April, 2021 and sponsored by the Federal Ministry for Economic Affaires and Energy within the scope of the INNOKOM funding programme "Market-oriented research and development", PTS pursues the goal to study the production and application of polysaccharide-based products as reversible wetstrength agents for the paper sector. This project is furthermore intended to make a meaningful contribution to achieving sustainable production of papers using such additives and their recyclability.

The state of the art mainly comprises permanent wet-strength additives based on formaldehyde resins and amine epichlorohydrin resins that cause problems for the repulping of mill broke or of recovered paper containing such additives. Known concepts for achieving a temporary and reversible wet strength and thus easier disintegration of wetstrength paper products involve the use, for example, of cross-linking aldehydes such as glyoxalated polyacrylamide (g-PAM). The underlying chemical mechanism is based on aldehyde groups capable of forming acetal groups with the hydroxyl groups of cellulosic fibres, wherein the formation of said acetal groups is reversible.

However, one disadvantage of g-PAM is that it is almost always available in diluted solutions only, because it tends to self-crosslinkage and would otherwise not be storable for a longer period. In most cases, fresh production in paper mills fails because they would need to use glyoxal, which is a mutagenic chemical, and are not normally equipped to the required degree, neither in terms of equipment, nor in terms of personnel.

One specific way to overcome said challenges is to use additives forming a temporary wet strength based on renewable resources that show either no or reversible homocrosslinking.

Use of aldehydic polysaccharides for making temporary wet-strength paper products

Aldehyde groups are formed by chemical conversion of polysaccharide base materials under oxidative glycol cleavage mechanisms. As described above and shown in Fig. 1, the aldehyde groups can react with cellulosic paper fibres to form reversible acetal groups and thus can be applied as temporary wet-strength (TWS) agents.

In comparison with g-PAM, polysaccharide-based products not only are produ-

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

Project type:

» IK-MF 200135

Research locations:

 » Papiertechnische Stiftung (PTS), project leader:
 Dipl.-Chem. Stefan Möckel



Fig. 1: Generation of reversible wet strength by "acetal formation"

ced from renewable resources according to aspects of green chemistry, but also are safe and harmless to health. As of the project launch, it is also expected that they can be stored in a solid form and can be added to production as freshly prepared solutions or as solutions having a longer shelf life. Furthermore, the wet-strength additives to be developed during the course of the project will be subjected to benchmark tests against conventional temporary and permanent wetstrength agents in terms of possible applications, mode of action and disintegration behaviour on a bench and a pilot scale. So the potential of the new additives can be assessed and may allow for the substitution of part of the currently permanent wet-strength agents in selected segments. PTS has the vision to improve the recyclability design of wet-strength papers and close another section of the secondary-fibre circuit, regardless of any impurities, because it would no longer be necessary for selected wet-strength papers to be discarded via the waste stream.



Fig. 2: Production of aldehydic polysaccharides inclusive of coupling the electrochemical chemical regeneration

Developments based on accordingly modified starch were already described back in the 1970s, but their application on a broader scale was not possible, because their production costs were higher than those of conventional additives at the time and established production processed did not exist. However, especially since the turn of the millennium, there is a growing trend driven by more efficient automatic controlling systems and improved electrode materials towards the generation and regeneration of inorganic and organic chemicals by electrochemical processes. PTS therefore wants to make use of the progress of these principles during the life of this project.

Innovation potential of the electrochemical generation of aldehyde-terminated polysaccharides

The mechanism for the generation of aldehydic polysaccharides is based on stoichiometric conversion with periodate. It involves an oxidation process on the polymer chains, which causes the ring to be opened and aldehyde groups to be formed. Periodate is reduced to iodate and obtained as a by-product. Considering the price of periodate and the required disposal of iodate-containing waste liquor, the production process would be extremely expensive.

A possible way to overcome this aspect is to couple the generation of polyaldehydes

as shown with an electrochemical iodate/ periodate regeneration. That is illustrated schematically in Fig. 2 and is the core of the current project. Especially, the fact that the electricity available in Germany and required for the electrochemical recovery of the periodate is more and more generated from sustainable sources increases the ecological balance of this approach. Preliminary studies prior to the application for the research project have already confirmed the feasibility of the idea in principle and do suggest that the manufacturing cost after appropriate process optimisation will be in the range of that of conventional wet-strength agents.

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Potential of cold-soluble cationic swell flours by means of reactive extrusion

Cationic starches and flours are already used with success as wet strength increasing additives in the wet end of the paper machine. The positive charge of the starch molecules interacts with the negative charge centres of the cellulose fibres while forming further bond points and thus improves the paper properties significantly, e.g. by higher strengths. The current state of the art is to dissolve the cationic starches or flours in a jet cooker prior to their wet-end use in paper mills. For this purpose, the papermaker needs both the equipment and the related knowledge, as well as steam energy. A ZIM cooperation project with the SME cersan Erfurt GmbH was designed to look for a new development approach for cationic flours to allow for a simple treatment process without energy-intensive equipment while ensuring the same or better strength values in the paper. The aim was to use and adapt the established technologies of extrusion and dry modification for this purpose, or, alternatively, look into the possibility of combining both technologies by way of reactive extrusion. The project resulted in the development of cold water-soluble cationic flours that showed almost identical strength increases in paper as compared with standard flours. However, total energy consumption for generating the cold-solubility in the pilot extruder of the Technical Centre exceeded that of jet cooking. Basic research on reactive extrusion on the contrary suggests an energy-efficient and thus lower-cost production of a cold-soluble cationic flour after optimisation of the technology. So reactive extrusion of cereal flours provides a promising potential. We will stay together on this.

The ZIM research project ZF4156905WZ8 was sponsored by funds of the Federal Ministry for Economic Affairs and Energy, BMWi.



Fig. 1: Process for the manufacture of wet-end products

Ceresan Erfurt GmbH is a medium-sized enterprise in Markranstädt, which uses a proprietary method for dry chemical modification of conventional cereal flours to make specific technical flour products for the paper and gypsum plasterboard industry. In contrast with conventional starch modification in suspension, the dry chemical method is characterized by high yield and low reaction temperatures. The secondary and by-products remain in the end product. This method produces no effluents and does without a drying step.

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Project title:

» "Development of a new cationic swell flour for application in the paper industry"

Project period:

» 01/10/2018 - 31/12/2020

Project sponsor:

» ZIM-KF 4156905WZ8

Research locations:

- » Dr. Franziska Mai, Uwe Wieneke & Tamás Wenzlow from ceresan Erfurt GmbH
- » Birgit Kießler & Dr. Alexander Feldner from Papiertechnische Stiftung (PTS)

High-quality full-colour inkjet printing now at PTS in Heidenau

To support the packaging market, PTS has invested in a high-quality full color inkjet printing system in order to have a possibility to perform material testing and analysis. Because of the wide variety of substrates in the packaging environment, such as corrugated board and cardboard, which are also frequently used in the food sector, a system with water-based inks was the first choice.

After looking at the different solutions, the HP C250 from DJM proved to be the optimal choice. The C250 print module is a full color HP-based inkjet printing system, using the HP's latest TIJ4.0 printhead technology, similar to the large WebPress systems of the T-1100 and C500 class, and can be used flexibly on a laboratory scale. The C250 print module has a printing width of 4.25 inches (108 mm) and at a speed of up to 75 m/min at a resolution of 600 x 600 dpi.

For the application of PTS, DJM designed a complete solution where the C250 print module is installed on top of a linear transport system. With this configuration, PTS can quickly and easily produce test prints on a range of different substrates, enabling the assessment of material behaviour, optimisation of materials, within research and customer projects, and development of new surface solutions.





