PTSNEWS

02/2020

FIBRE based solutions for tomorrow‘s products

“New normality” for PTS – Challenges, actions & proposals

www.ptspaper.com

PTS FIBRE based solutions

Contents

Cover page topic

Research topics

Service & technology

Networking

Advanced training

Editorial

Dear readers,

It feels like there was just one topic in the news tickers during the year. For Papiertechnische Stiftung, however, there was a bunch of tasks that were very important to us. The main focus, of course, was on ensuring the health of our employees and, for very many colleagues, also on providing care for their children, often very young. For the small number of colleagues still working in the laboratories, the work load was accordingly high. For us, as a company, this was a significant challenge, which we finally met all together. Despite all turbulences, fears, uncertainties and changes, the employees of PTS have managed to make 2020 a successful year.

We were able to successfully complete many research projects and start a multitude of new ones. The following pages summarize the excellent results. Topics range from thermoplastic properties of cellulosic fibre to CO_2-to-CO conversion. We present you with new early warning systems for production disturbances in paper machines and with new test methods for brittle ceramic materials.

After a long planning time, and thanks to a forward-looking initiative by the Saxon state government with their investment programme for industrial research facilities, Papiertechnische Stiftung was in position to get its building rehabilitation and digitization programme started. In good time before the beginning of the teleworking autumn, all employees were provided with laptop computers allowing them to work from home whenever possible. Of course, our investments are not limited to computer hardware, but we are also working on the continued digitization of our research and work procedures. The following months will be used to prepare for the rehabilitation of our building. At the same time, we will be able to invest in new research equipment for ensuring a continued excellent research level in PTS. Last spring, our newly installed 538 m² large photovoltaic unit, which has an annual capacity of 99 MWh, was connected to the grid and helps reduce the carbon footprint of our foundation.

Together with our customers, we were able to implement many exciting and thrilling projects. On a national level, we have made significant contributions to the model factory design. On an international level, we are committed to 4evergreen. In 2019, we started to internationalize our training programmes, and today, we hold many seminars, workshops and symposiums in the English language. A good decision, because international participants accounted for more than 60 % in most of this year's events, which are meanwhile entirely limited to online formats.

Despite digitization, I would be pleased to be able to welcome you in person at our PTS Coating Symposium 2021 in Munich on the 7th and 8th of September next year. The best might be to save this date right now, or register at www.coating-symposium on or before the 31st of December 2020 using the voucher code "Coating21" for a preferential fee.

Clemens Zotlöterer, Director

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

7th - 8th September 2021
Hybrid Event |
Online & Penck Hotel Dresden

Code: Coating21
www.coating-symposium.com

“New normality” for PTS – Challenges, actions & proposals

Fig. 1: Lessons learned about working from home during the Corona crisis: required arrangements, processes and procedural rules (cf. Hofmann, Riedel, Rief (2020), p. 16)

Picture 1

Picture 2

The “new normality” has been dominating the work environment in Germany since March 2020. Despite some ease during the summer months with a glimpse of the “old” normality, the “new normal” is back to stay for a while and impact the workaday world of the future. Said “new normality” has brought a lot of changes and challenges for the PTS team during the past few months, in terms of collaborating with our customers, coordinating our internal work processes, setting up home-based office workplaces, adjusting existing offers and developing new ones. Certain basic conditions need to exist to successfully meet the challenges and were already available to the company before Corona.

Basic technological requirements must be met in the first place to allow for “remote” working” without business process disruptions and health risks to the staff (cf. Hofmann, Riedel, Rief (2020), p. 16).

A survey was conducted among 500 companies in which the technological prerequisites that are essential for companies to respond to the Corona situation and make adjustments in the long run were specified and weighted (see Fig. 1) (cf. Hofmann, Riedel, Rief (2020), p. 16). Most of the things mentioned had already been implemented by PTS and were in everyday use.

The project to provide laptop computers to each of the employees was planned during the summer months and completed by the end of September to make precautions for a mobile work scheme in case of a second Corona wave, and the later development with the current situation shows that this was the right decision. As early as in March, we developed

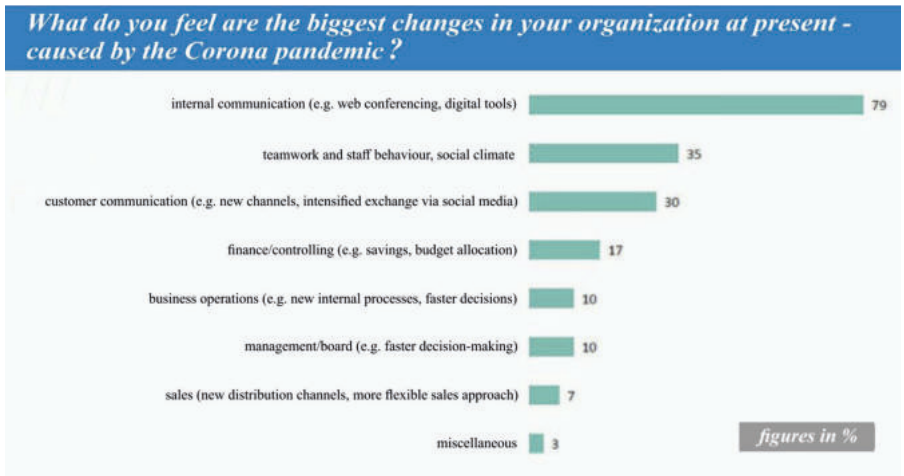


Fig. 2: Modifications to in-house organization (cf. Krmca, 2020, p. 5).

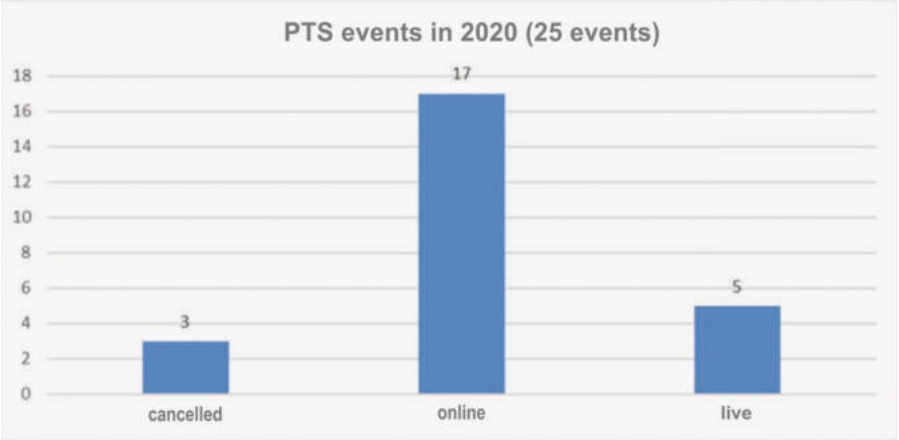


Fig. 3: PTS events – formats in 2020 (source: PTS)

the operating procedures and definitions for PTS for how to implement a "mobile work" system without bureaucratic constraints.

Additional challenges arose in the field of laboratory operations, which were maintained in compliance with all requirements thanks to the commitment of a highly involved staff and a detailed forward-looking order and resource planning approach.

Communication and collaboration

As usual also in other companies, MS teams and the Softphone software are meanwhile used for mutual exchanges between PTS colleagues, in addition to the pre-existing network drives or document management systems for editing and exchanging documents. Communicating through the new channels required new behaviours and new routines to be adopted in everyday practice, such as muting the microphone, setting up a background, raising hand to speak and sharing one's screen, which are routines that are very different from in-person meetings.

Meanwhile, all in-house events or meetings are held by virtual conferencing, whether Teams meetings or the monthly employee meeting or the 3rd PTS Health Day. Several months ago, the preparation for and performance of such meetings were entirely new to all participants, but are now routinely accepted and organized by all staff members. The online format is also preferred for meetings with external partners, such as customers or candidates, to continue business operations across all areas or even make them more efficient than before in certain parts. This development within PTS and, quite likely, in most of the German companies is emphasized by Fig. 2 (cf. Kcmar, 2020, p. 5).

Another effect of the internal changes is that the communication with customers takes place by virtual means. Customer workshops and meetings, which used to be held in PTS's seminar room or in the conference room with a view of the Elbe river, are now conducted online. Specific challenges consisted in preparing the technical contents for an online presentation as could and can be largely experienced in the PTS events.

PTS events – „New normal" online events

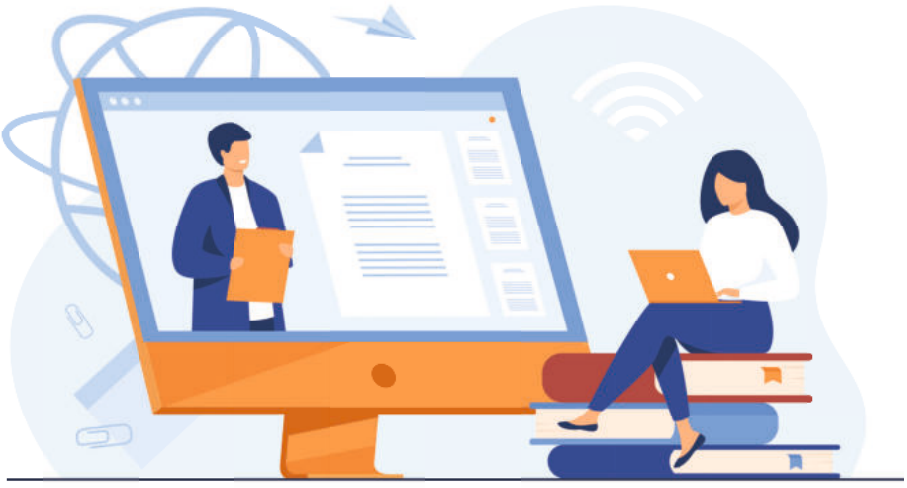
Last year, there were significant changes especially in the 25 programmed events of the PTS Academy and in terms of both the various formats and the numbers of participants. As illustrated in Fig. 3, the PTS team has managed very well to implement the transition from in-person to online events. Only three events related to laboratory equipment and practical on-the-spot exercises had to be cancelled for 2020 or moved to 2021. All pending events in the remaining programme were transformed by the event managers into online workshops or an online conference at an early stage and with a high international response by participants.

The challenges of implementing online workshops and conferences were:

- Reshaping of contents for online formats, because the existing face-to-face presentations could not be used as such for online presentation, neither in scope, nor in their design.
- Elaboration of interactive contents allowing for an exchange with participants while offering an entertainment value, which was achieved by means of surveys and interactive tasks.
- Selection of the appropriate online software for performing online events with a need to consider the different format requirements ranging from conferences to workshops. Varying systems were used according to requirements.
- Testing and trying out the online software as to its opportunities and limits in practice

For all of the 17 online events, the conference managers, workshop leaders and speakers fulfilled these new tasks with success. The first online event was the event with the highest number of participants, the PTS Network Days 2020 (Pictures 1, 2, 3), which took place on three successive days with 100 persons each.

Picture 3



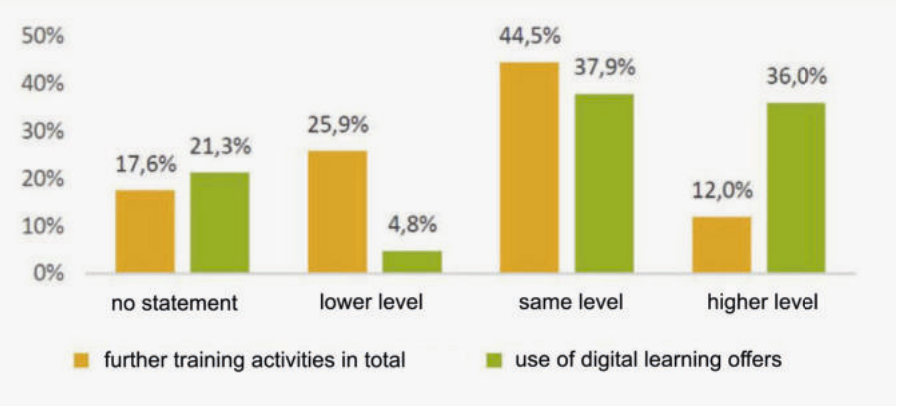


Fig. 4: Training activities since the beginning of the Corona crisis (source: IW-Covid-19-Panel, 2020)

The "adhesives" seminar, initially planned as a face-to-face training course, illustrated the high potential that lies in online formats. The number of registered participants was three times the normal number as compared with the previous in-person course, and the degree of internationality increased as well. The regular online workshops "Introduction to compliance work and quality assurance for paper and board in contact with food (FCM)" and "Recyclability of paper & board based packaging" confirmed both the positive response to the offers and the attractiveness of these formats for new groups of participants. In the light of this knowledge, Dr. Martin Zahel and Dr. Marcel Haft then decided also to use an online format for the "Biobased Solutions in Papermaking and Converting" conference and were rewarded with a positive feedback and an increased number of international participants. So, the PTS team gained further experience in how to make online conferences run smoothly. The final event was the PTS Corrugated Board Symposium 2020, for which an external online conference software was used in order to provide a follow-up replay option, a networking environment for interactive meetings via Zoom and a way to get directly in touch with sponsors.

In summary, PTS gained a wealth of skills and experience in this field during the past few months and intends to continue and further develop the online formats, mainly as a result of the success of the online events rather than the continued uncertainty of the Corona situation. This assessment is supported by the increased use of electronic learning offers, as shown in Fig. 4 (cf. Flake, Seyda, Werner (2020), p. 1).

The high number of participants from European and non-European countries raised the potential of new and interesting customer contacts. This has been a motivation for the PTS team to come up with new formats as a meaningful extension and addition to existing online formats.

In future, PTS will not only hold the "Papermaking Overview" introductory course and the "Introduction to papermaking" modular series as face-to-face training sessions in Heidenau, but also make an ***eLearning offer*** on a ***blended learning*** platform for flexible learning schemes according to the time resources of the participants. The contents of the training courses are adjusted to the electronic format, test questions are provided, virtual meetings are agreed with the course instructor, and a final certificate is awarded.

The latest online format known as ***"PTS Insight"*** comprises a one or two-hour-long session in which current research projects, trends, test methods or applications are presented in English. This offer is free and provides an environment for exchange of knowledge.

