end chemicals can be achieved with automatic controls based on reliable wet end measurements. This article presents practical means for achieving stable retention and illustrates the value of the control based on paper and board mill experiences.

Experience with ultrasonic drying in the paper making process
G.J. Emory and G. Plavnik • Heat Technologies Inc. • Atlanta / USA
Heat Technologies Inc (“HTI”), is a US company based in Atlanta, GA, manufacturing custom-designed advanced heat and mass transfer technology systems on the basis of ultrasonic energy for a wide spectrum of industrial applications. The primary systems are sold under the Spectra Ultra HE™ brand. The company has earlier presented IMPS membership an introduction to the underlying principles of ultrasonic heat and mass transfer with generic examples of potential results across a portfolio of application fields. Since that time, a number of paper producers have installed systems for the drying of paper during the board manufacturing process as well as moisture control in the board. Other installations are drying of coatings that traditionally restrict press throughput. For IMPS 2020, HTI will focus on these applications.

Participants received a brief overview of ultrasonic energy and gain an understanding of the basic points to review when considering the appropriateness of HTI systems. Participants will be guided on known ideal points of installation for paper makers to achieve line throughput or finished product quality advantages. HTI shared case study data from:
– A recent drying installation for the control of moisture/accelerated drying on the web edges Objective – Remove 1% (approximately 30 kg/hr) of water along the 40cm edge Result – 1.7% (50 kg/hr) to

Cornerstone of paper and board making efficiency: retention and drainage control
T. Rantala, J. Nokelainen, L. Kauppinen, Valmet Automation Oy • Tampere / Finland
M. Fostmannberger • Valmet Automation GmbH • Oberhaching / Germany
How to make a stable, uniform product at the desired quality level and at minimum costs – this is the challenge that paper and board makers around the world are facing every day. How to achieve this using mixed low cost raw materials, including recycled fibers that contain unknown amounts of disturbance materials, and at the same time applying advanced new chemistry systems? The ultimate target is to minimize downtime, off spec production and sheet breaks while running at the highest possible machine speed with fluently managed grade changes. A stable wet end is a crucial piece in this puzzle. Reaching the goal requires continuously well controlled and timed control actions: we need to measure the right things, take the right actions based on those measurements and optimize our targets.
It’s commonly known that retention interacts strongly with web formation and drainage. First pass retention – more precisely, the stability of white water consistency – is a sensitive indicator of process stability. White water consistency variation bears a direct relation to variations in the end product quality (basis weight, moisture, ash) and water circulations, to the efficiency of wet end chemicals, and to the runnability of the web. Stable retention and correct use of wet
Grupo Gondi is a leading paper packaging company in Mexico, strongly committed to its consumers, collaborators, investors, the environment and Mexico – where, over the past 60 years it has positioned itself as one of the major players in the paper and packaging industry. Grupo Gondi is composed of 15 companies and a labor force of more than 7,000 employees. Thanks to the multi-plant approach the offer comprises integral packing and packaging solutions, specializing in the production of paper, corrugated cardboard boxes, pre-printed corrugated boxes and solid fiber containers, folding containers, boxes of micro-corrugated cardboard boxes and labels as well as services that support the manufacture of these products. In addition, Grupo Gondi exports packaging products indirectly to over 159 countries, having presence in the five continents.

In order to optimize the production of coated board a continuous improvement process is established. With intensive testing and preparatory work one of the board machines has been chosen for the installation of a TurboCurtain Coater. The concept and experiences resulting in virgin fiber saving were presented.

Phenomena of hornification and influencing factors
Meltzer • Mercer Pulp Sales GmbH • Berlin / Germany; Fuzy and J. A. Polster • Enzymatic Deinking Technologies B.V. • Norcross / USA

Delignification, achieved through chemical cooking and bleaching, leads to micro and macro pores and primary fibrils on the fiber’s internal and external surfaces, which contribute greatly to the strength of the paper product once formed, pressed and dried. Nevertheless, once the freshly produced never-dried fibers have been initially dried, permanent closure of the pores, collapse of the lumen and reattachment of the fibrils to the fiber surface make it impossible for the pulp to regain its original properties through hydration. This process was first described as “Verhornung”, later renamed as hornification, in the early 40s by the German scientist G. Jayme. Due to the nature of chemical cooking and bleaching, chemical fibers suffer from hornification, leaving the market pulp producers condemned to losing 30% of the strength of the pulp processed through their dryers.