The system is fully controlled by DJM's Kameleon controller software, allowing PTS to run with different file types. The C250 has short setup times due to the integrated printhead service station, allowing for automated cleaning. Especially the fast execution of test procedures at practice-relevant speeds was required by PTS could be provided by DJM.

The investment in the system was made possible by the INNO-KOM investment grant funded by the Federal Ministry for Economic Affairs and Energy (BMWi). The printing system is already being used in ongoing research projects at PTS i.e. in IGF research project IGF 20425 BR, which deals with dimensional stability and curling behaviour of graphic and packaging papers. In the project IGF 21164 BG, the product properties of highly opaque coatings for inkjet printing are to be optimised through the use and targeted adaptation of the structure of the silica particle collective and their performance is tested and optimised using the new printing system.

In addition, the system is also available to customers and partners for their own developments and optimisations.

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About DJM

DJM is a company specialized in development of inkjet printing technology. With all development done in-house – from controller software, print module development, ink supply system, driver electronics and integration specialist – DJM is a leading company for special inkjet printing solutions. Therefore DJM works with global leading manufacturers, and has partnered with HP for over 16 years.



Student researchers at PTS: a closer look at the impact of adhesives and metallisations on recyclability

The students Vanessa Wortmann and Christiane Böhmer are working on their master theses in the Recycling and Digitisation department of PTS under the supervision of Lydia Tempel, Marie Geißler and Annika Eisenschmidt.

The master student in Hydrosciences and Engineering, Vanessa Wortmann, came to PTS to gather experience in laboratory and general daily work routines and improve her proficiency in the German language. Before that, Vanessa was involved in the testing of everyday samples according to the recycling method PTSRH 021:2012 to help establish a broad data base and gained valuable knowledge about the paper recycling process and its assessment by examining various paper and boardbased packagings. Moreover, she wrote her internship report for TU Dresden and has now also started her master thesis under the supervision of PTS.

Her master thesis covers the impact of process parameters on the disturbance potential of adhesive particles (stickies) in paper recycling. As existing recycling test methods were harmonised to the CEPI method within the European market, it is now required to review existing data and create a new database.

In this context, it is important to understand how variations of the defibration and fractionation parameters (e.g. temperature, time, pH, consistency and slot size) affect the fragmentation of macrostickies and their stickiness during paper recycling. To achieve this goal, samples with typical adhesives used in packaging and shipping cartons (hotmelts and dispersion adhesives) were tested using the CEPI method and different variations thereof. Figure 1 shows the result of such a variation in defibration temperature: macrostickies after defibration at 40°C (left) and at 20°C (right).

The results are evaluated mainly on the basis of the analytical image data from the Domas system, the sheet glue test, as well as the coarse and fine residues. Also, a water phase analysis is planned to evaluate the influence of disturbing components such as macrostickies on the process water.



Fig. 1: Difference in macrostickies due to variation in defibration temperature. Top: stained filters after fractionation in Somerville fibre fractionator, slot width 150 µm, for 10 minutes, bottom: image output of DOMAS system

Also, Christiane Böhmer deals with disturbing components in fibre recyclates within the scope of her master thesis. After more than one year of interesting work at PTS in the Functional Products and Recycling & Digitisation departments, the student in wood science and technology is now dealing with the impact of metallisations on the recycling process.

Such metallisations have a wide variety of structures and are often applied onto fibre-based packaging materials as decorative coatings or barrier coatings. Although the glittering metal particles in the pulp may have the appearance of a starry sky in microscopic images (see Fig. 2), they cause some difficulties in the recycling process. They form disturbing optical inhomogeneities that impair the quality of the secondary fibre and thus the quality of the paper products made from it.

Scientific studies are rare regarding the separability of these particles by cleaning processes used in typical recovered-paper treatment plants in packaging paper production, as well as by means of laboratory screening methods.

One reason for said lack of studies is that there is so far no standardised laboratory method for quantifying the metal particles as a result of the reflecting behaviour of the metal particles.

Therefore, the subject matter of the master thesis is to check the potentials of a well-established PTS measuring method for assessing the metal particle load in the pulp. The master thesis, similar to that of Vanessa, is focused on the new CEPI method as a recyclability test procedure.

Process parameters such as screening times and slot widths are varied and different defibration times are studied in order to determine, in the accepts, their influence on the quality and quantity of the metal particles in the handsheets.

Vanessa and Christiane are supported in their activities by the employees of PTS and blend in well with the friendly team climate.

In August, after finalisation of their master theses, the two students wish to do further research in paper recycling and to extend their current knowledge in everyday work practice.



Fig. 2: Left: Metal particles in handsheet pulp (hot embossing with aluminium), right: handsheet stained, 10x magnification by digital microscope



Fig. 3: Vanessa Wortmann (left) and Christiane Böhmer (right) at the Somerville fractionator.

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EU Single-Use Plastic Directive: what it means for paper manufacture

Although the project title does not suggest regulations for paper and board, their impact on the design of fibre-based products is significant. Brief outline.

Images of plastic waste on beaches and floating patches of plastic garbage in the oceans have raised public awareness. Moreover, consumers are concerned about potential decomposition into secondary microplastics and their uncertain impact on the environment and human health. Based on the "Green Deal", the Commission now intends to set up a regulatory framework for leading the European economy into a sustainable future by transforming it into a circular economy.

One step toward this goal is the Directive (EU) 2019/904 (Single-Use Plastics Directive) on the reduction of the impact of certain plastic products on the environment. There was a controversial debate on definitions and regulatory contents. By July 2021, the directive must be implemented on a national level by all member states, causing many single-use plastic products to be banned within the EU from said date. As of the 3rd July, 2021 a number of other products shall be labelled with a specific warning about plastic-induced environmental hazards. Just in time before the end of May 2021, the parties involved agreed on the finalised version of the related Commission Guideline C(2021) 3762 regarding the interpretation of the provisions set forth in the Directive.

Which fibre-based products are concerned? The following definitions apply:

Single-use plastic product: means a product that is made wholly or partly from plastic and that is not conceived, designed or placed on the market to accomplish, within its life span, multiple trips or rotations by being returned to a



Fig. 1: Hierarchy of regulations on single-use plastics (as of 1 June 2021)



Fig. 2: Products governed by Single-Use Plastic regulations.

producer for refill or re-used for the same purpose for which it was conceived. A product that is a single-use product by its design and its material characteristics cannot simply be re-declared a multi-use product.

"Plastic" within the scope of the SUPD means a material consisting of a polymer as defined in point 5 of Article 3 of the Regulation 1907/2006 (REACH), to which additives or other substances may have been added, and which can function as a main structural component of final products, with the exception of natural polymers that have not been chemically

modified; REACH defines polymer as a "substance consisting of molecules characterised by the sequence of one or more types of monomer units [...]".

Good news first: Single-use paper and board products that are solely made from paper and board and do not include any plastic lining or coating do not count as single-use plastic products for the purposes of the SUPD. The use of synthetic polymer additives such as retention agents, binders and processing aids does not transform paper into a "plastic"-containing product. But: If a plastic coating or lining is applied to the surface of a paper or board-based material (e.g. as a water/grease barrier), the resultant product is a composite product that is composed of more than one material, one of which is made of plastics. Thus, according to the current interpretation, papers or boards with a plastic coating or lining are within the scope of the Directive. A lower threshold for a "mass percentage" of plastic(s) does not exist; with the exception of coatings with natural, non-chemically modified polymers (e.g. native starches, MFC, nanocellulose). Regenerated cellulose, e.g. in the form of a viscose, lyocell or cellulose film, is not considered to be chemically modified. However, polymers obtained by artificial cultivation or fermentation processes in the industry, e.g. polyhydroxyalkanoates (PHAs) or polylactic acid (PLA), are not considered natural polymers, because they are not the result of a polymerisation process that has taken place in nature. Also, chemically modified natural polymers (cellulose acetate, starch ether, or the like) are deemed to be plastics under the regulatory framework when used for single-use products. It seems that the definition of "plastic" as "polymer" according to REACH also contemplates

silicones in paper/board coatings which are so far not explicitly regulated in the FCM section of the Plastics Regulation 10/2011.