Thanks to the measures taken in terms of equipment and facilities, the meanwhile routine handling of the new collaborative tools, which make everyday work more efficient, and the experience gained in online conferencing, the PTS Team will manage to successfully face further Corona-related restrictions and stick to a digitized way of working also in the future. ■

Armin Bieler,
armin.bieler@ptspaper.de

Sources:

Hofmann, Riedel, Rief (2020), Arbeiten in der Corona-Pandemie – Auf dem Weg zum New Normal, Fraunhofer IAO, Stuttgart

Kcmar (2020), ZUKUNFTSSTUDIE MÜNCHNER KREIS Sonderstudie zur Corona Pandemie, Münchner Kreis e.V., München

Flake, Seyda, Werner (2020), Weiterbildung während der Corona-Pandemie, KOFA kompakt, www.kofa.de/service/publikationen/detailseite/news/kofa-kompakt-weiterbildung-waehrend-der-corona-pandemie

“FibrePlast”: Chemical modification of cellulosic fibres

Manufacture of papers with thermoplastic properties

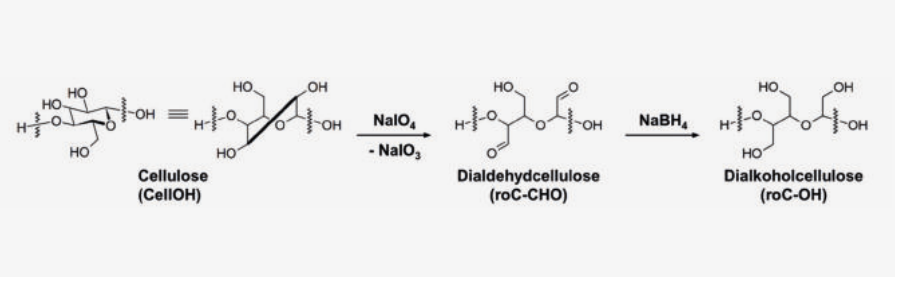


Fig. 1: Reaction schematic of two-step synthesis sequence for the preparation of dialcohol cellulose.

Project title:

» Development of a catalytic method for endocyclic bond cleavage in polysaccharides at the example of chemical pulp for a first-time economic production of paper materials with thermoplastic basis properties – “FibrePlast”

Project period:

» 01/01/2018 – 28/02/2021

Project type:

» IGF 19726 BR

Research locations:

» Papiertechnische Stiftung (PTS) project leader: Stefan Möckel

» Technical University of Dresden – Department of Chemistry and Food Chemistry – Chair for Organic Chemistry, project leader: Prof. Dr. Peter Metz

The joint project of PTS with the Chair for Organic Chemistry I of the Technical University of Dresden has been running since 2018. It relies on the promising results of the IGF CORNET 142 EGB “ACTIPOLY” project with the aim to ensure the manufacturability of thermoplastic papers based on the chemical transformation of cellulosic pulps into dialcohol cellulose fibre. Conventionally, a two-step synthesis sequence is necessary for this purpose, as illustrated in Fig. 1. In a first step, overstoichiometric amounts of sodium metaperiodate ($NaIO_4$) are used to generate dialdehyde cellulose (roC-CHO), which then undergoes complete reduction with sodium borohydride ($NaBH_4$) to deliver the designated dialcohol cellulose pulps (roC-OH).

The task of PTS was to develop an understanding of the synthesis of the roC-OH pulps and the resultant thermomechanical functionality of papers derived therefrom in the form of structure-property relationships and to ensure the runnability and processibility for implementing the production of papers in a continuous mode of operation. The Technical University of Dresden, however, looked into the problem of how to substitute innovative catalytic methods for conventional synthesis.

For this purpose, a library of oligomers structurally related to cellulose was set up, because the study of their chemical constitution in contrast with high-molecular cellulose is largely facilitated and the work mechanism of principal catalysts allowed the testing to be more efficient. Furthermore, catalyst systems for both synthesis steps were selected, prepared and tested for their suitability. It has been found that a catalyst system for the step of oxidizing cellulose into dialdehyde cellulose cannot be established in a practicable manner for the time being. Therefore, PTS intends to raise the efficiency of the first synthesis step by electrochemical coupling for in-situ regeneration and recovery of the used sodium metaperiodate. This approach will be further investigated in a follow-up research project. The reduction step showed promising results from the application of catalytic transfer hydration. So, it is possible after both reaction steps to achieve yields of more than 70 % for a model system by using a transition metal complex as the catalyst and an alcohol as the reductant. Typical yields from the conventional preparation of dialcohol cellulose pulps after both reaction steps range between 60 and 70 %.

The starting point of PTS in the project consisted in studying the cellulosic pulps commercially available in the market. In this context, the pulps were selected in the form of primary and secondary fibres according to their different chemical composition and distribution ratios of cellulose, lignin and hemicellulose in order to study their impact on the chemical reaction. It has been found that pulps with higher lignin contents, such as thermomechanical pulp (TMP) and chemithermomechanical pulp (CTMP) showed lower reactivity, which is due to the hydrophobic nature of lignin and thus reduced swelling and accessibility for aqueous reactive solutions. Higher reactivities were observed for deinked pulp (DIP) and birch sulphite pulps, but the reaction was difficult to control because of a higher degree of pre-existing mechanical or chemical damage to the fibres. Highest reactivities and achievable degrees of modification, in comparison with the pulp selection made in the project, were found for northern bleached softwood kraft pulp (NBSK) and cotton linters, with NBSK being then used in the project because of its lower purchase prices and better availability.

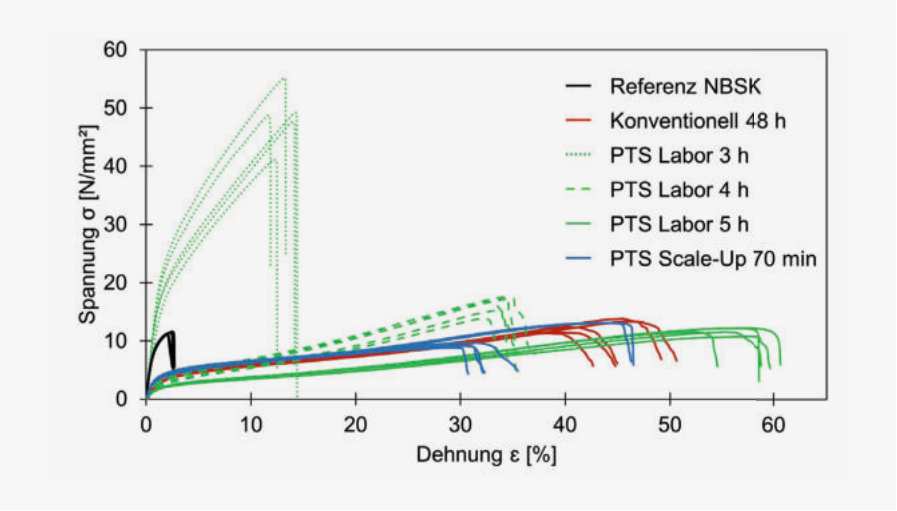


Fig. 2: Strain-stress curves of selected roC-OH papers.

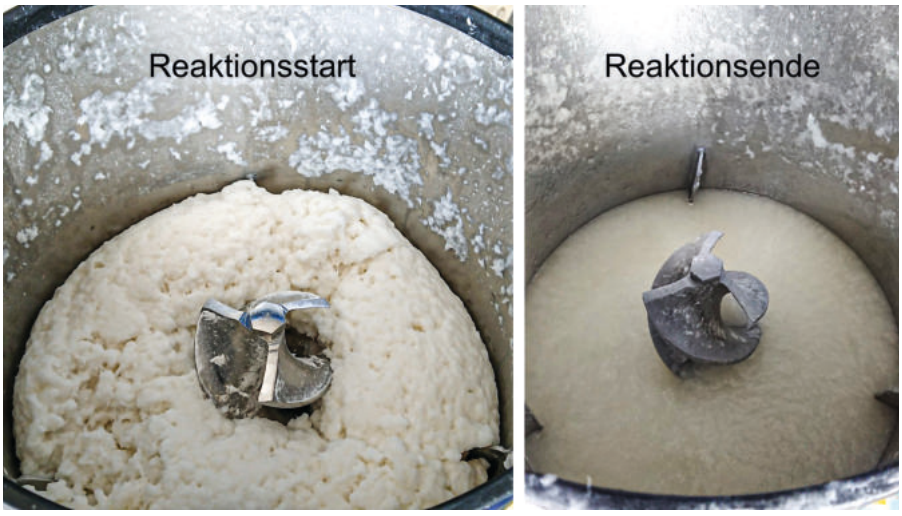


Fig. 3: Pictures showing the preparation of dialdehyde cellulose pulps in the pulper at the beginning and at the end of the reaction, respectively.

Typical conventional synthesis need up to 48 hours to produce roC-CHO in the first reaction step, whereas the reduction process is completed within one hour. This long first synthesis step provides fibres having an elongation at break (75 °C) within a range of 40-50% of their initial length after complete reduction. This is shown in Fig. 2 (red curves). The chart also shows the black-coloured tensile stress curves of the unmodified input material.

Therefore, one aim was to further optimize the first step of the reaction to achieve a significant reduction of the required reaction time. A statistical test design approach (Design of Experiment, DoE) was selected for this purpose. As a result of those experiments, it was possible to obtain pulps within reaction times of 3-5 hours, the papers of which showed 75°C elongation at break within a range of 10-60% (green curves). An existing reaction control allows the pulps to be manufactured customized to the needs of the potential applications of the papers made therefrom. Further, it was possible to transfer the reaction from the bench scale to the kilogramme scale by using a commercially available Lamort pulper as the reaction unit. This is illustrated in Fig. 3.

So, it was possible during the synthesis to increase the implementable consistencies up to a maximum of 9%, which made it possible to bring the reaction time further down to about 1 hour while saving required amounts of process chemicals. The papers made of the reduced pulps thus obtainable show elongations at break at 75 °C within a range of 30-45% (blue curves).

Examinations of the pulps for a drainability necessary for paper production in continuous operation and for their characteristic water retention values have shown that the pulps behave and can be treated in a way similar to heavily beaten stocks. Final trials are planned to be run on a pilot scale by the end of the year to prove the feasibility of paper production.

Further, it is envisaged to transfer the findings obtained by the Technical University of Dresden in catalytic transfer hydration of model substances to roC-CHO pulps and run the disintegration test for compostability and biodegradability by the end of the project.

The intention is to study, in addition to the thermoplasticity of papers, the applicability and work mechanism of the dialdehyde cellulose made available by this novel process as a reversible pseudo-permanent wet-strength agent in the paper industry. This approach relies on its crosslinkability which is made possible by the introduction of the aldehyde groups. The research application for this topic is currently being examined by the project sponsor and the project start is scheduled for QI/2021 ■

Stefan Möckel,
stefan.moeckel@ptspaper.de

TECHNISCHE UNIVERSITÄT DRESDEN

Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

Ex.i.st project: Model-assisted design of extruder screws for extrusion pulping

The potential of ***reactive extrusion*** for the in-situ modification of lignocellulosic plant materials had already been demonstrated successfully by PTS over the past few years. It became possible to obtain fibre materials, not only for papers but also for plastics and construction materials, that offer a much wider functional scope of the final products. The result is a platform technology allowing modified pulps, such as ionic or hydrophobic or quasi-thermoplastic pulps, to be synthesized under solvent-free/low-solvent conditions in the high-consistency range. Although constantly high reaction rates have been achieved for the reactive components, the scope of targeted control of fibre morphology in a narrow distribution was limited.

Therefore, the programmed research project is intended to look deeper into the impact of selected extrusion parameters on the morphology of the fibres. Special emphasis is placed on the task to identify the effect of varying screw configurations on the extrusion process of lignocellulosic fibre materials in different reaction mediums and thus different swelling conditions. The results will then be used as a basis for developing an application-oriented simulation tool that will allow the creation of exact models and come up with model-based proposals for screw configurations and designs adjusted to the desired fibre morphology. This will make a significant contribution to well-aimed fibre modification in the high-consistency range and thus to future industrial utilization of extrusion-treated pulps. ■

Dr. Alexander Feldner,
alexander.feldner@ptspaper.de

Project title:
» Development of an advisory service for the model-assisted design of extruder screws for extrusion pulping

Project period:
» 01/01/2021 – 31/12/2022

Project type:
» INNO-KOM IK-MF 49MF200073

Research locations:
» Papiertechnische Stiftung (PTS), project leader: Dr. Alexander Feldner

Gefördert durch:

Bundesministerium für Wirtschaft und Energie

aufgrund eines Beschlusses des Deutschen Bundestages

New type of gas diffusion electrodes based on special papers – **EL-Cat CO2 conversion into CO**

Power supply in Europe is facing a dramatic transition. The old energy world we know – which is based on the consumption of nuclear and fossil resources, dominated by combustion and steam processes, a distinct separation line between sectors, and a strong increase in energy poverty – is undergoing a process of noticeable transformation. The current development is striving for a world based on renewable energies, a high proportion of direct power generation without combustion or steam processes, a closely intermeshed sector coupling approach, and a significant reduction in energy poverty.

Regardless of the pace of progress of the energy transition towards renewable and sustainable electricity, there is a constantly increasing number of processes implemented on an industrial scale for using the power such produced. The chemical industry as a user of fossil resources for the production of chemicals is gradually switching to processes allowing the use of climate-heating greenhouse gases. This transition is to a large extent based on the "Power-to-X" approach, which uses electricity for implementing chemical transformation processes under mild conditions and with reduced carbon (CO_2) emissions, provided that green electricity is available.

A particularly promising and future-oriented method is the electrochemical conversion of CO_2, as anticipated by the project ("EL-Cat"), into the carbon monoxide (CO) component essential for the chemical industry. CO is an important intermediate product for the making

Fig. 1: Binational research project consortium funded under the 2 + 2 scheme.

of petrochemical products and plastics. Until today, methane and coal as fossil fuels are predominantly used in the generation of carbon monoxide. The basic idea of this French-German joint project is to develop a radically new and unprecedented CO_2 reduction technology to such an extent that the project results will allow the production process to be scaled up to industrial dimensions. In comparison with existing CO production processes, the project theme promises to achieve a significant reduction in CO_2 emissions such that the aim is to make a meaningful contribution to achieving the reduced CO_2 emission targets of the European Union. Additionally, the CO_2 in the project will be used as a feedstock for "green" C1 products. So, the process will even become a CO_2 sink.