Hornification, not a deeply studied subject in the pulp and papermaking field, is more relevant to pulp producers and their customers than
First thought, due to the growing importance of market pulp versus integrated paper production. During the research performed in collaboration between EDT and Mercer, hornification was proven to cause a reduction in the water holding capability of the fiber and the strength of the fiber network, which impact users of market pulp worldwide. This series of studies are pointed towards measuring the micro- and macro effects of hornification in an effort to mitigate the losses from this cause. While other techniques to reduce the hornification penalty in pulp dryers have been proven unsuccessful or not suitable for full-scale operation, the right enzymatic treatments can be efficient in mitigating these losses and producing a stronger pulp for the pulp and paper producers: introducing EDT’s patented technology pRefinase®. The potential of the enzymatic blend pRefinase has been confirmed through both laboratory- and full-scale experiments, resulting in faster drainage, stronger pulp, enhanced refiability, and reduced hornification as benefits to the pulp producer and the paper manufacturer. During this presentation, the physical and morphological advantages of treating European NBSK from Mercer Stendal and Rosenthal sites were presented for both unrefined and refined samples. An in-depth study of the effects of hornification in paper production and its relation to the drying intensity were also presented.

Improved efficiency via internal recirculation in refiners

P. Ziegler • J.M. Voith SE & Co. KG | DSG • Ravensburg / Germany

Voith has many years of experience in the market with our product Pluralis for double disc refiners. The Pluralis refiner fillings are successfully used by numerous customers worldwide in a vast variety of applications in order to achieve the required strength properties at low energy requirements. Since hundreds of installations of Pluralis fillings have already proven their advantages, customers have requested Pluralis technology for their conical refiners. We have developed the new product, Pluralis Conical in our R&D department. The proven Pluralis design was transferred to the conical shape and an additional function was integrated into the product by incorporating backflow channels. The backflow channels allow internal recirculation in the existing refiner and therefore offer higher flexibility in the operation of the machine. Furthermore by using the innovative backflow channels, a higher cutting length on the bar side of the fillings is possible which supports in refining more efficiently. Pluralis Conical has been extensively tested in installations in Europe and Asia. The products have already been running successfully for several months with very positive customer feedback. According to our customers, the innovative design of our Pluralis Conical saves up to 35% energy in their existing applications. In some cases savings in capital equipment can be achieved. These savings are accomplished maintaining high fiber quality and good fibrillation of the fibers.

Online condition monitoring with wireless vibration sensors + AI

M. Pieper • Kammerer Papier GmbH • Osnabrück / Germany; T. Ungan • endiio Engineering GmbH • Freiburg / Germany; F. Sawo • Knowtion UG • Karlsruhe / Germany

In the “Retrofit4Paper” project, a retrofittable IoT sensor platform with extremely low power consumption in combination with embedded AI algorithms for predictive maintenance was implemented using the example of rolling bearings in paper production at ambient temperatures up to 115 °C. The aim of the project was to automate the maintenance process and enable predictive maintenance. For this purpose, wireless sensor units were retrofitted to the roller bearing housings, which draw their energy from the machine heat and, if necessary, send sensor data to a central computer. The combination of a retrofittable, energy self-sufficient sen-
Sor platform and artificial intelligence (AI) made it possible to design production processes in paper production intelligently, efficiently and reliably. In the project it could be shown that the AI algorithm in the Retrofit Box reduced high-frequency sensor data (acceleration, vibration, gyroscope and magnetic field) to a few, particularly relevant features, thereby minimizing the energy consumption for wireless transmission. At the same time, it was shown that enough information could be collected and wirelessly transmitted to a gateway in order to be able to recognize changes in the condition of the bearings using a higher-level algorithm in the gateway. The measurement results were also collected and visualized in a web portal.