Apart from the ban of certain products such as cotton bud sticks, cutlery (especially forks, knives, spoons, chopsticks), plates, straws, beverage stirrers, support sticks to be attached to balloons, food containers made of expanded polystyrene, or products made from oxo-degradable plastic, the Directive also provides for a *consumption reduction on certain* products and packagings by 2026 as compared to the condition in 2022. These products include cups for beverages, inclusive of their covers and lids, and food containers (receptacles such as boxes for food) intended for immediate consumption either on-the-spot or take-away, if the food is consumed from the receptacle and without any further preparation.

Moreover, the *extended producer re-sponsibility* requires producers to establish and take over the cost for raising customer awareness for packaging waste and return systems (collection, transport, treatment).

Within the scope of raising customer awareness, single-use plastic products must bear a clearly visible, clearly legible and indelible *marking "plastic in product"* as of 3 July 2021. A transitional provision allows products to be marked with labels for a transitional period ending July 2022. Specific symbols for single-use plastic markings are prescribed (see Fig. 1).

Options for action

PTS will gladly be your partner for consultation and testing of alternative product developments that are outside the scope of SUPD but will provide the desired barrier effect against grease, water or migrating substances, and will be food-compliant and recyclable. Laboratory and pilot plants, as well as a broad portfolio of measuring and test services are available. PTS also offers analytical or other services confirming the absence of polymers for the purpose of the REACH Regulation.

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Well-aimed investments in automatic bale inspection

Recovered paper is an important base material for papermaking. Grades are classified according to EN 643. However, this may result in a high variability of supplied qualities and poses big problems for paper manufacturers. Current observations show an ever-increasing percentage of plastic and foreign matter in recovered paper.

In the light of this situation, it seems natural not only to weigh the incoming deliveries, but to take a deeper look into the recovered paper. In addition to simple moisture-measuring instruments, there is a growing trend of using more specific instruments that allow the recovered paper to be characterised on the basis of additional parameters, either manually or at various degrees of automation. PTS offers assistance especially for the introduction of automatic solutions. A consulting project with a requirement analysis and an action plan can ensure that the investment is optimized to fit in well with the logistic and warehousing processes for recovered paper. Further related topics of importance are, for example:

- Organisational flow
- Internal logistic strategy
- Spatial boundary conditions and transport strategy
- Staff capacities
- Integration in the IT infrastructure



- Essential performance parameters of the measuring system
- Timeline and budgeting of the investment

The successful outcome of several previous consulting projects showed that the detailed planning and professional supervision of the investment project was beneficial for earlier commissioning and faster ROI. Meanwhile, similar consulting projects have been successfully performed for three customers prior to the introduction of an automated inspection system for recovered paper deliveries, whereby the implementation of the project was significantly accelerated.

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PTS is a member of the 4evergreen initiative

The market share of fibre-based packagings in Europe is almost 40%. Thanks to their easy recyclability and higher sustainability in production than plastic-based packagings, they are a resource-saving alternative. To ensure optimal recyclability for the final packaging products, the European stakeholders along the value-added chain joined up to create the "4evergreen" initiative. The goal is to achieve a European-wide 90% recycling rate for fibre-based packagings by 2030. As there are more and more variations in fibre-based packaging, the current focus of optimisation is primarily placed on products still having reduced recyclability, such as to-go containers. To achieve the ambitious goals, five "workstreams" (WS) were set up, in which the members, i.e. paper manufacturers and converters along with representatives of waste management, recovered paper-based industries, collection & recycling systems and research institutes, exchange views and ideas on how to solve the problem.

Papiertechnische Stiftung joined the 4evergreen initiative in May 2021 to contribute to the various working groups. PTS works as a Technical Advisor in the first workstream and contributes to finding an evaluation scheme for the CEPI Test Method version 1 for standard packaging plants. WS1 also includes further development of the method for special installations and deinking plants. The members of the other workstreams discuss ways to design the process of better collection and sorting of recovered paper, create design guidelines and look at future innovations and their challenges for the paper circuit. All these actions take place under the umbrella of CEPI and translate the continuous efforts of the industry.

Within the workstream 4, PTS together with the industry and other research institutes are working on laboratory methods and innovations in screening and treatment.

"The mindset within the 4evergreen alliance is the best chance to really bring the recycling rate forward. Because recycling lives from all those that take part" Dr. Ing. Tiemo Arndt



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Nomination for the Otto von Guericke award 2021: current distribution in electrolytic cells made of special paper

Papiertechnische Stiftung in Heidenau (PTS), the Fraunhofer Institute for Manufacturing Technology and Advance Materials (IFAM), and the Fuel Cell Centre – Zentrum für Brennstoffzellen-Technik GmbH in Duisburg (ZBT) made it to the finals for the Otto von Guericke Award 2021 with their joint project "Development of porous titanium current distributors for PEM electrolysis using papermaking technology". The presentation of the research topic and the awarding of the prize are planned to take place in Berlin in December 2021.

Thanks to their outstanding interdisciplinary approach, the project leaders from the three research centres succeeded in bringing together three different technical fields to create the basis for a novel membrane-electrode assembly directed to fuel cell and electrolytic technology. One goal of this project, which is funded by the industrial collective research scheme IGF, is to reduce the cost of rolling out the water electrolysis process on



Fig. 1: REM cross-section of a titanium-filled special paper



Fig. 2: Sintered-titanium current distributor

an industrial scale. Such cost reduction can only be achieved by using less expensive manufacturing methods and increasing process efficiency or long-term stability.

The focus of the project was on so-called PEM electrolytic cells. The cost breakdown of a PEM electrolytic cell shows that electric-current distributors are the dominating cost factor. To reduce the investment cost of PEM electrolytic cells, the project teams successfully worked on the idea to develop titanium-based metallic sinterable papers for use as current distributors in PEM electrolysis. The disadvantages of conventional current distributors lie in very high manufacturing costs (fabric), high anisotropy and too low surface (nonwovens), high material thickness in connection with high manufacturing costs (sinter body), and generally excessive tolerances in parts.

Highly filled special papers should allow the aforesaid problems to be solved. For this purpose, the filler content of a paper is drastically increased to such a level that the property profile of the paper will be characterised by the functionality represented by the filler instead of the fibre (refer to Fig. 1). The fine metallic powders incorporated in the cellulose matrix are pretreated thermally be pyrolysis or oxidation. Sintering will then produce thin, porous, purely metallic bodies (refer to Fig. 2).

The project resulted in the production of various paper-derived current distributors of titanium. The titanium current distributors were then checked for their performance during the electrolysis. As a result, the research project showed that a microstructure with optimal porosity and pore size is crucial for the mode of operation of the electrolyser. Eventually, the project teams developed a current distributor comparable to the reference.

The Otto von Guericke prize is awarded by AiF for the IGF project of the year. The award includes EUR 10,000 in prize money and is given by AiF since 1997 for scientists with outstanding achievements in industrial collective research (IGF).