The consortium, which is composed of the Innovation Campus Frankfurt/Paris of Air Liquide, the Institute for Energy and Climate Research (IEK-3) of the Research Centre of Jülich and Papiertechnische Stiftung (PTS) as well as the Laboratoire Électrochimique Moléculaire der Université de Paris, runs a binational project (France/Germany) covering an innovative cross-sector technological solution in the energy sector for the use of renewable energies. The project looks not only into technological and scientific problems, but also into major economic and socio-economic aspects. The EL-Cat project will profit in a number of ways from the collaboration and knowledge exchange between French and German institutes based on the exchange of knowledge by sharing information, skills and experimental research findings. Especially, Air Liquide will act as bridge between ecosystems and partners thanks to its binational presence in the R&D centres of Paris and Frankfurt with special emphasis on French-German cooperation.

Each of the partners brings in their specific expertise in one of the fields essential to the project in order to achieve the envisaged goals. So, the Diderot University of Paris will develop a highly selective catalyst for the electrocatalytic conversion of CO_2 to CO, which will be applied onto novel paper-based highly porous electrodes to be developed by Papiertechnische Stiftung (PTS) within the scope of the project. The Research Centre of Jülich will process the novel electrodes such obtained together with the newly developed electrocatalyst to form so-called membrane-electrode assemblies (MEAs), which will connect the catalyst and the electrodes with an anion exchange membrane, as unique cells or stacks of cells. As well as the coordination of the project, the Innovation Campuses of Frankfurt/Paris of Air Liquide will perform the technology assessment and the testing of the resultant cells and stacks in a proprietary test stand.

The test stand allows for a sufficient amount of testing and qualification of the stacks in accordance with industrial standards. Especially, the task is to develop short-term and long-term test methods for testing and evaluating the performance of the EL-Cat stacks on the basis of specific characteristics, such as long life, robustness, selectivity towards CO etc. In addition to the identification of the characteristic values, post-mortem examinations of stack components will be made in cooperation with the Air Liquide Innovation Campuses of Frankfurt/Paris in order to obtain insight into the deactivation and degradation mechanisms in continuous operation. The final goal is to obtain expertise and knowledge in the field of CO_2 electrocatalysis and to scale up a laboratory process to a relevant industrial level. ■

Project title:
» „EL-Cat" – Anion exchange membrane – Electrocatalysis for CO_2-to-CO conversion

Project period:
» 01/10/2019 – 30/09/2022

Projektart/träger:
» ANR-BMBF „2+2" projects – Research and development for sustainable energy supply of Europe / project sponsor: Jülich (PTJ)

Forschungsstellen:
» Papiertechnische Stiftung (PTS) – Functional materials, Franziska Bauer & Dr. Stefan Knohl
» Forschungszentrum Jülich – Institut für Energie und Klimaforschung (IEK-3), Dr. Marcelo Carmo
» AirLiquide – Frankfurt Innovation Campus, Dr. Stefan Barwe
» Universitè Paris Diderot – Laboratoire Électrochimique Moléculaire, Prof. Dr. Marc Robert
» AirLiquide – Paris Innovation Campus, Dr. Nicolas Richet

Dr. Stefan Knohl,
stefan.knohl@ptspaper.de

To make flying a little “greener” – Innovative resource-saving recycling of aramid fibre

Fig. 1: Used honeycombs become a resource for papermaking – process chain of aramid honeycomb recycling. From left to right: aramid honeycombs, mechanically disintegrated honeycombs or honeycomb cutting waste, phenol resin-free fibre residues after chemical recycling and a fibre mat made thereof.

Project title:
» „SEpARAte“– Selective recovery of aramid fibres for the manufacture of sustainable paper-derived materials

Project period:
» 01/07/2020 – 30/06/2022

Project type/sponsor:
» IGF Requirements 21150

Research locations:
» Papiertechnische Stiftung (PTS), Dr. Stefan Knohl and Benjamin Büttner
» TH Wildau, Chair for Fibre Composite Material Technologies, Prof. Dr. Christian Dreyer
» Fraunhofer Institute for Applied Polymer Research IAP, Research Division of Polymeric Materials and Composite PYCO, Dr. Theresa Förster

Starting point and problem situation

Scarcity of resources is a global problem and calls for a responsible and more sustainable use of remaining resources. Setting up new substance and material cycles is an important step to minimize resource consumption in the future. This requires innovative recycling technologies, especially in the field of lightweight construction materials. At present, recycling such materials is unattractive, because their recovery is very expensive and the performance of the materials or products made thereof do not reach the level of new materials. Often, there are also other reasons why recycling concepts do not work out, e.g. lack of trust in the reproducibility of the properties of such materials, sales volumes, cost-benefit-ratio of the products made of secondary materials, or limited availability of the materials. In some of the industries, however, the pressure to take action is rather high, because they have an increasing need for annual amounts, but limited options for raising the capacities.

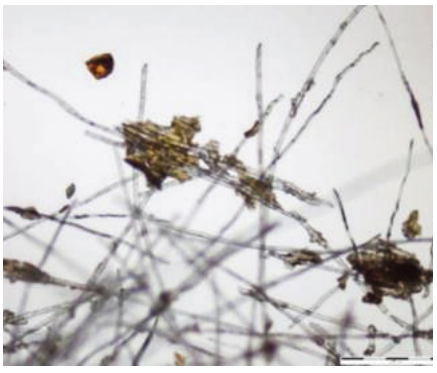


Fig. 2: Post-solvolysis aramid fibres showing small amounts of remaining resin deposits. In case of successful process optimization, new value chains can be created between aircraft industry and special paper manufacturers.

Project goal and solution approach

SEpARAte is an AiF-IGF project of Papiertechnische Stiftung, Research Division of Polymeric Materials and Composite PYCO of Fraunhofer IAP, and Fibre Composite Material Technologies work group of TH Wildau aimed at the resource-saving recycling of aramid honeycombs. These lightweight construction materials are used, for example, as flameproof materials in aircraft cabins. The research project is based on the idea that recycling these phenol resin-containing fibre composites will improve the availability of aramid fibres and thus support the development of innovative aramid products. An essential goal of the project is to recover aramid fibres from waste materials (e.g. paper, honeycomb pieces or off-cuts) with high efficiency and without shortening the fibres and then re-introduce them into a paper (Fig. 1). For recovery, a solvolysis-based recycling process is being developed and extended by downstream preparation and fractionation processes known from papermaking. Various reagents are being examined and tested in combination with microwave radiation. When the polymeric network covering the fibres has been chemically decomposed to a sufficient degree, the aramid fibres can be separated from the mixture, enriched, sorted by fibre lengths and prepared for the papermaking process. What is crucial is the characteristics profile eventually achieved: Is there excessive damage in the aramid fibres from solvolysis? Is it possible to ensure reproducible fibre properties? How big is the performance gap with well-established fibre types? The project intends to shed light on these questions. Initial trials show that the phenol resin coating of the honeycomb can be decomposed almost entirely by using appropriate reagents (Fig. 2). The consortium plans to optimize this process in the year to come for recycling aramid fibres with cost and time efficiency and without any resin deposits or loss of morphological properties.

Benefits for manufacturers, converters and users

In perspective, the development of an aramid honeycomb recycling process will enable the paper industry to have and use additional fibre classes with specific characteristics as raw materials or auxiliaries in addition to well-established primary fibre. This approach could help open up

the consolidated aramid fibre market to small and medium enterprises (SMEs) and create new interlinks between the papermaking, aviation, lightweight construction and recycling sectors. SMEs from the recycling and manufacturing industries as well as from the manifold application sectors could set up new product lines and reach not only their existing but also new customers by increasing the added value.

PTS is the project coordinator and can be contacted for any inquiries, requests, advice or other services in this field. The Polymeric Materials and Composite PYCO Research Division of Fraunhofer IAP provides the project with their specialist knowledge of chemical recycling and material characterization. One focus of the research activities of the Fibre Composite Material Technologies work group at TH Wildau, directed by Prof. Dr. Christian Dreyer, is the application of new technologies for the resource-efficient manufacture of lightweight construction materials.

So *SEpARAte* includes the evaluation of the potential of microwave radiation for shortening the process time. ■

Dr. Stefan Knohl,
stefan.knohl@ptspaper.de
Benjamin Büttner,
benjamin.buettner@ptspaper.de

Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

Dimensional stability in inkjet printing

Project title:
» Development of a dimensional stability prediction model for substrates in inkjet printing

Project period:
» 01/02/2019 – 31/01/2021

Project type:
» Joint Industrial Research (IGF), IGF 20425 BR

Research locations:
» Papiertechnische Stiftung (PTS) project leaders: Dr.-Ing. Martina Härting, Dr. Sabine Genest
» Sächsisches Institut für die Druckindustrie (SID) project leaders: Beatrix Genest, Carolin Sommerer

Project goal

The goal of the project is to be able to predict the behaviour of a substrate in terms of its dimensional stability during inkjet printing. When adjusting the substrates to printing methods involving high water input, the main focus so far has been placed on flatness properties, which are essential for the quality both in visual and in functional terms. This project is intended to look additionally into the stability within the flat plane, because dimensional changes in the x or y dimension can have an impact on further processibility, especially on the resultant position of the printed image relative to the outer contour of a product.

Research findings

Within the scope of the project, a measuring system was developed that relies on the computing capacity and the camera of a smartphone thereby ensuring the versatile applicability of the system. Thanks to a specially developed coordinate system and a measuring tool that holds the test specimen against a physical stop in a fixed position within the coordinate system, it is possible to measure the x and y dimensions of the specimen with a repeatability of up to 1 µm (Measuring set-up in Fig. 1). A corresponding evaluation software was developed for this purpose.

The magnitude of the z deformation in the tested specimens did not allow for topographic measurement. Because of this behaviour, all paper specimens were measured by means of the curl test apparatus shown in Fig. 2.

One aspect of the project was to look into the hydroexpansion of a substrate in an inkjet printing context, that is to study the change a substrate undergoes when aqueous ink is applied. For this purpose, various papers (kraft liners, top liners, graphic papers, one-sided and two-sided coated boards, test liners) were selected and characterized. In a first test round, an aqueous inkjet printing ink was applied to the full surface area of the 50 x 50 mm² specimens in three different dosage amounts (A: 3.2 g/m² single-pass; B: 9.6 g/m²; and C: 14.8 g/m² multi-pass), and the samples were tested for their dimensional changes in all spatial dimensions immediately after printing and at further time intervals.

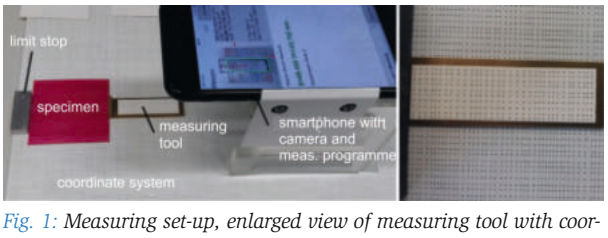


Fig. 1: Measuring set-up, enlarged view of measuring tool with coordinate system.

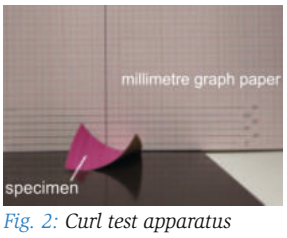


Fig. 2: Curl test apparatus

Dimensional stability of the specimens tested

The dimensional stability was evaluated by classifying the papers to be tested into

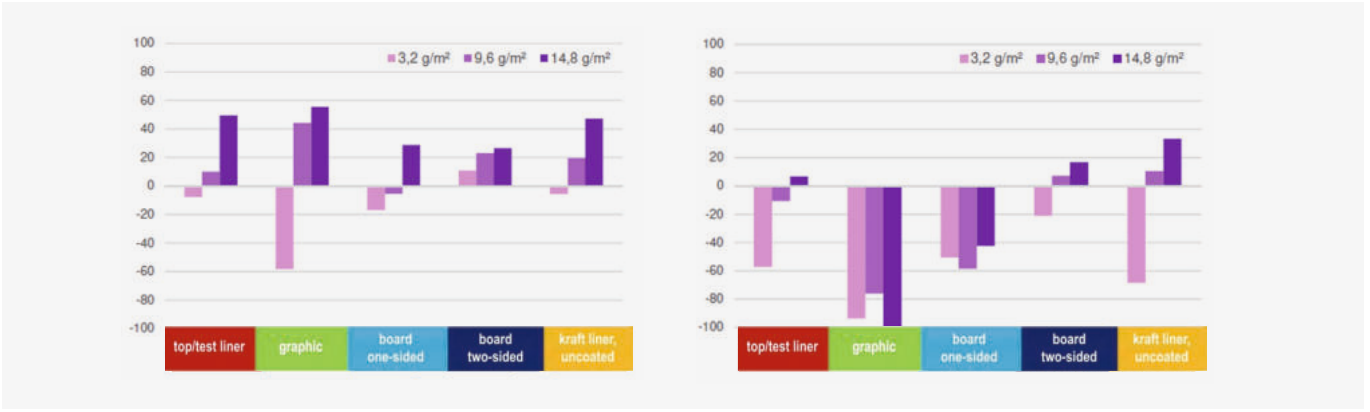


Fig. 3: Average elongation [µm] of paper specimen groups in the longitudinal (left) and lateral (right) directions 5 minutes after printing.

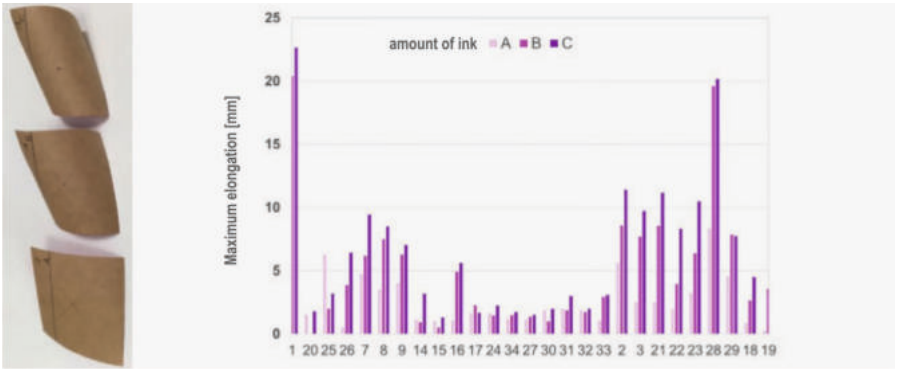


Fig. 4: Maximum extension/strain in z direction.

different groups. In Fig. 3, they are indicated by different colours . Fig. 3 shows the length or width dimensions of the substrates 5 minutes after printing with three different amounts of ink.

