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### **HSE improvement and machine condition monitoring by wireless noise surveillance system**

Shinichi Saito

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The Wireless Noise Surveillance System is a new digital Health Safety Environment (HSE) system consisting of a WN 100 radio noise meter and WN 30 noise map software, which provides the first real-time noise monitoring system for noisy and harsh environments.

The main purpose of this system is to prevent the hearing impairment of workers in the plant and to optimize the working hours limited by the noise level. Recently, however, the system has been applied to the improvement of HSE in the local community by monitoring the amount of noise propagating from the plant to the neighboring residential area, and to the condition monitoring to detect the failure by measuring the sound.

### **Improving operations by optimizing chemicals!**

#### **A practical chemical approach to solving problems in wastewater treatment process**

Seiji Hirotsune

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The pulp and paper industry is a water-based industry that requires an extremely large amount of water compared to other industries. Wastewater in the paper manufacturing process includes discharges from the steaming and bleaching processes, the paper making process, the deinking process, and the washing process. Although progress has been made in saving water and reducing water use by reusing and closing off water for each process compared to the past, large-scale wastewater treatment facilities are necessary to treat the large amount of wastewater from various processes.

In the wastewater treatment process, pollutants are treated with a combination of organic decomposition by biological treatment, coagulation sedimentation, and pressurized flotation. The industry is struggling to deal with these problems, but wastewater treatment facilities are not directly related to production, so it is difficult to make capital investment in them.

In this report, we are going to focus on the foam and odor problems from among problems in the wastewater treatment process. First, we explain the basic concept of foam control, the mechanism of odor generation and its adverse effects, then describe how our company deals with each problem.

## **Know your pulp, control your process**

Ryo Yamashita

Pulp & Paper Group, Process Automation Business, ABB K.K.

All papermakers know that variation in raw materials significantly affects process stability and product quality. To overcome this, we need to seek a way of adapting our processes to the naturally variable incoming fibers to both stabilize quality and reduce costs. Many paper companies dedicated to reuse raw materials for sustainability and recycling in recent years. However, to ensure output of the highest quality, the paper company must face the challenge of working with a wide variation in the properties of incoming fibers.

In this paper, I would like to share functions and features of the L&W Fiber Tester Plus, which is a fiber analyzer for the laboratory. Especially herein, I introduce the following three options in detail. Impurities: Kink, vessel cells, minishives, flocs and dirt are analyzed via special software, which has recommended settings for vessel cells and shives. Blend: Analyze the ratio of reference fiber species in a fiber mix in a software option. Crill: Determine crill quota in a separate measuring cell, by a method based on how particle diameter interferes with different parts of the light spectra. This product has been delivered more than 20 customers in Japan. This product is used not only for fiber analysis but also for CNF research today.

And, I continue to explain features and benefits of L&W Freeness Online, L&W Fiber Online, and our new solution, L&W Freeness and Fiber Online which can combine the online measurements of freeness and fiber properties. I also introduce ABB's pulp sampler, which has high reliability and durability. Customers give these product high marks for the automation and stabilization of freeness measurement.

Reliable system of offline and online pulp analyzing helps to monitor and control properties and qualities, and to create the best possible continuous and uniform process throughout from pulp furnish and to paper product. Offline and online pulp measurements have their own unique benefits. We attain a new level of process stability, reducing production costs through lower energy consumption by eliminating over refining. Finally, I would like to introduce the Wet End Control of ABB Ability™ APC. You can optimize raw material by analyzing data through APC process control.

## **ACA Permi Online Air Premeability Analyzer and RoQ Roll Hardness Profiler**

Takuya Sasaki

SHIN-NIHON CORPORATION

The RoQ roll hardness tester is a next-generation roll hardness tester that replaces the Schmidt hammer, which allows anyone to easily measure the roll hardness in the width direction with a minimum pitch of 1 mm. Since it can be profiled in the width direction, it is possible to detect wrinkles inside.