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The Bioeconomy Cluster of the ZUSE Association

We need bioeconomy for solving central problems of society and business in the future. The institutes of the Zuse Association can rely on comprehensive expertise and experience in a broad range of bioeconomic research areas, doing significant research and development work especially in transferring scientific findings into concrete technologies, products and services. The Bioeconomy Cluster of the Zuse Association was founded in May 2020 to increase their networking expertise.

Meanwhile, the Cluster comprises 19 institutes covering almost the entire raw material basis and value-added chain of modern bioeconomy. PTS brings in its expertise in bio-based fibres and materials as well as circular economy.

The cluster has the following functions:

- increased technical and organisational networking between the member institutes of the Zuse Association in terms of bioeconomy-related topics;
- priority topics focused on latest developments and basic issues of bioeconomy;
- better visibility of bioeconomy research by the Zuse Association.

The bioeconomy research within the Zuse Association follows the Bioeconomy Strategy presented by the German federal government in January 2020 and is divided into the areas of biological knowledge, innovative technologies, biogenic resource basis, and circular economy, as well as sustainability assessments and traceability. What makes the institutes of the Zuse Association so special is that all of those institutes have a large networking basis down into small and medium businesses both in Germany and beyond. Therefore, they form a crucial link between research and practice and are an important innovation driver.

Well-aimed communication efforts and discussions with the Bioeconomy Council and project sponsors of the federal government have largely improved the visibility of the innovative range of services of the ZUSE Association among political actors.

ZUSE Association

The ZUSE Association represents the interests of independent privately organ-

RESEARCH WITH NATURE: THE BIOECONOMY CLUSTER

Skills and Exdpertise



ised research institutions. The association comprises more than 75 institutes all over Germany and is open to any technologies or industries. They provide Germany's small and medium businesses with practically relevant and constructive ideas, translate scientific findings into applicable technologies and thus prepare the ground for innovations that ensure worldwide success of German small and medium-sized enterprises.



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FPT study on bio-based additives and auxiliaries for the paper industry



Paper is a comparably sustainable material based on renewable resources. However, there is a need for change to transform the energy-intensive paper industry into a bioeconomy having a low carbon footprint. One way to achieve this is to avoid resources of fossil origin. The main use of such resources in the paper industry is additives and auxiliaries. But is it really possible to make 100% biobased papers and paper products?

Recently, PTS in cooperation with the paper technology research association Forschungsvereinigung Papiertechnik e.V. (FPT) completed the study "Bio-Based Additives and Auxiliaries for the Paper Industry" to look into feasibility aspects.

The elaborated study discussed the potential for the use of bio-based resources in products and processes of paper manufacture and conversion. The study has the character of a technological feasibility study and contemplates individual resources bases and extractable or directly usable additives in the light of substitution for established fossil materials. The first part of the study used available market data on the usage of certain additives along the value-added chain to estimate the use requirements for bio-based resources. This point is of utmost importance, especially against the background of seasonal variations and potential competition with the food chain. Resource specificities and property profiles for various material classes were elaborated in detail and possible applications were analysed.

Finally, the status quo for selected process chemicals and additives in the wet end and preparation section was established for the use of bio-based materials and fossil resources, as well as for possible applications of bio-based resources.

For a successful transition towards biobased additives, the following recommendations for action can be given to suppliers, papermakers and converters as a result of the present study:

- Conventional additives and auxiliaries in papermaking should be replaced by high-performance variants based on renewable resources.
- For this purpose, the main goal must be to ensure the recyclability of the newly developed products.
- Suitable business models should be developed to make up for any potential additional costs. This can be done by good marketing practice or by solving a higher-level problem.

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Added value for members of Forschungsvereinigung Papiertechnik e.V. (FPT):

- Networking platform for all companies in the "paper" added-value network and beyond
- Free and preferred access to research & project-related forums
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- Participation in the annual Network Day
- Access to research findings, information and studies
- Representation of founders for standardisation topics
- Participation in research studies



Information & membership: www.ptspaper.de/fpt/

PTS Events Programme 2021: Online & Live

Event			Туре	Date	Place
Micropla regulato	stics and Single Use Plastics Directive (SUPD)-definitions, ry situation, analytical methods, alternative materials		Webinar	26/08/21	Online
 PTS Coat 	ting Symposium 2021		Symposium	07 - 08/09/21	Online
Recyclat	Recyclability of paper & board based packaging		Webinar	14 - 15/09/21	Online
Introduc and boa	Introduction to compliance work and quality assurance for paper and board in contact with food (FCM)		Webinar	05/10/21	Online
Micropla regulato	istics and Single Use Plastics Directive (SUPD)-definitions, ry situation, analytical methods, alternative materials		Webinar	05/10/21	Online
Surface	functionalization of paper & board based packaging		Webinar	06/10/21	Online
Recyclat	pility of paper & board based packaging		Webinar	06 - 07/10/21	Online
PTS Pulp) Symposium 2021		Symposium	23 - 24/11/21	Radebeul / Online

Registration, information & programme:

www.ptspaper.com/events

Some of the events may become online events, depending on the Corona regulations as applicable from time to time.

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30th PTS Coating Symposium 2021 Functional coatings for fibre based packaging



Start of Day 1 Application techniques

"Eco-friendly paper cup using chromatogeny" Dr. Mohammed Krouit – Centre Technique du Papier (CTP)

"Direct application for high strength and barrier properties, on-line, for wood-containing low basis weight papers" Tom Larsson – UMV Coating Systems AB

"Board Precoating: Coating Structure Effects on Topcoat Performance, Binder Hold Out & Barrier Functionality" Dr. Janet Preston – Imerys

"Hard nip sizing with spray and curtain application improve the strength properties of liner and coated board grades" Henri Vaittinen I Antti Räisänen – Valmet Technologies Oy

"Coating and laminating processes for paper packaging materials under the aspect of sustainability and recycling" Andrea Glawe – KROENERT GmbH & Co KG

New Barrier Feedstocks

"Bio-based Barrier Coatings on Paper with Polyhydroxyalkanoates: a View on Opportunities and Challenges" Pieter Samyn – SIRRIS Smart Coatings Lab

"Bio-Based Barriers for Packaging Materials – Impacts of Surface Treatment and Biopolymers on Barrier Properties of Packaging Paper" Dr. Samir Kopacic – TU Graz

"Technological and commercial advantages exchanging dextrin with native starch as cobinder in coating colours" Tilman Bauer – Bauer Verfahrenstechnik GmbH

Price: 590€

Date: 07th – 08th September 2021

Start of Day 2 Analytics and Process

"Rheology management in water based barrier coatings"
Vesa Kukkamo – ACA Systems Oy

"Oxygen and moisture barrier for packaging application: The impact of different precoating conditions" Dr. Beko Mesic – Karlstad University

"Efficient heating elements for sealing and drying applications" Marcus Stein – Watttron GmbH

All Cellulose Products

"Microfibrillated Cellulose –
Applications for Sustainable Barrier
Papers and Boards"
Tom Larson – FiberLean Technologies Ltd.

"Nanocrystalline Cellulose in Coatings and their Effects on Barrier Properties" Janja Juhant Grkman – Pulp and Paper Institute, Slovenia

Closing the loop

"When natural is required – achieving sustainability goals and winning the regulatory challenge"
Phil Greenall – EcoSynthetix

"Greater sustainability with Waste Coating Colour Recycling" Christian Makari – GAW technologies GmbH

"Dispersion barrier coated fiber based materials and holistic study about repulping" Mari Ojanen – KEMIRA Oyj



Information & Registration: www.coating-symposium.com

Chairs: Dr. Marcel Haft Conference Host Head of Divison Functional Surfaces +49 (0) 3529 551 661 marcel.haft@ptspaper.de



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"Paper & Board for Food Contact" Report on PTS Symposium

The well-established PTS symposium "Paper & Board for Food Contact" took place on the 02^{nd} and 03^{rd} of March, 2021 – this time with two new features. On the one hand, the conference language was English, and on the other, the symposium was organised as an online event. These changes offered the attendants an innovative programme with a wide variety of topics, and contributions from international experts.