In the future, this form of bearing monitoring should make it possible to monitor approximately 600 bearing positions of all guide and functional rollers as well as the drying cylinders of a complete paper machine without having to equip them with wired sensors. Cable connections are often an additional source of error, especially since the installation costs are not negligible.

An automated evaluation of the accumulated data is essential for success. Both the sudden and the long-term change in measured values must lead to targeted information about the affected bearing point, so that a targeted change of the affected roller can be carried out without an unplanned failure of the entire machine.

With the continuous data analysis of the sensor information and trend changes, it is, for the first time, possible to recognize the condition of rolling bearings that are difficult or impossible to access over a longer period of time. For Kämmerer this results in savings in the areas of avoided breakdowns of the paper machines as well as utilization of the service life of the bearing units and better planning of maintenance activities.

Digital Twin in the Fiber Industry – Experience from the first implementation in a Cross Laminated Timber line
E. Schrapp • Siemens AB • Stockholm / Sweden

The Digital Twin concept sits at the center of digitalization, linking all models and data related to products, their production and their operational performance, and providing in real time all needed information to designers, engineers, operators and service technicians across the entire industrial lifecycle.
Unlike as in other manufacturing industries is the implementation of a Digital Twin in the Fiber Industry some rarely rare species, especially a real Digital Twin implementation, as this is by far more than “only” the generation of a Virtual Twin of the production line for training reasons.

Which is certainly for many years also in the Paper Industry already state of the art and you can find this kind of Virtual Twin simulation with Siemens SIMIT tool around the world in many Pulp and Paper mills.

Real Digital Twins are outside of the Fiber Industry already widely used, specifically mentioned in this respect the automotive industry, with the most extensive Digital Twin concepts over the entire value chain: from design, developing and virtually testing the new car model instead of a real prototype, material flow, so as the entire manufacturing line, which already “producing” the virtual car far ahead of the ground breaking ceremony of the real car factory, up to the ultimate goal: implementation of simulation algorithms to be computed in real time so that they can run in parallel to the manufacturing process, providing the user at any time with enhanced decision support on optimal usage by means of augmented reality and virtual sensing.

With the longtime experience of Digital Twins Siemens and our customer, a leading global provider of renewable solutions in packaging, biomaterials, wooden constructions, we decided to pilot the Digital Twin implementation in a Cross Laminated Timber (CLT) production line via our Plant Simulation Software with the target to:

– Create a digital model of the CLT production line and simulate different production batches with the target to understand how a digital twin can help to optimize production efficiency
– To run Bottleneck analysis and What-if scenario
– Simulating in fast motion (annual production in seconds) changes of production parameters and their input of the main KPIs
– Visualization of KPIs and production parameters in real time

This presentation helped to understand better the definition and quantification from Virtual/Digital Twin implementations, will show references from Digital Twins, specifically of course the first pilot implementation of a real Digital Twin in the Fiber Industry: in a CLT production line.

Better performance with a new ceramic press roll coating

A. Miletzky • W. Hamburger AG • Pitten / Austria; H. Jungklaus • Voith Paper Rolls GmbH & Co. KG • Laakirchen / Austria

In conventional press concepts the center press roll, not matter if solid bulk or deflection controlled, is still called the “heart” of the paper machine. On that “heart” the paper sheet touches a roll surface for the first time in the machine and will be mechanically dewatered by the nip load of one or more counter rolls. After this pressing the sheet should be able to be pulled off from the roll surface easily, means without stretching it too much. Here, the material and quality of the roll coating are most important, these should remain constant as long as possible over the production period.

Hamburger Containerboard produces at Pitten, Lower Austria, on their PM3 and PM4 a large spectrum of uncoated test liner, top layer, box board and platter paper. In total about 450,000 t with a grammage of 120 – 200 g/mm² leave that site per year.

Especially the high number of varying product types, and thus, the adjustment to be refitted numerous times in a short period, in combination with varying influences from the raw material and helping additives, make the production process sensitive, also in the press.