Many of the test specimens showed a correlation between elongation and the amount of ink applied. However, also shrinkage was observed after initial moisture-induced elongation. It was found that in some cases the elongation behaviour after 24 hrs, i.e. after the specimen was completely dried out, was opposite to the value measured directly after printing, because the initial elongations did not only disappear, but ended up in irreversible shrinkage in some of the cases.

The dimensional changes in the z direction were evaluated by means of the apparatus shown in Fig. 2. Apart from the maximum change in height, the evaluation also included curl direction (lateral, longitudinal, diagonal directions).

Similar to the elongation in the x and y dimensions, and as expected, the amount of curl increased as the amount of ink increased, cf. Fig. 4.

Typically, as anticipated, curl and deformation in the plane were the lower, the higher the grammage of the substrate was. In most of the specimens tested, the curl direction reflected the orientation of the fibres.

The main fibre direction specified and the fibre direction determined by breaking and suspension tests do not match the results of the TSO measurement. Therefore, there is a need for a reliable method of measuring the main fibre orientation or, where possible, deviations therefrom, especially for multilayer papers.

Outlook

During the course of the ongoing project, further printing trials will be performed using a larger format (20 x 20 cm) and additional inks. Since the findings selected for this article refer to a behaviour without tensile loads, whereas tensile loads are relevant in the handling and processing of material webs, further tests will be run to determine the lateral and longitudinal elongation under tensile stress and z-strain after stress relief. The related results will be given in the next PTSNews issue. ■

Dr.-Ing. Martina Härting,
martina.haerting@ptspaper.de
Dr. Sabine Genest,
sabine.genest@ptspaper.de

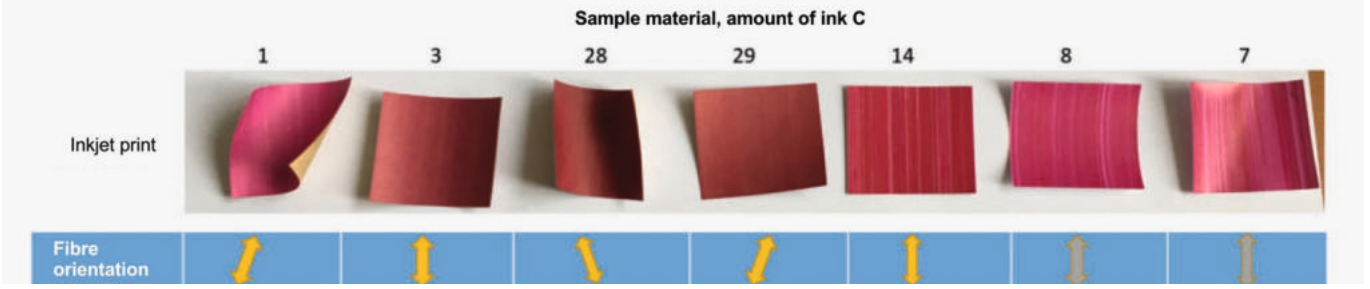


Fig. 5: Curl of the selected specimens

Carbon fibre reinforced thermoplastic semi-finished products in the wet-laid nonwoven process

The goal of the joint research project of PTS and Cetex Institute was to develop a new type of hybrid semi-finished product that is composed of a thermoplastic matrix and a base of recycled carbon fibres, mainly recovered in the pyrolytic process, and new fibres.

Background and motivation

Thanks to their excellent mechanical properties while having a low density, carbon fibres show a high potential for reducing the weight of structural components subjected to high loads. They are used as a single-axis-oriented reinforcing material in fibre-plastic composites for the manufacture of fast-moving high-strength lightweight structures and thus are of great importance in aerospace engineering, automotive engineering, machine and plant engineering, sports and power engineering. The worldwide demand for carbon fibre-reinforced plastics showed steady growth during the past few years to reach an estimated amount of 141,500 metric tons in 2019 [1]. On the one hand, there is proportional growth in the amounts of processing waste, such as cut-offs and waste rovings. On the other, there is also an increase in end-of-life components which will have to be returned to the recycling process in the foreseeable future. To date, the pyrolytic process is the means of choice in carbon recycling. Pyrolyzed carbon fibre is commercially available at a cost of 60% to 70% of the price of a primary fibre. The research into and development of appropriate full-featured applications for the "lower-quality" [2] CFRP recyclate fibres is currently as demanding as the research into adequate recycling processes.

This situation triggered the motivation to transform recycled carbon fibres into an appropriate semi-finished product that can be reused as a reinforcing material in structural components. The focus was laid on recycled short carbon fibres of up to 40 mm in length, because qualified strategies for the reuse of these fibres did not exist.

Research goal

The goal of the research project was to develop a new type of hybrid semi-finished product with a thermoplastic matrix having recycled carbon fibre, mainly recovered in the pyrolytic process, as a basis. The studies were focused on two main hypotheses:

- The well-aimed use of recycled carbon fibre allows for the manufacture of a high-duty product showing the performance of a product based on primary fibres.
- Thanks to a specifically designed load-conforming combination of non-oriented organo sheets based on recyclate fibres and UD tapes in a load-conforming arrangement, it is possible to produce specific material component solutions with optimal load absorption characteristics and in high number thereby reducing the component weight and saving costs.

Project title:
» Novel hybrid semi-finished products based on recycled carbon fibres for applications in lightweight structural engineering

Project period:
» 01/01/2017 – 30/06/2019

Project type:
» IGF 19281

Research locations:
» Cetex Institut gGmbH
» Papiertechnische Stiftung (PTS) project leader: Franziska Gebauer

Procedure & results

Hybrid wet-laid nonwovens of various configurations were made using the paper process which allows for good isolation of the reinforcement fibres and a homogeneous fibre distribution of the fibre mix within the nonwoven. Fibre lengths, fibre types and mixing ratios of matrix and reinforcement fibres were varied. The wet-laid nonwovens were manufactured on a small scale in the inclined-wire pilot paper machine of PTS. The wet-laid nonwovens were stabilized by a hydroentangling process at the end of the wire section. The existing contact-drying capacity in the paper machine was not sufficient for drying the wet-laid nonwoven web. For this reason and for optimal activation of the thermoplastic matrix fibres, the produced material was reeled up in a wet state at the end of the paper machine and then dried by

Fig. 1: Blending chest with rCF and PA6 fibres (left), pilot paper machine with inclined wire headbox (centre), hybrid nonwoven rCF-PA6 (right) (source: PTS)

Fig. 2: Organo sheets made of hybrid nonwovens (source: Cetex)

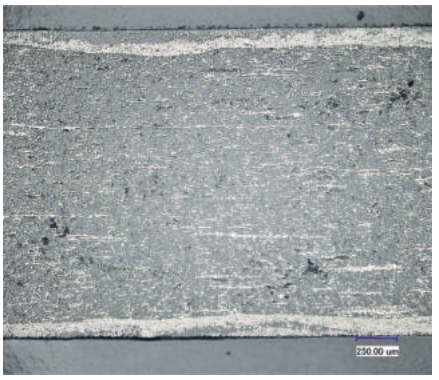


Fig. 3: Sandwich structure of rCF hybrid nonwovens with UD top layers (source: Cetex)

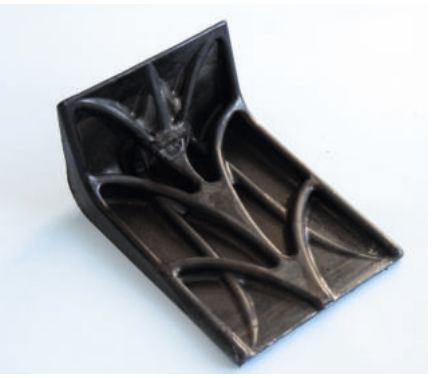


Fig. 4: Demonstrator structure made of rCF hybrid nonwovens (source: Cetex)

through-air drying (TAD) in a subsequent step. The then prevailing temperatures of 200 °C caused slight melting of the PA6 fibres, which had a stabilizing effect on the nonwoven. The evenly distributed fibres both in the blending chest and in the finished wet-laid nonwoven can be clearly seen in Fig. 1 below.

Then, the nonwovens were transformed into organo sheets (Fig. 2). Organo sheets were made in a hot pressing process followed by cooling, and the new fibre composite was mechanically characterized. Despite low reinforcing fibre lengths (l_{rCF} = 10 mm), the determined strength characteristics were excellent (σ_M = 350 MPa; E_t = 33 GPa).

The material analysis showed a pronounced anisotropy of the characteristic values. So the tensile strengths in cross direction, i.e. perpendicular to the production direction, were about 30 % lower. Thanks to the combination with unidirectional fibre-reinforced tapes, it was possible to provide the new material with a load-conforming additional reinforcement (Fig. 3). The combination with just a few UD tapes resulted in a drastic increase especially of the bending stiffness of the fibre composite. Various demonstrator structures were implemented in the Thermoform process in order to validate the new material (refer to Fig. 4). In this manner, it was possible to demonstrate the suitability of the material under use conditions.

Summary and conclusion

The project results show that it is possible to produce semi-finished products for structural fibre-reinforced lightweight components by controlled selection of base materials from recycled carbon fibres and thermoplastic matrix fibres and their defined combination with UD tapes. They can replace conventional commercially available fibre fabrics.

The very good mechanical parameters and the processing of recycled high-performance fibres are considered to be the drivers for their successful and sustainable establishment in the market.

The new types of hybrid semi-finished products make it possible to design components customized to their specific applications by using wet-laid nonwovens manufactured at low cost on the basis of recycled carbon fibres. Combining wet-laid nonwovens and UD tapes compensates for bending stiffness disadvantages wet-laid nonwovens might have.

This enables manufacturers of special papers and fibre fabrics, mainly SMEs, to generate an economic advantage over competitors when producing and using the newly developed fibre semi-finished products. The benefit of the research results for small and medium enterprises lies in the development of new product ranges and customer groups for material applications of papers and wet-laid nonwovens.

The findings of this project are directly conveyed to related additional research and development activities of the ZIM cooperation network “RESSOURCETEX” (www.ressourcetex.de). This network of 18 industrial and scientific partners develops technical solutions for textile lightweight construction in large-scale production and reuse concepts of waste fibre material and recycled carbon and mineral fibres. ■

Franziska Gebauer,
franziska.gebauer@ptspaper.de
Johannes Tietze,
tietze@cetex.de
S. Nendel,
Nendel@cetex.de
Steffen Schramm,
steffen.schramm@ptspaper.de

Gefördert durch:

Bundesministerium für Wirtschaft und Energie

aufgrund eines Beschlusses des Deutschen Bundestages

1 Dr. E. Witten, V. Mathes. Der Markt für Glasfaserverstärkte Kunststoffe (GFK) 2019 : AVK-Industrievereinigung verstärkte Kunststoffe
2 T. Reussmann, E. Oberländer, M. Danzer, A. Honderboom. Verbundwerkstoffe aus Recyclingcarbonfasern. WERKSTOFFE, S. 26-31

New research-funding facilities for companies

	Tax incentives for research (FZulG)	Central innovation programme for SMEs (ZIM)
Target group	Companies of all magnitudes	Companies having up to 500 employees, up to 1,000 employees, in cooperation with an SME
Eligible R&D projects	Basic research, industrial, experimental and contract research	Close-to-market experimental development and industrial research
Time when the support is provided	After the end of the business year	On approval of the project
Legal consequence	Statutory right where the relevant eligibility conditions are met	Review of R&D projects for compliance with financial support policy
Eligible expenses	Personnel expenses and contract research	Personnel expenses as well as further costs such as cost of materials
Amount of eligible costs	Up to EUR 2 million per annum	Up to EUR 550,000 EUR per project
Funding rate	25%	Up to 55%

German Research Grants Act (FZulG) and innovation vouchers provide new stimulus to business investments in research

The new Act on Tax Incentives for Research and Development (in short Research Grants Act, or FZulG) was passed by the federal German government in 2020 to establish an entirely new form of financial support for research and development in and for businesses. For the first time ever, the FZulG Act introduces a statutory right to reimbursement for research and development expenses. All businesses chargeable to tax in Germany are eligible. The research grant is set off against the assessed income tax or corporation tax. Where the research grant exceeds the assessed income or corporation tax, the excess amount will be actually paid out. Small and medium businesses as well as large or start-up businesses can file an application for research grants based on their cooperation with PTS in contract research. However, R&D projects must meet certain formal requirements to be eligible: precisely defined indivisible task, clearly defined goals, detailed specifications for the determination of the results, as well as further requirements.

Research and development projects are eligible when falling under one or more of the following categories:

- basic research;
- industrial research;
- experimental development.

Economic stimulus package doubles the amount of the research grant to € 1 million per annum

The Research Grant Act provides that a company can claim € 2 million at a funding rate of 25% each year. When research work is contracted out to research institutes like PTS, the funding rate is 15% of the total contract volume. The stimulus package of the German government is designed to raise the research grant from €500,000 to €1m and to double the assessment threshold of project expenses from €2m to €4m.

The first step to obtain the research grant is to file a grant application with the competent certification body (BSFZ / www.bescheinigung-forschungszulage.de). The certification body will verify the contents to determine whether the basic conditions have been met and provide the company with a certification confirming the eligibility of a research and development project.

In a second step, the beneficiary must submit its research grant claim to the revenue office responsible for the income tax assessment. The claim shall be made separately from the tax return. The Research Grant Act is designed to provide new impetus to the German economy by cutting the cost of research and development and thus raise the attractiveness of Germany as an industrial location for innovative businesses.

Project-related support for SMEs, start-up businesses, R&D newcomers and large businesses within the ZIM programme

ZIM stands for Central Innovation Programme for SMEs (www.zim.de). Small and medium enterprises have been using this form of project-related support for many years. PTS runs 5 to 10 ZIM projects every year and is a member in several ZIM networks. We perform a great deal of the preparatory work for the companies during the application phase and coordinate the work programme together. A new feature in ZIM is that also large businesses can profit from the programme when working together with at least one small or medium enterprise. Also, it is now possible to claim support for feasibility studies that are conducted in preparation for a R&D project. The funding rate ranges between 50 and 70%, according to the size of the business. Expenses incurred by a company for feasibility studies are eligible for an amount of up to €100,000. In case of joint feasibility studies conducted by several companies, the eligible expenses for the entire study are limited to €200,000. Feasibility studies are especially directed to:

- Microenterprises: less than 10 persons employed.
- Young businesses: founded within the last 10 years.
- First-time beneficiaries: SMEs that have not received so far any ZIM funds for their R&D projects or any funds un-

der national, regional or EU support schemes during the past three years.