The public was international, and for the live transmission, Dr. Harling and Dr. Kleebauer 70 extended their welcome to attendants, participants and speakers from 15 countries (D, F, ES, DK, Israel, USA, India, CZ, AT, CH, Pakistan, BE, FL, NL, SWE).



Fig. 1:® Pixabay / PTS: FCM conference attendants by countries

PTS used the services of StreamPate to transform the PTS seminar room in Heidenau into a two-day live studio for streaming the moderation and the presentations. Also, the speakers were linked up with the online studio to hold their presentations and take part in the "round table" discussion both visually and acoustically – from Denmark to Pakistan.



Fig. 2: © *PTS: The online studio of PTS: introduction by Dr. Harling*



Fig. 3: [©] PTS Screen view of the symposium, Dr. Kleebauer presenting the programme.

Renowned international speakers from scientific institutes, public authorities and industries provided updates and impetus with typically high potentials for discussion.

Current FCM Legislative Developments in Europe and Germany – An Update, Katharina Adler, Federal Ministry for Food and Agriculture (BMEL)

Mrs. Adler provided information about the legal background of food contact materials (FCM) and the current situation of the *evaluation and revision of EU FCM provisions.*

The Commission intends to revise the legal framework for food contact materials in order to improve food safety and public health (especially by reducing the usage of hazardous chemicals), encourage the use of innovative and sustainable packaging types based on environmentally friendly, reusable and recyclable materials, and help reduce food waste. Within the scope of the Action Plan for a Circular Economy, the Commission also plans to prepare a legislation initiative for reuse in the field of food services with the aim to replace single-use food packagings, single-use dishes and single-use cutlery by reusable products ("Farm to Fork" strategy, May 2020). The first proposal for the revision of the FCM rules is anticipated for the end of 2022.

The goal is to shift the focus on the finished material and to address the properties of all finished materials and products in a better way. The migration of all potentially migrating substances (non-intentionally added substances, NIAS) should be considered, not just that of intentionally added substances (IAS). The intention is to define safety levels and rules how to reach them (e.g. by EU legislation or self-regulation), and to strengthen GMP rules on GPM. A first idea is to use a graduated approach based on different danger classes (public risk assessment versus self-evaluation). 1. CMR, endocrine disruptors, persistent, bio-accumulable, toxic; 2. substances with specific properties (Nano), 3. rather harmless, low migration. Mrs. Adler also referred to legislation initiatives such as the "EU Chemical Strategy for Sustainability" towards a toxic-free environment which foresees a ban on the most harmful chemicals in consumer products (e.g. food contact materials). The intention is to encourage safer and more sustainable FCMs, and to define clear rules for safety assessments in reuse and recycling and for the exclusion of risks from impurities. One declared goal is to ensure coherence and consistency with environmental laws. Furthermore, the Commission plans to pass a regulation on the need for conformity declarations for all types of FCMs.

The 15th regulation amending the Plastics Regulation 10/2011 introduced a provision stipulating that migration may not increase for repeatedly reused FCMs from the first through the third tests. Furthermore, it introduced rules for testing the migration of components from food (processing) plants or apparatuses on a whole. Further changes may include the deletion of the entry of wood flour and wood fibres as plastic additives because of insufficient information, especially in terms of their toxicological evaluation (EFSA Statement 2019). "Bamboo articles", such as coffee-to-go containers, which are melamine resin articles with added bamboo, are not marketable under Regulation 10/2011, because, as stated by EFSA, bamboo is not wood and already a permitted additive/filler for plastic FCMs.



Fig. 4: FCM with bamboo additive – not marketable under Plastics Regulation 10/2011

National projects such as the "*Printing Inks Ordinance*" and the "*Mineral Oil Ordinance*" are still in the phase of inter-ministerial coordination and will be continued, because the Commission is not planning to take any European measures.

The new Council of Europe FCM-Resolution CM/Res(2020)9 on the safety and quality of materials and articles for contact with food, Dr. Ingo Ebner, Bundesinstitut für

Risikobewertung (BfR)

Dr. Ebner presented the Council of Europe Regulation for FCMs non regulated by specific single measures, which was published on 7 October 2020. *The Council of Europa FCM Resolution* is complementary to EU and national legislations and fills a regulatory gap. The goal is to ensure better consumer protection against substances from FCMs and make a contribution to harmonizing the regulatory approaches all over Europe.

The resolution includes an annex with complementary Guidelines for food articles of daily use and accompanying Technical Guidance documents covering material-specific issues and for conformity documentation / conformity declaration. They contain not only provisions for applied substances and their risk assessment but also guidelines for marking, traceability, GMP, conformity declaration and accompanying documents as well as conformity checks. A specific **resolution on FCMs made of paper and board** will be published before long.

The new ECMA Good Manufacturing Practice Guide – Approach and provided guidance, Jan Cardon, ECMA – The European Carton Makers Association

Jan Cardon presented the new GMP Guide of the European Carton Makers Association fresh from the press. The guide is based on common standards of the food industry such as FSSC 22 000 and BRCGS Global Standard Packaging Materials Issue 6. Many useful flowcharts and decision trees provide guidance through the good manufacturing practice complex, help to identify critical control points based on the HACCP concept and derive measures at crucial points in the carton manufacturing process. Influence of relative humidity on the transfer of volatile organic compounds from paper and board to Tenax®, Nancy Wolf, Sylvie Hoyer, Prof. Dr. Thomas Simat, TU Dresden – Chair of Food

Science and Food Contact Materials

Mrs. Wolf from TU Dresden/AK Simat presented interesting comparative migration studies on the Tenax[®] simulant and organoleptic tests of paper under the influence of relative humidity (rH). The fact that a "wet dog" has a stronger smell than a "dry dog" was also confirmed by the exemplary results of the migration tests on corrugated board base paper (testliner): a clear increase in released volatile organic substances (VOC) was found at higher relative humidities, especially at \geq 75%rH. Also, the organoleptic impression changed entirely at changing humidities. Further paper grades are planned to be tested to evaluate the significance of this finding for future test strategies.



Fig. 5: Organoleptic impression of corrugated board base (testliner) as a function of relative humidity (rH) [®] Nancy Wolf, TU Dresden

EuPIA Guidance on Migration Test Methods for the evaluation of substances in printing inks and varnishes for food contact materials, Werner Oechsle, European Printing Association – EUPIA

Werner Oechsle presented methods for testing the safety and migration of substances from printing inks and varnishes for FCMs on the basis of the latest update (August 2020) of the EuPIA Guidance document. This industrial guide addresses printing inks for both non-direct and direct food contact (DFC). For this purpose, it recommends testing under worst-case conditions (by a screening approach), but such test is not intended for replacing the conformity test of finished printed food contact materials. The recommended test hierarchy is the following: "worst case" - calculation, modelling of migration, accelerated migration with test simulants and, in case of continued failure to obtain conclusive confirmation of conformity, eventually migration tests on the real food with the intended use of inks and varnishes. The sample to be generated for the printing test should preferably be representative of the final packaging application as used in practice, and the test should reproduce as closely as possible the printing and drying process, the foil weight, and the type of substrate used. The test conditions will be selected by taking account of the type of substrate (board, foil), the type of contact (direct, non-direct), and the food properties (fatty, moist, dry) in order to choose the appropriate simulant and contact time.