At the shoe press roll of PM4 it was noticed that the ceramic cover, which worked fine formerly, got rougher much sooner with the increasing variety of paper types, resulting in a worse sheet release. Additionally, in case of a break, the paper did not run into the couch pit, but, depending on the grade, “Jumped” off the roll surface in direction dryer section, which also caused further problems.

Voith Paper’s solution as a combination of the new roll cover TerraSpeed together with the coated doctor blades SkyTerraS, which contains an adjusted bevel, resulted in an intensive stabilizing of the production process and, thus, a significant improvement of the overall performance over a longer time period. Details on this improvement were discussed in the presentation.
Employing ultrasound for optimized sludge dewatering
A. Nath • Südwasser GmbH • Erlangen / Germany; B. Scheuringer • VTA Deutschland GmbH • Passau / Germany

Sewage sludge disposal is expensive: In Bavaria, for example, thermal recycling already incurs costs of well over 120 euros per ton (in Germany particularly up to 200 euros), and the trend is continuing to increase. It is therefore important to dewater sludge as effectively as possible: In addition to more stable plant operation, there are more economic reasons for this than ever.

This is exactly where the VTA mudinator® comes in, another innovation from the VTA Group. Like the patented VTA GSD, this technology also works with ultrasonic, but with one crucial difference: Less energy is used so there is no disintegration in the sludge. The floc structure is changed in such a way that the charge can be balanced better with the polymers used. All of this results in stable flocs, a clear & clean centrate and increased dewatering capacity at customer site.

The VTA mudinator® is particularly powerful when combined with the new VTA Biocitran®, a “turbo” for ultrasonic treatment. The product, inspired by the citrate cycle, ensures a stable and increased cleaning performance, is biologically fully compatible and guarantees safe and rapid phosphate precipitation. VTA Biocitran® based on citric acid leads to a reduction of the back-charge in the centrate / filtrate and an increased flake stability.

The result: The dry residue in the discharge is increased by up to 5 percentage points, the backcharge on the system is reduced. The polymer consumption can be reduced by up to 30%. Last but not least, the new technology also saves costs for the transportation of the sludge for recycling or disposal, because much less water is “driven through the area”.

Moisture measurement of waste paper at full truck-loads
K. Mitterböck • KMC GmbH • Ferschnitz / Austria

The control of the delivered raw materials regarding the agreed quantity and quality is a matter of course for every paper mill. Due to the large quantities of the delivered goods, it is quite sufficient to limit itself to sample measurements for industrially produced raw materials such as chemicals.

The control of the recovered paper deliveries, which is the biggest cost factor in the value chain, is, despite all efforts, a very difficult undertaking, since the composition and quality of the paper bales – especially for mixed paper grades – cannot always be ensured.

Although a lot of efforts are already in place to classify the different grades of recovered paper, in practice this “homogeneity” of deliveries cannot be ensured in many types of recovered paper, both in terms of quality conformity and in terms of the moisture content.

Up to now, it was only possible to determine a representative moisture content of the recovered paper from entire truck loads with very high time and personnel costs. The known measuring systems determine the moisture content either by placing the measuring system on the surface of the paper bales or by drilling holes into the bales and taking samples out of the paper bales. However, all these methods are limited in statistical representation in relation to the total load of a truck.

A new microwave-based measuring system is able to measure a large part of the total paper load in less than 40 seconds in terms of its average moisture content, stressing that the moisture content is determined over the entire cross-section of the paper load.

Other features of this system are that it works non-destructively, is very easy to use, does not contain moving parts and the results are recorded automatically. The plastic tarpaulin of the truck does not need to be removed for measurement.

Depending on the degree of automation, the results of the moisture measurement can be introduced into the factory IT system and the corresponding statistics and billings can be compiled there.

Due to the very fast measurement, it is therefore possible to check the moisture content of all incoming trucks with waste paper loads without interfering the logistics process in the factory, whereby for exact measurement results the loading of the trucks with the paper bales according to certain criteria must be met.

The results available to date show that in addition to a delivery-based payment of the delivered fibers, the quality of the delivered paper is also generally increasing.

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