Apart from the ZIM programme, companies can rely on further financial support facilities to get part of their research and development expenses reimbursed. PTS also gives advice to companies on how to handle applications and implement specific regional innovation vouchers. These instruments enable businesses to move forward with their product development and market launch activities in an uncomplicated and fast manner, whether on their own or in cooperation with other businesses. ■

We would be pleased to advice you on how to benefit from the cooperation with PTS for the research grant application.

Dr.-Ing. Tiemo Arndt,
tiemo.arndt@ptspaper.de

Insight into material science with the scanning electron microscope (SEM) – Series #1

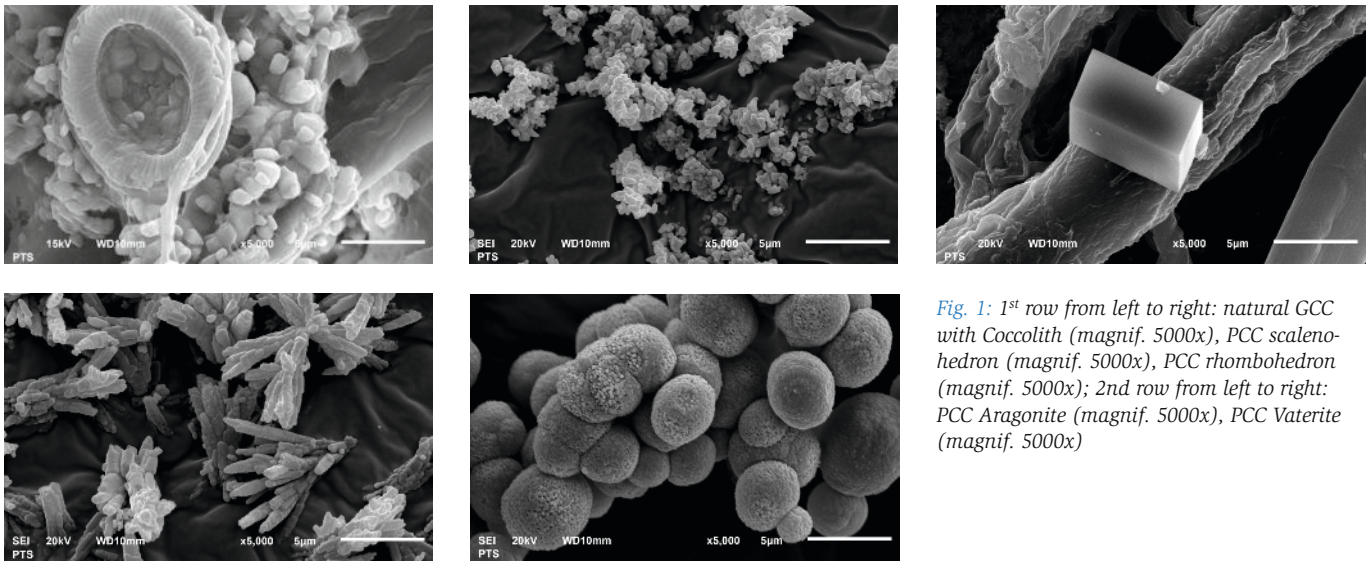


Fig. 1: 1st row from left to right: natural GCC with Coccolith (magnif. 5000x), PCC scalenohedron (magnif. 5000x), PCC rhombohedron (magnif. 5000x); 2nd row from left to right: PCC Aragonite (magnif. 5000x), PCC Vaterite (magnif. 5000x)

Object/material:
Calcium carbonate ($CaCO_3$)

Description:
Calcium carbonate is among the most important constituents in use in the paper industry since the middle of the 19th century. Its use is dominated by properties such as particle shape and size, brightness, refractive index, density and specific surface area. Natural $CaCO_3$ (GCC; Ground Calcium Carbonate) is found as chalk, limestone or marble. Precipitated $CaCO_3$ (PCC; Precipitated Calcium Carbonate) is mainly obtained by adding CO_2 to a calcium hydroxide slurry (lime-milk) and by appropriately adjusting its crystal structure and pigment size according to the mode of process operation.

Application:
$CaCO_3$ is the most commonly used pigment in the papermaking industry. It has an effect on the porosity, improves the brightness and the opacity, whether applied as a pigment in a coating layer or added as a filler in the paper pulp. For example, gloss properties can be adjusted by selecting an appropriate crystal structure of the PCC.

SEM analysis:
- Determination of the particle morphology (size, shape, aspect ratio),
- Filler distribution in the paper cross-section, surface characteristics of uncoated / coated papers,
- Coating thickness determination,
- Analysis of artefacts and defects in the coating layer ■

Pia Schenke,
pia.schenke@ptspaper.de
Stefan Lupatsch,
stefan.lupatsch@ptspaper.de

Execution of deeds by public notaries in Germany – Ink: project completion

For more than 20 years, Papiertechnische Stiftung (PTS) has tested printers and copy machines for use in the execution of original copies, official copies and certified copies of notarial deeds in accordance with Section §29 of the Notary Service Regulation (DONot).

Until recently, all printers and copy machines were tested in black-and-white operation only. Over time there had been more and more requests by equipment manufacturers and users from public bodies and authorities for obtaining test certificates pursuant to Section §29 of the Notary Service Regulation for printers and copiers in coloured operation.

Together with several equipment manufacturers and the German Federal Chamber of Notaries, a joint project was conducted to develop test patterns, test methods and sets of requirements allowing the resistance to ageing and antifalsification security of coloured copies/prints to be characterized.

As of 1 September 2020, it is now possible to issue test certificates for the coloured operation of printers and copiers. PTS takes this opportunity to once more thank all project partners for their assistance in the development activities. ■

Katrin Kühnöl,
katrin.kuehnoel@ptspaper.de

Young researcher from PTS wins the Heinzel-Mondi-Sappi Award 2020

The Heinzel-Mondi-Sappi Award is bestowed annually for outstanding scientific achievements in the field of sustainable recovery and reuse of wood, pulp and paper. Gerrit Roosen received this award (bestowed by Mondi) in the category of "Resource Efficiency" for his paper on "New findings on the defect of ridging". His work generated new insights into ridging defect patterns, comprising the quantification and classification of their different forms of appearance and the analysis of ridging defects on industrially manufactured paper grades. The PTS team are very happy about this new success of one of their young scientists. Meanwhile, Gerrit Roosen has left PTS to successfully apply his knowledge in the paper industry. ■

Dr.-Ing. Tiemo Arndt,
tiemo.arndt@ptspaper.de

Early warning system for production disturbances in the paper machine

Introduction

Significant production disturbances in the form of stickies-related web breaks or product defects are often problems that occur very abruptly and are limited to several hours or days of duration. It is assumed in many cases that a major cause lies in fluctuating, and occasionally very high short-time peak, levels of polymeric substances in the recovered paper base material. Basically, it has not been possible so far to evaluate such anomalies and reduce their occurrences on a cause-effect basis because of the general delay between the requested subsequent system analysis and the actual event and because of the measurements being isolated.

Project contents

A monitoring system for the amount of polymeric particles contained in the finished paper is a practicable way to ensure a much earlier and better targeted response by acting on the substance input from the base material or by adjusting selected process variables. A trend analysis can be used to identify continuously increasing load levels of polymeric impurities very early, and for continuous operation it is possible to define precise threshold values (alert thresholds) based on empirical values from machine operation.

Project title:
» Development of an impurity monitoring method for enhanced production continuity and product quality in paper mills

Project period:
» 01/04/2019 – 30/09/2021

Project sponsor:
» IK-MK 49MF180157 / Federal Germany Ministry for Economic Affaires and Energy

Research locations:
» Papiertechnische Stiftung (PTS) project leader: Lutz Hamann, Dr. Enrico Pigorsch

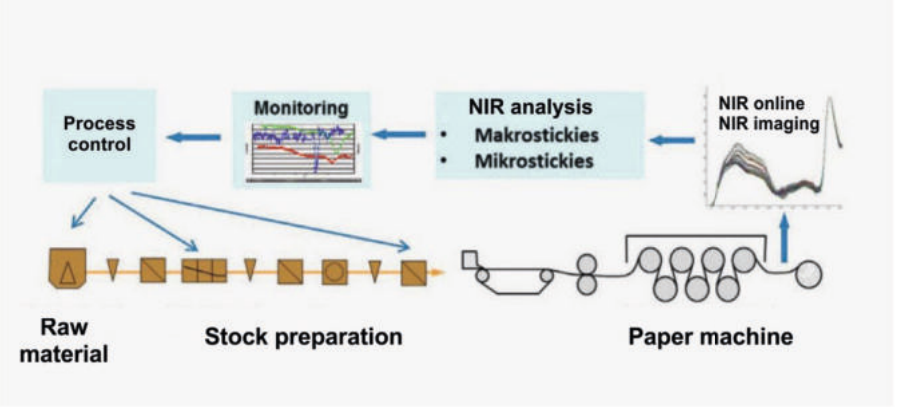


Fig. 1: Schematic view of the impurity monitoring system application

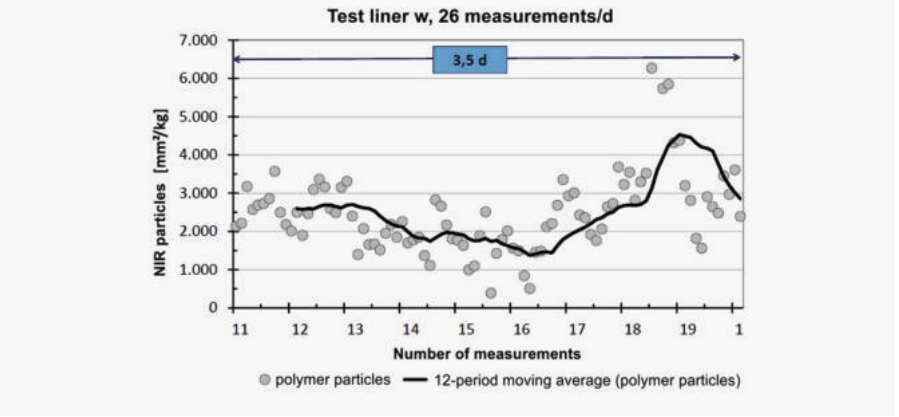


Fig. 2: Monitoring of total polymer particles

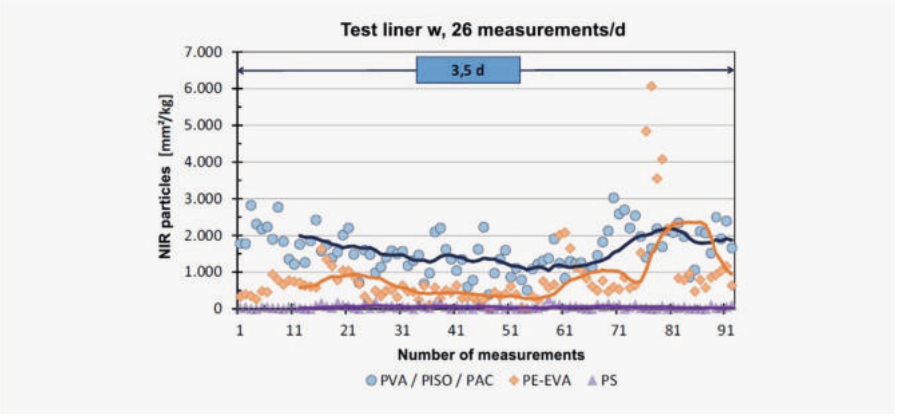


Fig. 3: Classification by types of substances

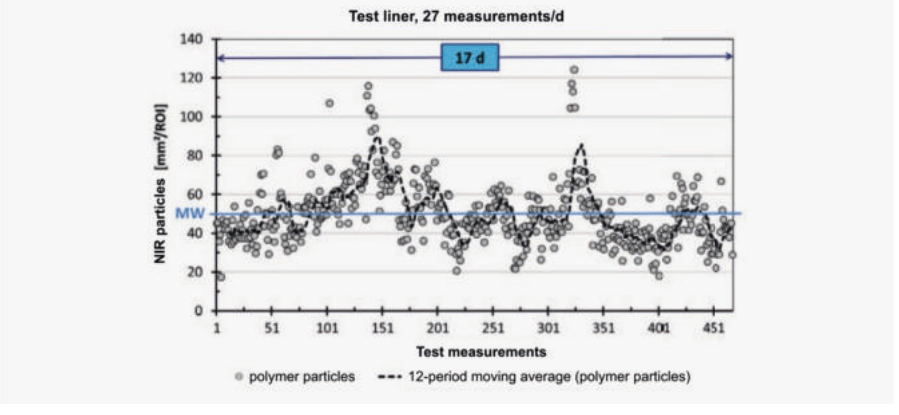


Fig. 4: Long-time study of fluctuation range of polymer loads

The goal of the research project is to develop an equipment-based "Impurity Monitoring" service for application in paper mills. The monitoring system uses NIR measuring methods to ensure both quantitative and qualitative detection of impurity loads very early with high specificity and differentiation.

Fig. 1 is a schematic view of the main components of the impurity monitoring system: Based on continuous detection of a measurement signal and data analysis by means of threshold control, the base material input and process parameters such as reject rates, disperser work or use of additives can be controlled in a timely manner.

Intermediate results

Fig. 2 shows the total level of coarsely dispersed polymer particles in a finished paper over a period of 3.5 days at a measurement frequency of approximately 1 measurement per hour. The moving average of 12 periods (approx. 0.5 d) is a good indicator of the trend, and as you can see, the impurity load may well vary by the factor 3 at small intervals. In Fig. 3, the total polymeric load is further classified by level of detail into 3 substance classes, which are either preferably sticky (PVA polyvinyl acetate / PISO polyisoprene / PAC polyacrylate or PE-EVA polyethylene ethylene acetate) or preferably non-sticky (PS polystyrene).