Optimization of packaging through software-based prediction of shelf life Dr. Matthias Reinelt, Fraunhofer-Institut für Verfahrenstechnik & Verpackung IVV

Dr. Reinelt from Fraunhofer IVV demonstrated how the software-assisted development of new packaging solutions will



Fig. 6a/b: © *PTS, CMYS inks, multicoloured printed cupcake liners*

be successful. The manifold interactions between a packaged good and the packaging material that have an impact on parameters such as loss of flavour, oxidation, outgassing, required gas exchange for breathing, microbiological growth and moisture can be translated into algorithms, and the impact of the different variations can be studied, and an optimum can be recommended. Thanks to the creation of a digital twin, it is possible to avoid time-consuming storage trials that would take several months.

Titanium Dioxide – Update on Classification and Possible Impacts, Dr. Martin Erben, Venator Germany GmbH

Dr. Martin Erben provided an update on the classification of titanium dioxide and the effects resulting therefrom. In September 2017, the Risk Assessment Committee (RAC) of ECHA suggested the classification of TiO2 as potentially carcinogenic (Cat. 2) when inhaled. The Commission accepted the classification proposal on 4 October 2019 and published it in the Official Journal in February 2020 after more than 2 years of regulatory consultations. The classification of TiO2 will start to be mandatory on the 1st of October 2021 after a transitional period of 18 months. This results in diverse labelling requirements for titanium dioxide as a solid, but also for liquid mixtures and solid mixtures containing 1% or more of titanium dioxide particles having an aerodynamic diameter of 10 µm. The classification as carcinogenic when inhaled, however, applies only to mixtures with a relevant aerodynamic diameter in the form of a powder. The classification of the mixtures is derived from workplace exposure determinations that use a rotating drum or a drop tower to simulate the behaviour of titanium dioxide powder (EN 15051). Detection is by filters, cascade impactors, laser diffraction analysis or ToF spectroscopy. The classification as a CMR substance in powder form also has an impact on rules and regulations regarding applications in cosmetics and toys, as well as on the admissibility of eco-labels - where CMR substances are mostly excluded.



Fig. 7: Titanium dioxide – in solid form classified as carcinogenic in Category 2 – what does that mean for FCMs? © Pixabay

The new Danish Regulation: PFAS ban in paper & board,

Mette Holm, Ministry of Food, Agriculture and Fisheries, The Danish Veterinary and Food Administration

Since 2015, Denmark has been discussing and preparing a ban on per/polyfluoroalkyl substances for food contact materials, including but not limited to paper and board, because of toxicological concerns, potential health problems and their known environmental persistence. Mette Holm was the speaker. The ban on the use of PFAS for FCMs made of paper and board was adopted in 2019 to enter into effect on 1 July 2020 (681/2020). Because of the ubiquitous presence of PFAS, e.g. also from paper recycling, it was not possible to fix a limit based on the very low toxicologically acceptable values for organic perfluoro compounds, but it was necessary to define an indicator value of 20 µg PFAS for an unavoidable background load, measured as Total Organic Fluorine (TOF) / g of paper. The ban does not apply to papers with a functional barrier that prevents PFAS from migrating into food. However, a suitable analytical method for the PFAS Class, which comprises more than 4500 different substances, does not exist neither in terms of quantification or migration methodology. As such, there was an intense debate among attendants who expressed their doubts as to the enforcement and legal certainty of such requirement. According to Mette Holm, there is a sufficient number of PFAS alternatives for achieving greaseproofness in papers.

Total organic fluorine (TOF) analysis for PFAS impurities determination in recovered paper grades,

Sandro Kuttig, Eurofins Umwelt Ost GmbH, Freiberg



Fig. 8: Greaseproof pizza boxes may contain PFAS – the ban in Denmark calls for alternatives

The PFAS debate was continued by Sandro Kuttig who presented a paper on total organic fluorine (TOF) analysis for determining PFAS as a sum parameter. For this purpose, it is necessary to distinguish between inorganic and organic fluorine compounds. The analysis uses combustion followed by fluorine determination by ion chromatography. There was a great discrepancy between the single determination method using 22 detected PFAS single substances and the TOF analysis, showing that the specific method only detects a percentage as low as 0.00004-11.3% as compared with the TOF methodology. Furthermore, several matrices in the TOF methodology, especially those having high levels of inorganic fluoride, are responsible for interferences that lead to failure to determine PFAS although PFAS was present.

Thermal developers – BPS and other BPA Alternatives, Annemarie Greb, TU Dresden – Professur für Lebensmittelkunde & Bedarfsgegenstände

The presentation of Mrs. Greb covered systematic observation studies performed by TU Dresden between 2015 and 2020 regarding the substitution of bisphenol A (BPA) in thermal papers. Since the ban on BPA became effective in the EU and other countries, BPA has successively been replaced by alternatives. Here, BPS plays a major role as a substitute, which is why the Recommendation XXXVI defines limits for migration from recycling papers into food. But BPS is not the dominating substitute. Other BPS derivatives are also used, as well as the phenol-free Pergafast 201, which is currently one of the main substitute products in addition to BPS. Substitute product developers, however, do not show higher optimism than for BPA, because the situation of the toxicological and environmental persistence data simply is not known for some of the derivative products. Thermal papers enter the paper recycling stream through parcel labels and adhesive labels and thus are more important than receipts for FCM issues. BPA and BPS from thermal paper are proven to contaminate the paper and board recycling stream. Further substitutes are being developed and applied. They will be observed with appropriate attention. According to Annemarie Greb, there is no chance of getting bored.

Thermal paper in daily use



Fig. 9: Thermal paper in daily use. © *Annemarie Greb*

Multi-Client-Project BPS, BPA, PERGAFAST 201, PFAS, Max Schneider, Papiertechnische Stiftung (PTS)

Poor waste paper qualities alone may lead to excessively high indicator levels for PFAS (TOF) and may thus cause the need for a functional barrier, as shown by Mette Holm. BPA and its substitutes BPS and Pergafast impose a load on the recovered-paper cycle, as outlined by Annemarie Greb. Therefore, PTS has launched a multi-client project to gain insight into the input of said substances in the paper cycle through various waste paper grades. Max Schneider presented the project in detail. Apart from measuring the contents and migration levels, the project is designed to allow conclusions about the paper qualities used and their BPA, BPS, Pergafast and PFAS (TOF) loads. The outcome will be presented in an anonymised form only and made available to the project participants only. The project is open to all papermaking and converting companies interested, who may still join the project by the beginning of June 2021.

Aluminum release of FCM – outcome of research work. Antje Kersten, TU Darmstadt – Paper Technology & Mechanical Process Engineering (PMV)

The limitation of release of aluminium from paper FCMs in food was adopted in the BfR Recommendation XXXVI, as outlined by Antje Kersten. The test according to EN 645 (cold water extract), however, requires a number of important details in sample preparation to make sure coating particles from e.g. China clay are excluded from detection or to avoid non-comparable results. Influences such as pH and ionic strength of the water used, sample reduction and filtration require detailed specification. Comparisons with food migrations showed where the reality and the simulation of the aluminium release were in agreement and where not. However, the release of aluminium is only relevant in case of foreseeable contact of the papers with moist and especially acid food items. The findings are intended to be incorporated in a revised version of the EN 645 standard and in an in-house aluminium test specification.