Permi Online Porosity Analyzer is an epoch-making system that can measure air permeability online in real time. Quality control methods and process reductions that were not possible with conventional offline sampling inspections will be realized.

Since the shear rate and viscosity are not correlated, it is necessary to measure the viscosity at the shear rate of the coating color (750,000 1 / s or more) at the actual coater part. The ultra-high share viscometer Ax-100 is a viscometer that can measure viscosity at a maximum shear rate of 1,000,000 1 / s, which was not possible with conventional rotary viscometers. As a new function, extensional viscosity can also be measured.

The FLOW WR Water retention tester (compliant with TAPPI T-701) has been newly developed as an analyzer to replace the existing water retention meter. It can be used in combination with the ultra-high share viscometer AX-100 for research and development of coating colors, and it is also possible to inspect and optimize the water retention of coating colors and prevent dehydrated cakes in dry parts.

## **Numerical simulation in compressive strength analysis of corrugated box**

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Corrugated fiberboard boxes are often stacked and used for transportation and storage, and a considerable load is applied to the bottom box. If the box cannot withstand this load, not only will the box collapse, but there is also the risk of package stack crumbling on the pallet. Therefore, the box compressive strength measured by the box compression test is one of the important qualities as an index of the box's resistance to crushing. If this box compressive strength can be predicted in advance by simulation, it will eliminate the repetition of experiments and trial production, and will lead to shortening the development period of new products. In this report, we will introduce an example of performing box compression analysis on corrugated box by numerical simulation using nonlinear finite element analysis.

First, we developed an analysis method. The corrugated board is a three-dimensional structure consisting of two linerboards and a corrugating medium, but the box was modeled using shell elements, assuming that it can be approximated by a single plate. The top panel of the box was compressed by applying a compressive displacement, and the maximum load of the load-displacement curve obtained at this time was calculated as the box compressive strength. As a result of the analysis, it was possible to reproduce the difference in buckling mode and the order of strength depending on the presence or absence of a hand hole. Next, we examined a corrugated box with a regular polygonal cross section, and showed that increasing the number of angles could approach the buckling mode of a cylinder and increase its strength. Finally, a compression analysis of the corrugated boxes stacked on the pallet was carried out, and it was possible to show that it is possible to prevent the package stack crumbling depending on the stacking pattern.

## **Analysis of the bled compounds on paper surface by XPS and TOF-SIMS**

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The phenomenon that low molecular weight components come out to the plastic surface is called "bleeding". Resin components of pulp may bleed to the paper surface and it is important to do research on the bled phenomenon to analyze the surface changes on the paper. X-ray Photoelectron Spectroscopy (XPS) and Time-of-Flight Secondary Ion Mass Spectrometer (TOF-SIMS) are surface analyzers which can analyze the depth region of several nanometers of the substance. Therefore, these are essential for research and development and quality control in various industrial and scientific research fields. The bleeding phenomenon is also known in paper fields, and we studied on the bleeding phenomenon that occurs on the liner board surface and the effect to the decrease in the friction coefficient of the liner board. We verified the correlation between the bled components and the friction coefficient.

XPS with the Argon Gas Cluster Ion Beam (Ar-GCIB) was established as a method for detailed analysis of organic materials. It is widely recognized that the milder etching of a sample surface can be achieved by Ar-GCIB sputtering, comparing to the conventional Ar<sup>+</sup> sputter etching. It is because of its low energy per atom and lateral sputtering effect. By using the Ar-GCIB sputtering, we have developed a method to analyze the surface modification of polymer materials.

## **Report on the Results of the Fiscal 2021 Follow-up Survey on” JPA’s Carbon Neutrality Action Plan” and Related Information on Measures against Global Warming in the Japanese Paper Industry**

Yasuharu Sakina  
Japan Paper Association

The Japan Paper Association (JPA) established its “Voluntary Action Plan on Environment” in 1997, in response to The Japan Business Federation’s call to the Japanese business community to organize “The Voluntary Action Plan on Environment”. Since then, JPA has carried out a follow-up survey and published the results every year.