A longer monitoring trial for 5 weeks in total (about 2.5 weeks are shown in the picture) was conducted to examine a total number of 900 paper samples for coarsely dispersed polymer particles using NIR imaging. The dash-lined trend curve also shows level variations by the factor 3 with an average across all results of 50 mm²/ROI. The measured surface area of each finished paper specimen was 25 x 40 cm and needed 5 minutes of measuring time. The work is currently focused on matching the results with the runnability in the paper machine during the studied period.

Outlook

The results illustrated in the charts were obtained with the new PTSNIR Imaging

Fig. 5: Potential online measuring system

System for macrostickies. The analysis takes place offline at the premises of PTS using finished paper samples submitted by the paper mills. The use of the NIR imaging method reduces the time needed for the measurements by 95 % in comparison with the previous INGEDE Method 4. In a first step, it has to be checked whether the NIR measuring signal shows a distinct correlation with the number of web breaks and paper machine down times.

The ultimate goal of the project is to develop a NIR-based online measuring system that should be positioned next to the moving paper web just before the reel winder to deliver a continuous detection signal indicative of the quantitative polymeric load in the paper. Fig. 5 is a schematic representation of the envisaged measuring system.

Further related PTS developments are an optional in-situ remote control of the online measuring system and an algorithm-assisted data evaluation and prediction tool with integrated simulation models regarding the quality of the recovered paper and the stock preparation process steps. Together with the INVITE project described in the next section, the impurity monitoring project is an essential component of digitizing proposals for the paper industry in the PTS Smart Services & Products (SSP) Division. ■

Lutz Hamann,
lutz.hamann@ptspaper.de
Enrico Pigorsch,
enrico.pigorsch@ptspaper.de

PBS products as a use case for Industry 4.0 transformation

INVITE4.0

The INVITE project

PTS has since 2018 been developing guidelines for the implementation of Industry 4.0 in the paper industry. The project was performed together with the ifak Institute for Automation and Communication based in Magdeburg. The need to transform existing products and machinery into smart products was identified to be an essential component for Industry 4.0 implementation. But what is a smart product and how can transformation succeed?

Smart product

A product is smart when it has information on its own manufacturing process and the ability to collect and communicate data during the manufacturing and use phases. Products, also known as assets, need a virtual representation to be able to access the incoming data. Once this condition is given, the next step would be to implement and offer a smart service. The representation of the physical asset by means of data can be done via an asset administration shell (AAS). The manufacturing data as well as the data of the use phase are stored in this digital shell around an object.

Virtualizing the Asset Administration Shell via the AASX Package Explorer

The Industry 4.0 platform recommends a specific software for exchange and virtualization of administration shells: the AASX Package Explorer. AASX stands for "Asset Administration Shell Explorer". The tool allows asset administration shells to be created and edited with concept descriptions in the formats XML and JSON. Each individual administration shell has a specific "International Registration Data Identifier", which is a worldwide unique identification code of the "ecl@ss" standards. The AASX Package Explorer is a freely available open source implementation. The software allows the creation of administration shells, submodels and concept descriptions for assets.

Project title:
» Invite4.0 Smart Services in the Process and Paper Industry

Project period:
» 01/10/2017 – 30/06/2020

Project sponsor:
» INNO-KOM VF

Research locations:
» Papiertechnische Stiftung (PTS) project leader: Björn Zimmermann
» Institute for Automation and Communication (ifak), project leader: Holger Zipper

PBS products use case

PTS has tested the developed Industry 4.0 method on its own product portfolio. The goal was to transform the PaperBaleSensors (PBS) of PTS, which

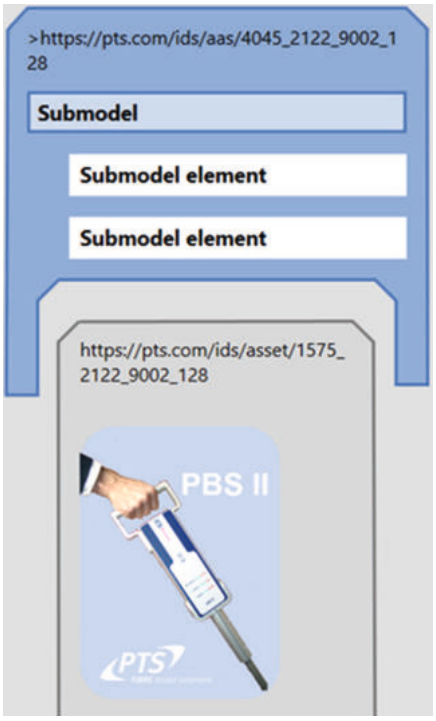


Fig. 1: Administration shell and physical asset

are used to determine the quality of recovered paper bales, into assets having an administration shell. The sensors generate data that can be used in MES and ERP systems or in databases. This requirement is important and has to be met before the sensors can be considered to be a smart product. PTS as the equipment manufacturer also maintains the product's manufacturing data, which is stored as statistical data in a tabular form. For the purpose of the Industry 4.0 concepts, said data is transformed into a format readable both by machines and by humans. In this case, the tabular data was transformed into XML. After transformation, the data can be visualized in a clear layout in a graphical user interface (GUI). The AASX Package Explorer was used for this purpose. In the future, the administration shells can be accessed via this software when adjusting existing information or adding new products. For transforming the product portfolio into assets with administration shells, PTS could rely on the assistance of Dr. Michael Hoffmeister, Festo SE & Co KG, a representative of the Industry 4.0 platform. It is thanks to his advice that the integration of the data in the AASX Explorer was successful. The asset administration shells are now stored on the servers of PTS and accessible for location-independent use. This makes the PaperBaleSensor the first entirely implemented smart product of PTS.

Conclusion

Many of the business models that are created nowadays use data for value creation. It is important for a company wishing to be well-prepared for smart business models to have involved products represented by data. Storing the data in connection with the use of an asset administrative shell forms a solid basis so as to be all set for such data-driven projects in the future. This use case has shown that a large number of existing measuring tools can be transformed into assets having an administration shell. PTS thanks warmly the sponsor for financing this forward-looking project and ifak for the very good teamwork. ■

Björn Zimmermann,
bjoern.zimmermann@ptspaper.de
Richard Fankhänel,
richard.fankhaenel@ptspaper.de

ifak

Gefördert durch:

Bundesministerium für Wirtschaft und Energie

aufgrund eines Beschlusses des Deutschen Bundestages

```
<aas:assetRef>
<aas:keys>
<aas:key type="Asset" local="true" idType="IRI">https://ptspaper.de/ids/asset/1575_2122_9002_128</aas:key>
</aas:keys>
</aas:assetRef>
<aas:submodelRefs>
<aas:submodelRef>
<aas:keys>
<aas:key type="Submodel" local="true" idType="IRI">https://ptspaper.de/ids/sm/5565_2122_9002_1281</aas:key>
</aas:keys>
</aas:submodelRef>
<aas:submodelRef>
<aas:keys>
<aas:key type="Submodel" local="true" idType="IRI">https://ptspaper.de/ids/sm/5565_2122_9002_1282</aas:key>
</aas:keys>
</aas:submodelRef>
<aas:submodelRef>
<aas:keys>
<aas:key type="Submodel" local="true" idType="IRI">https://ptspaper.de/ids/sm/5565_2122_9002_1283</aas:key>
</aas:keys>
</aas:submodelRef>
</aas:submodelRefs>
<aas:conceptDictionaries />
</aas:assetAdministrationShell>
<aas:assetAdministrationShell>
<aas:idShort>2530000200110_2930000200125</aas:idShort>
<aas:category>CONSTANT</aas:category>
<aas:description>
<aas:langString lang = "de">Messgerät zur NIR - Erfassung von Altpapierballen</aas:langString>
<aas:langString lang = "en">Measurement Device for NIR - measurement of recovered paper bales</aas:langString>
</aas:description>
```

Fig. 2: Extract from the XML code of the asset administration shell

The future of calibration services is contactless:
PTS handheld & DOMAS scanner systems

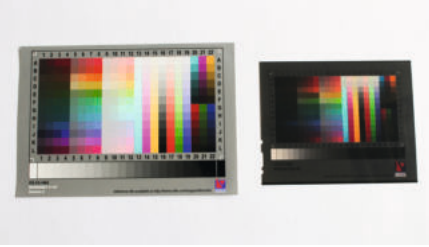


Fig. 1: IT8 targets for DOMAS calibration

Fig. 2: Reference samples for PBS II handheld instrument

Fig. 3: Online calibration in process

Online calibration service

There has been an increasing level of awareness of contactless service among the companies in the paper industry during the past few months. Whereas in the past measuring instruments were maintained by PTS staff in places all around the world, there is a shift in demand towards a pure remote service. PTS now offers such services for its PBS handheld units and its DOMAS scanner systems.

An annual calibration is necessary to ensure the measuring system continues to meet the high quality standards. Doing without calibration might result in instrument drift due to the ageing of light-emitting elements and built-in photosensitive electronic devices.

Calibration procedure

After having been requested to make a proposal, PTS sends various specific calibration targets to the customer. Then the customer and PTS agree on a time and a date for the calibration. This is another advantage of the online procedure: the time and date can be agreed at much shorter notice. The online calibration service is a personal service via TeamViewer, or by video call, where necessary.

DOMAS: The scanner calibration targets are two IT8 targets, which is a common standard nowadays used for the calibration of scanners, digital cameras, monitors and printers. They guarantee for colour consistency between different units.

For online calibration, the customer places the targets one by one in the scanner. Each target is measured with reflected light as well as transmitted light. After each scan, the measured data is transmitted to PTS where the scanner settings are verified or recalculated and then returned to customer as an ICM file.

PBS II: The calibration targets provided to the customer for the handheld units are custom-made items from the Technical Centre of PTS. These samples are cylindrical objects of a defined fibre mix to be slid onto the PBS measuring lance and to be measured as instructed by the remote expert.

During calibration, the data from the measurements of the different samples are also transmitted to PTS and then returned as an optimized configuration file or directly uploaded.

The reference samples can be used for up to 3 years when stored in a dark and dry place.

In case of the PBS, the remote maintenance procedure is also used for troubleshooting and specific repairs. A possible scenario is lamp failure. Within the online service connection, the instrument can be switched over to a second built-in lamp thereby ensuring continued use of the sensor by the customer.

Advantages for PTS customers

The instrument is ready for further use right away after calibration. Furthermore, a test report is issued to the customer and the measuring system gets a sticker label having validity for another year.

Calibration is the basis of a good measurement, and the online calibration service makes it even easier for customers to meet the required quality standards with PTS instruments. ■

Just request your calibration targets.

Jörg Hempel,
joerg.hempel@ptspaper.de

New test method for brittle ceramic materials – double ring bending strength (ring-on-ring method)

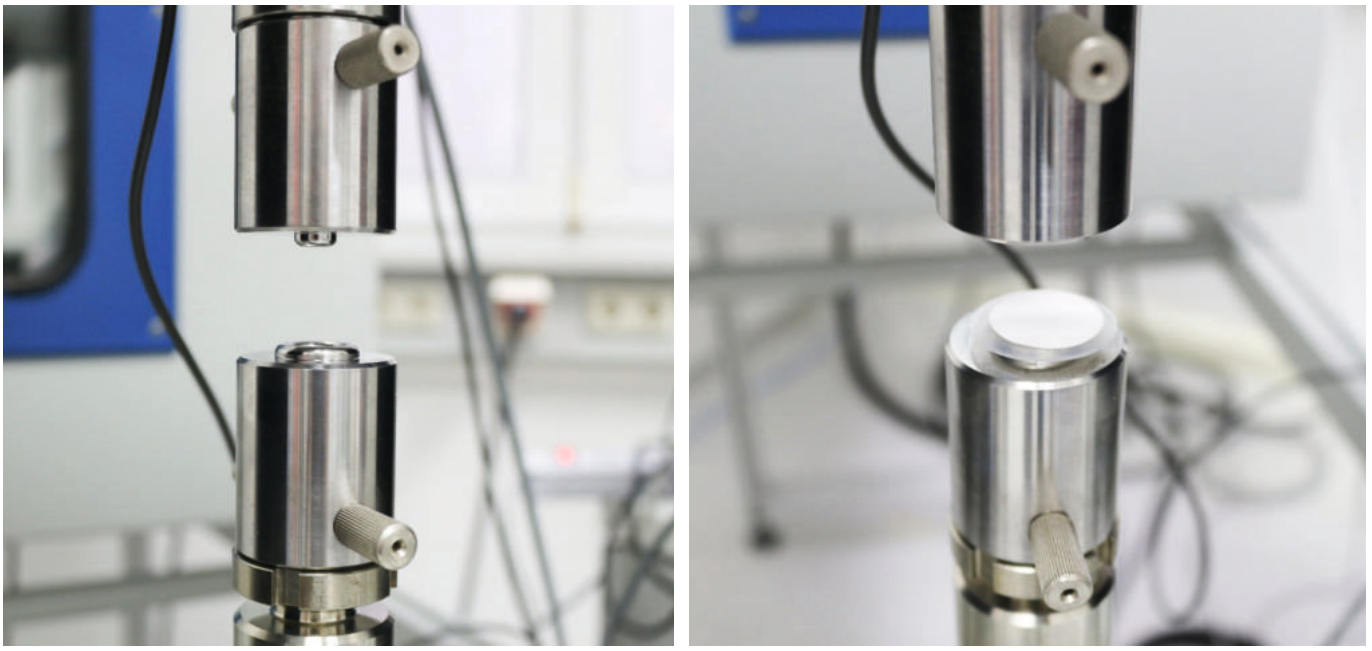


Fig. 1: Photograph of the test unit, without specimen (left) and with specimen (right).

Paper-derived ceramics based on high filler-loaded special papers have during the past few years become a study area with increasing scientific focus within PTS and are currently a subject of various publicly funded and student research projects and industrial contract research. The developed special ceramics are very variable in terms of material, porosity, strength and surface properties. Also, the green bodies (papers with high ash contents before sintering) can be produced at low cost and in high amounts in the pilot paper machine and have a good shapeability which allows for various geometric structures (e.g. corrugations, wound structures). Paper-derived ceramics offer versatile applications, especially in the fields of insulation, filtration, carrier materials, membranes or porous burners. A special programmable sintering furnace, which is of great importance for this research area, was acquired under the INNO-KOM programme of the German Federal Ministry for Economic Affairs and Energy (BMWi) (Module IZ) already in 2020 to study the sintering behaviour of green bodies.