Drinking straws made of paper – technical issues, Dr. Imke Cravillon, DREWSEN SPEZIALPAPIERE GmbH & Co. KG

Dr. Imke Cravillon presented the technical challenges for the manufacture of drinking straws made of paper. The Single-Use Plastics Regulation has caused a boom for such paper alternatives. The release of MCPD, DCP, mineral-oil hydrocarbons, paA and photoinitiators was a challenge already in the past. There are also certain technical performance details to be addressed, such as delamination in beverage contact, premature softening, loss of gas from carbonated beverages, and an unpleasant feeling on the lips. Such details need to be optimized to ensure the product is accepted by customers and consumers. A plantbased coating might help.



Fig. 10: Drinking straws made of paper, © Pixabay

Chloro propanols release from FCM paper: recent results from an official control laboratory, Lydia Richter, Chemisches und Veterinäruntersuchungsamt CVUA Stuttgart

Also, Lydia Richter from the Chemical and Veterinary Investigation Office (CVUA Stuttgart) presented results regarding the release of MCPD and DCP from drinking straws into the cold water extract (EN 645). In this case, slightly more than half of the tested drinking straw samples (6 out of 13) did not meet the MCPD threshold given in the BfR Recommendation. Out of altogether more than 108 paper samples and, additionally, bakery bags, disposable plates, napkins, paper towels or cupcake liners, 6% exceeded the recommended MCPD threshold, and DCP was detectable in 3 samples (3%) only. The paper industry is well on its way to minimisation.

Halal production of paper and board – requirements and certification, Farhan Tufail, Halal Certification Services GmbH

The final paper was an entertaining live presentation by Farhan Tufail from Pakistan. He explained what a product needs to be "halal". To put it very simple: "Everything which is not forbidden is allowed." What is not forbidden is, for example, animals properly slaughtered according to Islamic law and substances obtained from them. Packaging materials must be checked for the absence of hidden substances such as animal stearates which are used in the manufacture of plastic containers. According to the assessment of Mr. Tufail, packaging material manufacturers will soon be flooded with halal inquiries because of increasing awareness and growing halal certification.

Dr. Antje Harling

antje.harling@ptspaper.de **Dr. Markus Kleebauer,** markus.kleebauer@ptspaper.de

Report on PTS Recovered Paper Conference

All things seem possible in May: This year, the 22nd Recovered Paper Conference was held online and in English on the 18th and 19th of May. Thanks to the new format, the PTS conference attracted altogether 20 speakers and 35 participants from 22 countries. So it became possible to gain insight into trends and modes of operation in other countries and continents and receive impetus from very different fields.

Day one was mainly focused on regulatory trends in circular economy, design for recycling and an overview of various methods for recyclability assessments. The online format made it possible for a scientist from the Western Michigan

University (USA) to present their local pilot-scale recyclability method and consult with European laboratories which are currently establishing a harmonised recyclability assessment method. At the end of the first day, the speakers from scientific institutes, business companies and international associations held a round table discussion for mutual exchange. The discussions showed a major trend towards a shift in recovered-paper input qualities as a result of the increasing replacement of plastic products by new fibre-based products and the need for adequate response by the industry that uses recovered paper. During the round table, the participants were also asked for their opinion as to what the

major challenges for the paper industry are during the next five years to come. The resultant tag cloud (see Fig. 2) clearly shows that topics in the area of water-based coatings, water contamination and thus contamination by microplastics are perceived as most urgent.



Fig. 1: A glimpse behind the scenes: Marie Geißler and Dr. Annika Eisenschmidt moderating the "Design for Recycling" session

collecting, sorting Different legeslations microplastics/ particles barrier polymer processing water contamination barrier polymer price quality laminates waterbased coatings Fibre yield Legislations micropplastics Availability unwanted chemical ingredients tracebilety of the paper used for recycling and optimizing the recept energy consumption Fines plastic diverse materials composite products Guiding brands Plastics/finer compounds meant to replace plastics

Fig. 2: Tag cloud representing the participants' opinion on current development trends in paper recycling

The discussions on Day two were focused on new developments in recovered paper management, digitising solutions in stock preparation, and utilisation of rejects. There were very different views on whether it will be possible to run a recovered paper yard without any human workforce in the future: time will tell. Of course, a truly circular economy cannot be achieved unless and until all components of the fibre-based product can be put to reuse as materials. Thus, the focus is more than ever on the treatment of rejects, and the discussions of the final sessions covered options such as chemical recycling and waste-to-biogas solutions.



Fig. 3: Round table discussion

The "StreamPate" service provider from the city of Chemnitz managed with success the professional live stream of the conference in the Penck Hotel in Dresden and the implementation of a presentations on demand option. In-person sessions are usually accompanied by break-time talks over coffee and cake which are often used to make new contacts – this gap could be filled, at least in part, through the platform wonder.me. Most of the participants, however, wish to meet again in person next year, maybe as a hybrid event.

Dr. Annika Eisenschmidt, annika.eisenschmidt@ptspaper.de **Lydia Tempel,** lydia.tempel@ptspaper.de

3. PTS Network Day 2021: research, future prospects, start ups & 70 years PTS





For the third time PTS organised its Network Day and, for the second time, as an online conference because of the well-known pandemic situation. In spite of the circumstances, the PTS team put together a varied programme for partners, customers, stakeholders and donors in order to provide impetus for the year to come and for the future.

The Network Day started off with the PTS research forum, which included six presentations on current research projects and developments within the research activities of PTS. During this part of the programme, the participants were given the opportunity to use Slido (online moderating and polling tool) to ask their questions which were then answered by the speakers. Also, topic-related opinion polls among the participants were initiated to encourage active participation, and proved to be enriching for the Dr. Martin Zahel as the moderator.

After the research forum, the participants had the opportunity to video-chat with the speakers and experts via the networking tool "wonder me" and pursue the networking idea by virtual means.



"Thinking 70 years ahead" – 70 years of Papiertechnische Stiftung

The keynote speaker session accompanying the 70th anniversary of the Papiertechnische Stiftung foundation was placed under the motto "Thinking 70 years ahead". The event started with Clemens Zotlöterer (PTS Director), Dr. Thorsten Voß (future PTS Director) and Dr. Karrer (PTS Foundation Council) extending their welcome to the participants and speakers.

With the masterful moderation by Petra Hanke (executive director of Zellcheming e.V.), the keynote speakers then shared their views on disruptive innovation with research and cooperation, design of the future in the paper industry and joint implementation of innovations within the paper industry.

In the following discussion the keynote speakers highlighted and discussed the best ways how to initiate innovations and disruptions for existing and upcoming challenges with the main focus being on the idea of joining efforts to address and solve these tasks. The discussion also covered the way of thinking and attitude towards new ideas and the readiness to take the risk to go new ways, and led to the conclusion that more courage and development is required to bring about disruptive change.

Ideas of the future – start-up businesses present their ideas

The impressions from the round table discussion were followed by the start-up session in which four start-up businesses presented their innovative ideas. At the end of this part of the programme, the participants were asked to elect the winner of the four presentations. PTS and VDP (association of German paper mills) as the joint initiators of this programme section offer an award in support of further development. PTS offers the winner a prize money of € 10,000 for the further development of the related product. VDP provides all start-up businesses which held a presentation with portraval space in the association's revue "Paper kann mehr", which has



a circulation of 40,000 copies and will help their young ideas to receive wide attention in the industry and potential supporters for the areas of networking, finance and development.