As the Voluntary Action Plan finished in fiscal 2012, JPA newly started “the Action Plan towards a Low Carbon Society” which is renamed “Carbon Neutrality Action Plan” this year and has been actively addressing global warming prevention in order to achieve the following targets set in the plan:

- Compared to BAU scenario(based on specific CO<sub>2</sub> emission rate of 2005), reduce fossil energy-derived CO<sub>2</sub> emissions by 1.39 million tons by fiscal 2020 .
- In view of securing forest resources and increasing forest carbon sink, expand forest plantation areas owned or managed by the paper industry at home and abroad to 700 thousand hectares by fiscal 2020.

According to the results of the fiscal 2021 follow-up survey (actual results for fiscal 2020), fossil-energy derived CO<sub>2</sub> emissions in fiscal 2020 was 15.59 million tons, a 5.9% reduction compared to the fiscal 2019(16.57 million tons). Compared to BAU scenario, fossil energy-derived CO<sub>2</sub> emissions were reduced by 3.13 million tons, achieving the target of 1.39 million tons reduction by fiscal 2020.

This is attributed to each manufacturer’s active efforts including energy saving and energy conversion from fossil energy to non-fossil energy such as biomass energy.

In addition to the results of the follow-up survey, this report introduces the current energy situation in the Japanese paper industry, outline of “Countermeasures against Global Warming aiming at Net Zero GHG emission from the Paper Industry– Long-Term Vision 2050’ ”and the latest information of countermeasures against global warming.

### **The summary of the history of Japanese paper industry**

Kiyoaki Iida

Japan, triggered by the Meiji Restoration, accepted the social and industrial structures of the Western countries, and changed itself toward them. The paper industry came up to supply paper for printing which made information exchangeable and paperboard which supported distribution of goods. Since then, for the period of 150 years, the industry has contributed to Japan’s economic growth as one of the industrial members.

The paper industry took off at about 1905, and kept increasing its output at the yearly rate of more than 10%. Along the way, it extended its territory to Hokkaido and then to Sakhalin, and developed its own business model.

After crushed at World War II, the Japanese economy recovered extraordinarily. It, however, slowed down in 1970-1975. The paper industry filed to a list of negative industries, as it had such problems as environmental pollution, raw material shortage, menace from import and highly energy consuming. With technological break-through and intensive recycling of products which were bio-degradable in their nature, it was regarded one of sustainable industries.

As the volume of digital information increased exponentially since 1995, the demand for printing paper is declining for the first time in its history.

## **Properties of Mitsumata Paper Produced by Pressurized Cooking Process**

Naoichi Muto

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The bast fibre of Mitsumata (*Edgeworthia papyrifera* Sieb. et Zucc) has long been used as a paper material in Japan, and the paper made of Mitsumata has characteristic egg yolk colour and unique texture. To obtain the fibre material, the bark of Mitsumata is cooked in the aqueous alkaline solution, and pressurized cooking process is generally employed for mass pulping production. Parenchyma cell is a non-fibrous cell contained in Mitsumata pulp, and it is known to have considerable effects on the optical and physical properties of paper.

In this paper, the effect of the alkaline cooking reagent on the properties of Mitsumata handsheet was studied. The bark was cooked with the aqueous sodium hydroxide solution in a pressure cooking device. Sodium hydroxide solution makes the bark swell, and dissolves the substance such as pectine. Sodium hydroxide solution also neutralizes the acidic substance which would be eluted from the bark and would cause the degradation of fibre. Handsheets made of Mitsumata were observed by optical microscope and scanning electron microscope. It was found that the colour of the handsheet depends on the coloured components within the parenchyma cells rather than the parenchyma cells itself. As the addition rate of sodium hydroxide increased, the fibre strength given by wet zero span tensile strength increased, and the fibre bonding strength given by dry and wet short span tensile strength decreased. Mitsumata pulp was fractionated into fibres and parenchyma cells by passing the pulp through the mesh sieve, and properties of the handsheet made of the fractionated fibers and Py-GC/MS analysis were examined.