For the characterization of the newly developed ceramic products, their mechanical strength is a central factor in addition to properties such as porosity, dimensional changes and thermal conductivity. Test methods such as the 3-point or 2-point bending tests do not deliver meaningful results for these types of ceramics, because they are so thin and show an entirely different material behaviour. That is why the test laboratory of PTS set up the “double ring (or ring-on-ring) bending strength” test method after DIN 51105 as a new characterization test. This method has been used for a while in research to test thin ceramic layers. It allows the characterization of monolithic ceramic high-performance materials having a grain size of less than 100 µm at standard room temperature.

Fig. 1 shows the set-up during testing. A circular and preferably plane-parallel specimen is placed onto a specific rubber sheet on the support ring and loaded by means of the loading ring at a constant rate until it breaks. The maximum force at break can then be used to calculate the double ring bending strength (in MPa) by means of various specimen parameters. Additionally, a failure analysis of the ceramics can be made according to standard. ■

Dr. Stefan Knohl,
stefan.knohl@ptspaper.de

New testing equipment in PTS: **Thermographic camera system**

In September 2020, PTS commissioned a modern thermographic camera system (cf. Fig. 1). The photonic high-efficiency testing system XGA (made by InfraTec GmbH Infrarotsensorik und Messtechnik, Dresden) uses a high-end ImageIR® 9480 hp (Modell 2019) camera unit, which is state of the art. Thermography is a thermal imaging method that allows the ***surface temperature of objects*** to be indicated. For this purpose, the test unit detects the infrared radiation emitted from a certain point and measures its intensity, which is correlated to the temperature prevailing. So the thermographic camera converts the infrared radiation, which is invisible to the human eye, into electric signals such that temperature differences can be found and analysed during the evaluation process. Basic advantages of this inspection technology are the ***imaging operation principle***, the high test rate with scanning frequencies > 1 kHz, and the relatively easy automatability. Thermographic methods also allow the identification of flaws in workpieces that are beneath the surface and thus invisible from the outside, by analysing the heat flow or thermal conductivity in the test pieces.

The applications of the new camera are versatile and many use cases are conceivable. For example, the camera can be used to analyse heat signatures in materials as a result of ***mechanical loads on materials*** and related internal friction. Local heating differences in a test specimen can then be used for an early ***detection of a failure point***. Thus, materials can be tested for their mechanical (break) behaviour with higher accuracy and further improved on the basis of the results obtained. The resultant images can be compared with images from optical strain field analysis, a method used by PTS for several years, to identify common features and difference of both methods.

Furthermore, the system allows ***thermal conductivity tests*** to be carried out on e.g. porous paper structures. They can be used as an insulating material or for cooling down air flows, and what is especially important in testing is their inhomogeneities caused by the anisotropy of the material, as well as transition and border areas and joints. Even smallest deviations in ***insulation materials*** can cause thermal bridges and eventually lead to failure from dew condensation.

Another research area is the ***crystallization of waxes on (paper) surfaces***. The platelet-like wax structures that form as a result of phase transformation during the course of the cooling process and the underlying formation process can be observed and analysed, because the small size of the structures of just a few micrometres and the very quick formation within just a few seconds are now detectable.

Conductive tracks that are printed in conductive inks directly onto paper or board, commonly known as ***printed electronics***, have to withstand enormous mechanical loads in packaging and logistics, such as friction/abrasion impacts, bending and stretching of tracks, or creasing and folding. The stability of such conductive tracks must be analysed beforehand already. This is made possible by thermographic measurements that are performed on a conductive track during load simulation thereby ensuring an early identification of locally distributed microcracking. One way to make up for this problem is to reprint such points of failure. Generally, the coating and printing parameters can then be adjusted such that the weak points in the track are minimized.

Investigations into the ***antifalsification security of toner-based digital prints*** tend to show more and more test-position-specific differences in mechanical erasure tests on the A4 test printouts. The causes lie in the fixation process, which is affected by heat and pressure transmission. Direct intervention into the fixation process is not possible for equipment reasons. The intent is to seek compensation by determining the distribution of heat in the actual printout immediately after printing. Temperature differences within the surface area of a printed DIN A4 sheet are expected to be indicative of a locally variable fixation quality and thus erasability of the printed characters.

Funded system:
» Thermographic camera system – Photonic high-efficiency tester XGA

Funding programme and code:
» "INNO-KOM Module Investment Grant for scientific & technological infrastructures" – Funding code 49IZ200010 – supported by the Ministry for Economic Affairs and Energy (BMWi)

Research locations:
» Papiertechnische Stiftung (PTS), project leader: Benjamin Hiller, Martin Röllig

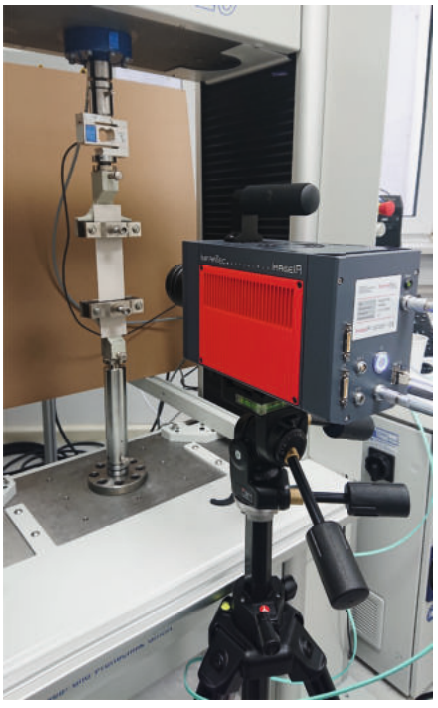


Fig. 1: Camera set-up during a tensile test on folding boxboard

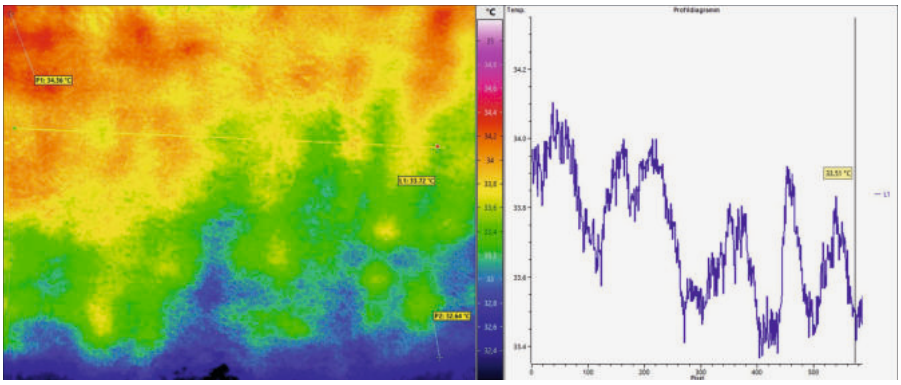


Fig. 2: Inhomogeneous distribution of temperatures during the heating process of a sheet-type heater element produced in papermaking

The range of application of this technology further encompasses detecting internal defects for hierarchically structured ***high filler-loaded paper-derived ceramics***, measuring thermal distributions and heating/cooling curves for ***heating elements made of paper*** (cf. Fig. 2) or ***cooling bags***, analysing ***moisture condensation*** from local cooling or in paper/metal contact points, and studying the ***combustion behaviour*** of papers and paper-derived materials.

To meet all these modern measuring requirements, the thermographic system offers the following specifications:

- Self-cooling measuring system for reducing the camera's self-heating effect onto the measured result by means of a rotary Stirling cooler, offering an optimal combination of maximum sensitivity, accuracy, spatial resolution and speed;
- Large-size detector format of (1,280 x 1,024) infrared pixels;
- High thermal resolution in the range of < 30 mK;
- Frame frequency of 180 Hz in full frame (up to 2,601 Hz in line) thanks to the camera's low integration (exposure) time;
- Modular basic concept for optimal adjustment of the measuring system to a given measuring tasks with different lenses (macro, standard, telephoto);
- Trigger interface and matching interface for adaptation to existing measuring equipment;
- Low size and weight for mobile and movable uses. ■

Benjamin Hiller,
benjamin.hiller@ptspaper.de
Martin Röllig,
martin.roellig@ptspaper.de

Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

Bioeconomy off to a flying start in Central Germany: Cooperation between BioEconomy HUB Leuna and PTS

The PTS news issue 1/2020 contained already detailed information on what bioeconomy means in Germany. Driven by the phasing out of coal, the structural change towards bioeconomy is already becoming reality, e.g. in former coal mining areas. Germany-wide model regions are being developed for this purpose. One of those regions in Germany is Saxony-Anhalt, to be exact. As one of the German regions most affected by the structural change, the need for innovation is particularly high. On the other hand, also the innovative strength is high because of many years of expertise in the chemical industry. This constellation forms the current basis for attempts to find answers and solutions to the problems and challenges of the structural change and view it as an opportunity for transformation towards the better.

In a first step towards this "Sustainable Chemistry" model region, the BioEconomy Cluster in Halle will establish a BioEconomy HUB together with Fraunhofer CBP. The goal of the HUB is to become a technology and service centre providing demonstration facilities and project-related operations for the use of biogenic materials thereby supporting the implementation of innovative business ideas. The focus is placed on the chemical and biotechnological conversion of regrowing raw materials, but also on peripheral topics such as logistics or preparation of raw materials. For this purpose, it is planned to install new facilities, but also to ensure better networking between the existing infrastructures of the various partners based across all over Germany. The intention is to give young businesses the opportunity to develop innovations all the way up to the industrial level.

PTS will act as a strong partner in this network and will first of all be a service provider offering its existing infrastructure portfolio with the related knowledge base, e.g. in the preparation of raw materials or development of new materials, but also in terms of subjects of circular economy, to generate key innovations in bioeconomy and thus take an active part in the structural change in Germany. ■

Dr. Martin Zahel,
martin.zahel@ptspaper.de

PTS Health Days 2020

Presentation on "Health and Ergonomics at the Workplace" by Ms. Richter

PTS held its first health days in 2020. At the end of every quarter, always on Thursdays, PTS released its employees and students from work to give them time for proposed health activities.

Planning the health days started right away in January when first general health-related surveys were organized. An important aspect from the very first moment was to give every staff member the opportunity to take an active part in occupational health and to indicate preferences or submit proposals. The set of ideas such collected were then used to plan the first health day. For this purpose, talks were held with the responsible employers' liability insurance association as well as various health insurance funds.

Cooking class with Mr. Haufe

Questions and ideas about "Occupational Health" are welcome at any time.

To do so, please contact:
Lena Pergande
(Human Resources student)
lena.pergande@ptspaper.de

Ergonomic advice by Ms. Richter and Mr. Stiehr (source: PTS)

After all staff and students were sent to mobile working at the end of March, the health day planned for the end of the month was also cancelled at short notice. However, the initial health day plan was then adjusted to the applicable regulations and Covid-19 requirements such that the health day could take place at the premises of PTS three months later, on 25 June 2020.

The programme in June included three morning and afternoon physiotherapy sessions offered by "DIE Physio" from Heidenau. Ergonomic advice was given all day long in parallel with the courses and sessions. Ms. Richter taught important aspects of ergonomics and exercise at the workplace. She answered all questions and responded to the individual needs of the audience. Then, all staff members were given the opportunity to have a "Workout Break". Easy workout exercises for everyday working life were demonstrated and copied by the employees and students. The final item was an introductory course with yoga and Pilates practices for the everyday work. Again, everyone had the opportunity to try out the exercises and to provide feedback.

Although some of the employees and students still worked from home, there was a lively response and the health day was very well received. Afterwards, all employees directly received a questionnaire to give an evaluation for the day or to give reasons against attending. The feedback results were taken into account for the preparations of the next health day.

The second health day took place as the highlight of the year on 24 September 2020. PTS hired Philipp Haufe, the chef of the restaurant of the country hotel "Zum Erbgericht", and the dietitian Laura Albrecht. Mr. Haufe performed three cooking classes with employees and students in the outdoor area of PTS thereby directly preparing the meals for the attending staff. The vegetarian class prepared courgette cordon-bleu, ratatouille and a rice salad. The other two classes prepared fish, guinea fowl, beetroot salad and couscous.

Laura Albrecht gave four open presentations with additional information on diet and nutrition. All participants had the opportunity to ask questions and learn ideas and new approaches for a healthy lifestyle.

In parallel, the physiotherapists repeated the three contributions already made during the health day in June and offered ergonomic advice all day long. An additional consultation hour for urgent cases was offered in the afternoon.

The September health day was versatile with many integrated team-building elements. The Covid-19 regulations and requirements were respected both by the planners and the participants.

The next health day will take place on 17 December 2020. It will be held under the motto "Mental Health and Addiction Prevention". The organizing team is already planning the event and has established first contacts. This will be the final point of the 2020 health day series. Based on the feedback, a future concept for the operational health management in PTS will be developed. The intent is to give all staff members and students access to health activities through PTS at any time. ■

Lena Pergande,
lena.pergande@ptspaper.de

PTS Sustainability Weeks 2020

Source: PTS

Sustainability through staff involvement

It is generally known, at least since this topic receives increasing media attention, that sustainability is a concern that affects each and every one of us. So it is all the more encouraging for PTS to see that the idea of organizing sustainability weeks came from staff and students. The proposal was submitted to the management only after first ideas, actions and contributions had taken shape.
The present article summarizes the major subjects and lessons learned. Various actions were planned for the "PTS Sustainability Weeks 2020" with the aim to raise awareness of the sustainability goals within PTS. The sustainability goals are a reflection of the 17 Sustainable Development Goals (SDG) of the United Nations. The MS Teams software was used to set up an additional channel for the "PTS Sustainability Weeks 2020" in which all staff members and students had the opportunity to share articles, pictures and comments about sustainability. This channel has survived the action programme to remind everyone of the importance of this topic.

PTS Sustainability Tips

Winston Churchill once said: "Personally, I'm always ready to learn, although I do not always like being taught."

With this in mind, 16 sustainability notes were posted in different places within the PTS building, containing tips for a more sustainable living. In addition, all employees and students were given the opportunity to add their own ideas on a blank piece of paper headlined: "Tip 17. What are your tips for a more sustainable living?" This initiative aroused astonishment at first, but then received a lively participation. Very soon, the papers were filled with tips from different spheres. So the waiting time near the automatic coffee maker became quality time in terms of sustainability awareness. Some of the most useful tips were:

1. Buying unpackaged products, associated with recommendations where to find appropriate shops nearby.
2. Drinking tap water instead of buying bottled water.
3. Mending one's clothes instead of discarding them

Very soon, there were so many tip notes

Source: PTS

that a noticeboard had to be put up.