Start-ups - presentations by

- Aidboards Sven Gille
- Algofaktur GmbH Niklas Treutner
- Fungtion.berlin Bastian Schubert & Jan van Riesenbeck
- Papair Steven Widdel

The first presentation was made by Aidboard. They presented their corrugated-board beds, which are a modular design and mainly intended for emergency relief in disaster zones as a lightweight and sustainable alternative to single-use beds. The purpose of the second startup, known as Algofaktur, is to retrofit production machineries with sensors of any type to make them fit for Industry 4.0. Fungtion, the third start-up, produces compostable bio-foam materials on the basis of fungal myceliums and agricultural residues and, in a first step, is focused on the manufacture of external shells of helmets. Finally, Papair presented their paper-based air-cushion foil as a sustainable and economical alternative to plastic air bubble films. The participants were invited to ask questions about each of the start-ups and made good use of this opportunity.

Finally, the participants cast their votes. The winner of this session was Papair. All parties involved perceived this session as a refreshing and interesting way to tackle things so that the intention for the future is to enhance the network between the paper industry and start-up businesses.





The two moderators, Dr.-Ing. Tiemo Arndt and Dr. Martin Zahel, then wrapped up the 3rd PTS Network Day 2021, which was a smooth and faultless operation thanks to the commitment of the PTS team and the external streaming service partner "StreamPate". The PTS team express their thanks to all external presenters and speakers, because the multifaceted programme would not have been possible without them. And PTS is already looking forward to the 4th PTS Network Day, which will hopefully and probably be held in person after an interlude of two online events.

Dr.-Ing. Tiemo Arndt, tiemo.arndt@ptspaper.de Armin Bieler, armin.bieler@ptspaper.de

Note the PTS network day 2022!

31.05.2022

Information: www.pts-paper.de

Event highlights in 2021

Registration at:

www.ptspaper.de/veranstaltungen



PTS Coating Symposium 2021 😹

Online Conference

You can look forward to presentations by recognised speakers from science, business and administration in the following sessions:

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- Application techniques
- New barrier materials
- Analyses and methods
- All cellulose products
- "Closing the loop"



PTS Pulp Symposium 2021 🗰

Hybrid-Event	Q	Doline & Radebeul/Dresden
u=u Ⅲ 23 & 24/11/:	2021	www.pulp-symposium.com

We bring the latest developments in pulp and fibre research together with a unique networking facility on the PTS Pulp Symposium 2021.

Lignocellulosic fibre materials from wood and non-wood sources are more and more important in developing a global and carbon-neutral bioeconomy. Growing markets in the various areas of the global packaging, health, mobility and construction sectors provide many opportunities of introducing new methods and materials based on lignocellulosic fibre for the design of the future. The PTS Pulp Symposium is directed to people working in these areas all over the world. It will take place as a hybrid event with more than 100 expected international guests in Radebeul near Dresden from the 23rd of November to the 24th of November, 2021.

PTS Basic Course "Introduction to papermaking"



The participants will be given a very detailed overview of relevant raw materials and additives, as well as of all major steps of industrial papermaking and paper converting processes.

The course is directed to newcomers or employees from a different professional background in the papermaking industry, supplier industries (raw and auxiliary materials, machine and plant

- 12/10 to 13/10/2021 Module 1: Fibre resources for the paper industry, pulping and stock preparation
- 13/10 to 14/10/2021 Module 2: Approach system, paper machine, instrumentation & process control
- 14/10 to 15/10/2021 Module 3: Effects and optimal use of chemical additives
- **15/10 to 16/10/2021** Module 4: Coating technology – From dispersion to the finished coating

construction, instrumentation) and paper converting industry, from printing & trade and research institutes, who want to gain insight into the overall papermaking processes.

This event is also recommended for all those having general interest in "paper" and want to get a condensed in-depth overview of this subject matter within a limited time.

PTS Packaging Workshop Series – from 05/10 to 08/10/2021 – online workshop series

Introduction to compliance work and quality assurance for paper and board in contact with food (FCM) *****

Workshop 05.10.21

Recyclability of paper & board based packaging ₩

Workshop

06. - 07.10.21

Surface functionalization of paper & board based packaging ******

Paper based packaging materials for food and consumer goods are highly demanded by end customers as well distributing companies. In many cases one or multiple coating layers enable the packaging to protect e.g. food via barrier functionalities. In the workshop we explain what materials show good barrier properties, how they can be applied onto paper and how they act into the recycling process. With the focus on paper, cardboard and tissue, the relevant food law is presented and tips for implementation in companies are given on the basis of exercises and practical examples.

- Information on sources of migrating substances
- basic analytical methods, sampling, information transfer along the supply chain
- Evaluation and interpretation of test reports and certificates
- Preparation of declarations of conformity

The participants will be familiarized with current framework conditions and the basics of paper-based recyclability.

- Framework aspects of recycling
- Technical aspects of recycling
- Test methods for recycling
- Packaging design

Workshop

07. - 08.10.21

During the workshop, questions and problems of the participants can be specifically addressed.

The workshop is aimed at engineers, technical staff of paper manufacturers and converters, product managers and business development. Previous knowledge is not required.



PTS eLearning Platform "Paper manufacture at a glance"

Formats of learning are versatile. Learning platforms and video conferences. In future, PTS will hold their "Papermaking at a glance" seminars and "Introduction to papermaking" training modules, in parallel with face-to-face training sessions in Heidenau, also on a blended learning eLearning platform for flexible learning schemes following the time resources of the participants. Each of the teaching units will be divided into 5 to 10-minute modules and will include interactive elements striving for eureka moments.



PTS Insight – Online events for gaining insight into research and projects

The team of PTS have organised a PTS Insight session every month since the end of 2020. PTS Insight is a one to two-hour-long online session where PTS experts present current research topics, projects and methods and are available for questions by partici-

pants. Previous topics included paper as a high-performance material, IoT 4.0 in the paper industry, chemical paper analysis with IR and raman spectroscopy, and functional surfaces in packaging. This format is intended for you and us to exchange views in order to encourage innovations and project ideas. The PTS Insight sessions are free of charge. All you need to do is to register at www. ptspaper.de/veranstaltungen.

Further interesting insight sessions are planned for the six months to come:

Subject	Format	Date	Place
Ageing and safety – PTS test services	PTS Insight	13/07/2021	Online
CEPI Comparative Testing Service	PTS Insight	28/07/2021	Online
Determination of paper qualities for baking by instrumented analysis methods	PTS Insight	25/08/2021	Online
Faserersatzstoffe	PTS Insight	29/09/2021	Online
"What is my paper made of?" Methods presentation (REM, TGA, RFA, DSC)	PTS Insight	27/10/2021	Online
FEM in processing – material parametrisation by measuring bending resistance	PTS Insight	25/11/2021	Online
Transfer of R&D findings in practice using modern pilot plants	PTS Insight	15/12/2021	Online

Registration & free participation: www.ptspaper.de/veranstaltungen | ptsacademy@ptspaper.de

Media room for the "New Normal" and PTS online formats

Because of the Covid-19 pandemic, it is almost impossible to imagine a world without online meetings and webbased training courses. Some parts and advantages of these formats are here to stay, such as online training sessions, exchange of knowledge on an international scale, and giving the impetus for entering into cooperation.

That is the reason why PTS enhanced and expanded the required infrastructure for these formats by installing a highspeed fibre-optic connection and a newly furnished media room in order to be able to make online offers (online seminars, workshops, conferences, PTS Insights) in a better quality for the participants and with appropriate equipment for our speakers and presenters.



The PTS media room is equipped with two workplaces enabling speakers to use green-screen technology as well as highend cameras and microphones. Later this year, all PTS online formats will be transmitted in this room thereby ensuring that the PTS team will increasingly improve and extend their streaming skills. There



is a wide range of use scenarios for the media room, e.g. allowing a speaker to present a paper on a conference, or accommodating a PTS Insights session with about 100 participants.

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