Focus topic

Every day over a period of two weeks the focus was placed on a different SDG topic. Day after day, the diverse group of Microsoft Teams channel members posted both interesting stuff and facts for reflection as well as funny things in relation to the focus topics. One result was the initiative to launch the first PTS Car-Free Day. The ambition for all staff members and students was to make an attempt to give up their cars for one day, specifically on the 30th of September 2020, and to get to work by bicycle, public transport or ride sharing.

The positive response to the 1st PTS Car-Free Day was reflected by the huge number of bicycles in PTS that day.

Cell Phone Collection Initiative

A collection box for old cellular phones was placed near the entry on day one of the "PTS Sustainability Weeks 2020". This recycling initiative was launched by Deutsche Telekom. Almost every single phone can be reused or recycled. Deutsche Telekom guarantees for the correct and sustainable implementation of this process aimed at reintroducing valuable base materials into the economic cycle and safeguarding our natural resources.

The collection box initiative is not over yet. In order to continue drawing the attention to this particular topic, the box is still in place near the reception desk where all employees and students as well as all guests and customers have the opportunity to discard their used devices in order to give them a second life.

How about the future?

We believe that the PTS Sustainability Weeks 2020 have been a success. They made people think and brought about changes. What is important now is to remain proactive also beyond this initiative.

The aim was to enhance the awareness of the sustainable development goals and to give food for thought. There are a lot of projects in existence that are designed, e.g., to provide education and water in poorer regions of the world. But there are also ways for immediate action: So people might wish to think twice before buying whether they actually need a certain product, or before discarding clothes, whether there is someone out there who would be happy to have them, or whether animal products have to end up every day on our plates. We all are responsible for what the world is becoming.

We express our thanks to everyone having taken an (inter)active part in the PTS Sustainability Weeks 2020 and are looking forward to the Sustainability Actions 2021. ■

Lena Pergande,
lena.pergande@ptspaper.de
Richard Fankhänel,
richard.fankhaenel@ptspaper.de

Links for more information:

Official SDG site:
www.sdgs.un.org

17 goals for sustainable development:
www.17ziele.de

"Good deeds for tomorrow":
www.tatenfuermorgen.de

PTS Events Programme 2021: Online & Live

Event	Type	Date	Place
Introduction to compliance work and quality assurance for paper and board in food contact (FCM)	Workshop	02 - 03/02/21	Online
Recyclability of paper & board based packaging	Workshop	03 - 04/02/21	Online
Surface functionalization of paper & board based packaging	Workshop	04 - 05/02/21	Online
Paper manufacture at a glance	Basic course	23 - 24/02/21	Online
Introduction to compliance work and quality assurance for paper and board in contact with food (FCM)	Workshop	02/03/21	Online
★ Paper & Board for Food Contact	Conference	03 - 04/03/21	Online
Introduction to stock preparation & paper manufacture – Practice	Workshop	09 - 11/03/21	Heidenau
Introduction to paper manufacturing	Basic course	16 - 17/03/21	Online
Recycling-friendly design of fibre-based food packagings	Basic course	13 - 15/04/21	Online
Recovered Paper	Conference	18 - 19/05/21	Online
★ PTS Network Day 2021	Network Event	01/06/21	Online / Heidenau
Adhesive labels – Production. Testing. Application	Basic course	08 - 09/06/21	Online
Quality control and assurance by microscopic inspection of paper, fibres & fillers	Basic course	15 - 16/06/21	Dresden / Heidenau
Recyclability of paper & board based packaging	Workshop	22. - 23/06/21	Online
★ 30th PTS Coating Symposium 2021	Symposium	07 - 08/09/21	Dresden / Online
Fibre properties	Basic course	21 - 22/09/21	Dresden / Heidenau
Introduction to compliance work and quality assurance for paper and board in contact with food (FCM)	Workshop	05 - 06/10/21	Dresden / Heidenau
Recyclability of paper & board based packaging	Workshop	06 - 07/10/21	Dresden / Heidenau
Surface functionalization of paper & board based packaging	Workshop	07 - 08/10/21	Dresden / Heidenau
Introduction to papermaking – Module 1: Fibre resources for paper industry, pulping and stock preparation	Basic course	11 - 12/10/21	Dresden / Heidenau
Introduction to papermaking – Module 2: Approach system, paper machine, instrumentation & control	Basic course	12 - 13/10/21	Dresden / Heidenau
Introduction to papermaking – Module 3: Effects and optimal use of chemical additives	Basic course	13 - 14/10/21	Dresden / Heidenau
Introduction to papermaking – Module 4: Coating technology – From dispersion to the finished coating	Basic course	14 - 15/10/21	Dresden / Heidenau
Selection and assessment of recovered paper	Advanced course	02 - 03/11/21	Dresden / Heidenau
Testing of paper, board and packaging	Basic course	08 - 11/11/21	Heidenau
★ PTS Pulp Symposium 2021	Symposium	23 - 24/11/21	Dresden / Radebeul
Introduction to stock preparation and paper manufacture – Practice	Workshop	30.11. - 02.12.21	Heidenau

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.

Contact:
Anne Martin
ptsacademy@ptspaper.de
+49 (0) 3529 551 618

Event highlights in 2021

Register at:
www.ptspaper.com/events



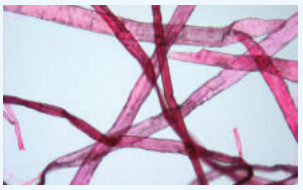
PTS Coating Symposium 2021

Symposium

Hybrid: Dresden & Online **07 - 08/09/21**

The PTS Coating Symposium is the international meeting for experts from industry and research and development to learn and discuss about latest innovations in coating and surface treatment of paper and board materials. Besides a well selected scientific program you will get the chance to broaden your network and enjoy the event.

www.coating-symposium.com



PTS Pulp Symposium 2021

Symposium

Hybrid: Dresden & Online **23 to 24/11/21**

This PTS Symposium aims to bring together pulp, its processing and use in different value chains. This is one of the reasons why the PTS Pulp Symposium is regarded as a meeting place for the industry. Up to 100 participants from research and industry are expected.

www.pulp-symposium.com

Recovered Paper Conference

Conference **Online** **18 to 19/05/2021**

The conference covers information on the two related subject areas:

» Recovered paper as a base material for the paper industry

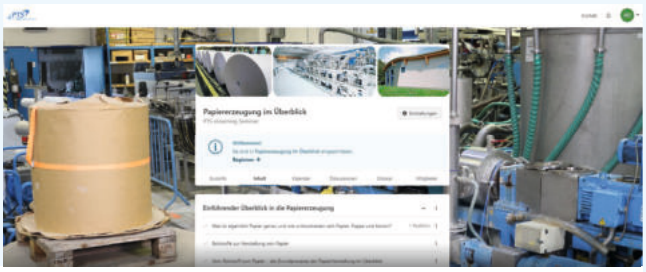
» Recovered paper stock preparation in the paper mill

Recovered paper matters: The subjects of “Paper instead of plastics?”, recyclability and availability or pricing and trading are omnipresent in the media. Furthermore, new large-size facilities for recycled papers are being built in Germany and Europe. The thematic focus is increasingly placed on climate protection by reduced rejects and closed circuits.

In May 2021, Papiertechnische Stiftung (PTS) will hold the Recovered Paper Conference (formerly known as Focus on Recovered Paper) as a European platform around the topic of paper recycling.

Online Workshops

Registration at:
www.ptspaper.com/events



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

Online Workshop | 05 - 06/10/2021

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

Recyclability of paper & board based packaging

Online Workshop | 06 - 07/10/2021

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

Surface functionalization of paper & board based packaging

Online Workshop | 07 - 08/10/2021

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.

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.

Coming soon!

PTS eLearning Platform “Paper manufacture at a glance”

Formats of learning are versatile. Learning platforms and video conferences have meanwhile become an integral part of the educational system, whether in schools or in universities. 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.

The PTS eLearning contents will be available on demand on mobile terminals and will be complemented with web meetings with tutors for answering queries or questions. Further, the system is provided with interfaces enabling companies to embed the contents in their in-house IT environment.

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

Hybrid Event l Online & Penck Hotel Dresden

Date: 07th – 08th September 2021

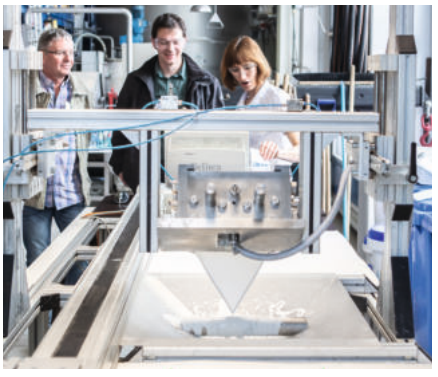
Information & Registration: www.coating-symposium.com

Questions & Information about the 30th PTS Coating Symposium 2021:
ptsacademy@ptspaper.de
Phone: +49 (0) 3529 551 618

Dr. Marcel Haft
Event Manager
Head of Divison
Functional Surfaces
+49 (0) 3529 551 661
marcel.haft@ptspaper.de

Dipl.-Ing.
Ina Greiffenberg
Event Manager
Project Manager
Functional Surfaces
+49 (0) 3529 551 715
ina.greiffenberg@ptspaper.de

Sections	Topics
Resources	Biobased Feedstock, Tailored Properties via Chemical Modification, Behaviour during the Recycling Process, High-Performance Coatings, Regulatory Issues and Solutions, Sustainability from a Holistic Perspective
Processes	Installations and Modifications in Production Equipment, Integration of new Modules in Existing Machines, Multilayer Coating, Drying and Curing Technology, Prescription of Functional Components, Artificial Intelligence in Process Control, Adjustment of Machines from Plastic to Paper
Converting	Sealability, Printability, Gluing, Formability, Limits of Product Design, Flexible Coatings
Products	New Product Launches, All Cellulosic Compounds, Circular Economy and Zero Waste, Smart Packaging, Replacing Conventional Products, Made for Recycling Product Design



Follow-up on the conference on “Biobased Solutions in Papermaking and Converting”

The idea to launch a new technical conference on “Biobased Solutions in Papermaking and Converting” was born in autumn 2019.

So far, this highly topical and exciting subject matter had not been covered by any events or conferences across the entire industry. The conference was designed as an international event to be held in front of the picturesque vineyard slopes of the town of Radebeul.

In spite of the Covid-19 pandemic, we held on to a live event for quite some time before finally opting for an online format in accordance with the pandemic situation. What seemed to be a workaround in the beginning proved to be a success on its own!

During two days, more than 100 persons from around the world listened to the exciting papers and presentations in the areas of *markets and trends, surface functionalization, papermaking and converting.*

The opportunity for an active visitor to attend such a conference without huge travelling expenses is one of the positive outcomes of last year’s situation. PTS will continue to pay special attention to the segment of on-line training also after Corona.

The conference was moderated by Dr. Martin Zahel and Dr. Marcel Haft and started off with a presentation on renewable carbon by Christopher vom Berg (Nova Institute). Ernst-Ulrich Wittmann and Elizabeth Swan (Withers & Rogers LLP) then gave an overview of the patent situation in the field of biobased materials. Finally, the PTS hosts asked the question to what extent 100 % biobased products are possible and they provided answers in their presentation.

The conference block on surface functionalization provided impressive insights into different materials and their suitability as lining materials. Joel Köykkä from CH-Polymers held a lecture on the manifold possible applications of natural polysaccharides, followed by Yannick Vercammen from Solenis who presented biowaxes as a lining material and their benefits for recycling. Berthold Köhler (Gelita AG) showed possible applications of gelatine products in different areas of the papermaking process. The first conference day ended with the keynotes by Jürgen Luchtenberg (Nouryon) regarding the use of carboxymethylated cellulose products as additives, and Natnael Behabtu (DuPont) who showed the manifold application possibilities of biotechnologically produced polysaccharide.

After a programme of a bit more than 5 hours, the online visitors could either

have their well-deserved end of the day or return to their business. Online seminars mean reduced travelling expenses thereby allowing visitors to attend training sessions without leaving their desks for several days and then being faced with a backlog of work when they return.

The second conference day was focused on papermaking and converting. The first speaker was Seema Saini from Kadant Lamort who presented a new technology for making microfibrillated cellulose and emphasized its advantages in recycling.

She was followed by Johannes Kritzinger from Omya International who showed new ways for obtaining pigment dispersions with high mass concentrations. Elisabeth Lackinger (Kemira) provided information about biobased adhesives. After lunch, Jens Buller (Fraunhofer IAP) held a lecture on how to use starch as a wet-end additive by way of structural optimization. Then, Klaus Dölle (ESF New York) provided us with information about the retention behaviour and mechanical strength improvements by tapioca and maize starches.

The converting presentations were mainly focused on gluing. Firstly, Martin Zahel (PTS) referred to the development process for a biobased hot-melt adhesive, then Thomas Walther (Baumer hhs) discussed the sustainability of biobased adhesives.

Last but not least, Ulrich Zang (Isega) held the closing presentation focused on the biodegradability of paper products.

We are still in the phase of emergence of biobased additives with many further exciting developments ahead of us. Therefore, the PTS conference around this topic is intended to be become a periodic event with the aim to inform a broad international public about the latest developments in this field.

Topics that will have to be dealt with by the industry in the future certainly include the impact of new substances onto the machines and processes, the part of biobased materials in recycling, and the holistic sustainability approach for value creation based on products from nature.

We are curious and are looking forward to the next conference two years from now. ■

Dr. Martin Zahel,
martin.zahel@ptspaper.de
Dr. Marcel Haft,
marcel.haft@ptspaper.de

PTS
FIBRE based solutions

Address
Papiertechnische Stiftung
Pirnaer Straße 37
01809 Heidenau
E-Mail: info@ptspaper.de

Information & questions
info@ptspaper.de

Event management
www.ptspaper.com/events
E-Mail: academy@ptspaper.de

/papiertechnische-stiftung-pts-
/papiertechnischestiftung
/ptspaper

Layout: svenja-klau.de

www.ptspaper.com