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Household and CNF

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Development Status of Cellulose Nanofibers (cellenpia®)

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In recent years, increased awareness of the global environment has led to calls for the realization of a low-carbon, sustainable, recycling society. Nippon paper industries (NPI) have been studying cellulose nanofibers (CNFs) as a new way to utilize pulp. CNFs are generally produced in the form of aqueous dispersion at low concentrations, and it would lead to some issues. On the other hands, in the process of heat drying, CNFs strongly agglomerate. As a result, characteristics of the CNFs are significantly reduced when re-dispersed in water. In this paper, we report that the keys to make dried CNFs which can be easily re-dispersed in water are to add anionic dispersing agents and to use short-length CNFs.

NPI produce carboxymethylated CNFs powders and TEMPO-oxidized CNFs powders by combination of various techniques, including methods mentioned above. Currently, we use carboxymethylated CNFs for foods and cosmetics applications, TEMPO-oxidized CNFs for industrial applications. The new technology we have developed to manufacture CNFs powders expand CNFs applications and accelerate commercialization.

Characteristics and Applications of Phosphorylated Cellulose Nanofibers

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Recently, woody biomass is expected to be used in multiple ways as a carbon-neutral and renewable resource. Among them, cellulose nanofibers (CNFs) are attracting attention as a new nanomaterial derived from cellulose, one of the major components of trees. We have established a unique CNFs production method by introducing phosphate groups to the hydroxyl groups in wood pulp and mechanically processing the resulting phosphorylated pulp. The obtained phosphorylated CNFs were completely nanofibrillated (about 3 nm in width) with high yield, and their aqueous dispersion was highly transparent, viscous, and stable at pH 3-11. The aqueous dispersion of phosphorylated CNFs can be dehydrated and dried to form transparent CNFs sheet with densely-packed CNFs. This sheet has high transparency, strength, and thermal dimensional stability, and at the same time, it has paper-like flexibility. To promote the practical use of this technology, we have currently been developing the new composite of CNFs and polymer materials. Natural rubber, polycarbonate, and polypropylene have been successfully composited with CNFs. These composites showed the specific mechanical and thermal properties and have the potential to replace commercialized products. We will continue to develop the use of cellulosic materials in composites while taking advantage of the features of phosphorylated CNFs.

RCNF and Mineral Wool Composite Sheets

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The cellulose nanofiber "RCNF" developed by Rengo is obtained from wood pulp and has various characteristics, such as viscosity characteristics, heat resistance, and reinforcing effects. This paper introduces the application example of RCNF, specifically the "RCNF and mineral wool composite sheets" developed by Rengo and Marusan Paper.

The mineral wool sheets manufactured by Marusan Paper are lightweight and possess excellent heat and flame resistance, and are used in a variety of applications where high temperatures are anticipated. However, mineral wool sheets are not suitable for applications that require strength. Therefore, we have explored the possibility of enhancing the strength of mineral wool sheet by adding "RCNF". Since the strength of the sheet varies greatly depending on the type of binder, we attempted to select the optimal binder for use in combination with RCNF. As a result, the tensile strength of the sheet was significantly improved compared to the sheet without RCNF. Additionally, due to the small amount of RCNF added, the sheet primarily consists of mineral wool, resulting in high flame resistance. This lightweight, strong, and flame-resistant sheet is expected to be utilized as building materials. The use of this sheet instead of traditional heavy building materials such as gypsum board is predicted to reduce the burden on the construction work and improve safety.

Furthermore, the addition of RCNF significantly enhanced the sound insulation properties of the sheet, particularly for relatively low-frequency (250-500 Hz) sounds. It is thought that the rigid nanofibers contained in the porous sheet efficiently reflect sound, improving sound insulation. Traditional materials known for their high sound insulation properties, such as metal or rubber, tend to be heavy. However, this sheet is lightweight, yet has high sound insulation properties. Therefore, it is anticipated that this sheet will contribute to reducing the weight of soundproofing materials used in applications such as automobiles.

Results and potential of amphiphilic nanocellulose for solder paste, an electronic packaging component

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The study started with a prototype study using SAC-based solder and confirmed the various effects of CNF addition. However, it was difficult to visualise CNFs alone because they are nano-sized and extremely compatible with Ag in SAC-based solder. CNFs are expected to be widely used in the future by adding CNFs to Sn-Bi solder, which has a low melting point and low cost and is attracting attention as a means of promoting a decarbonised society.

In this paper, the presence of CNFs in Sn-Bi solder has been clarified and a mechanism of strength enhancement has been demonstrated: in Sn-Bi solder, CNFs act as a wedge connecting the Sn and Bi crystals and contribute to strength enhancement.

The Development of manufacturing process for high contents ＣＮＦ Composite Pellets in Pilot scale

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Cellulose nanofiber (CNF) is a naturally derived fiber extracted from woody biomass, and is a material that can contribute to the realization of a low-carbon society.

We developed a manufacturing process for CNF reinforced plastics with the aim of reducing manufacturing costs, which is one of the challenges in social implementation of CNF.

As a result, we developed a mass production technology for carbamate cellulose, found the optimal processing conditions, and established a manufacturing technology for highly productive CNF reinforced plastics with a twin-screw extruder. (CNF contents 67%, 250 kg/h byφ48 mm equipment) We have developed a process technology that can consistently produce CNF reinforced plastics.

Optix AI Driven Autonomous Control –tissue

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A new approach to modernising papermaking operations is available by using artificial intelligence (AI) and predictive analytics to provide real-time measurements and feedback to optimise production quality and efficiency. Unlike traditional papermaking operations that rely on laboratory tests conducted over time OR periodically, this approach uses machine learning algorithms that provide instant feedback on key process indicators. Instantaneous feedback allows operators to make informed control decisions and appropriate and timely adjustments to improve efficiency and reduce off-quality production.

This paper discusses how AI can be used in papermaking operations, how it can be used to inform control decisions, and what its potential benefits are. Specifically, the team will discuss how AI enables predictive analytics by providing real-time understanding of indicators such as speed changes, kappa swings, and chemistry changes. The authors also explore the potential use of AI for utilising existing data from laboratory tests to further refine predictive accuracy. Finally, the team presents an example case study from a large Tissue mill that implemented this approach and discuss their results, including efficiency gains and quality optimisation.

AI and predictive analytics can bring greater efficiency to paper machines. By using wet tensile tests, it is possible to adjust wet strength chemistry for optimisation and to adjust strength targets for better control. Moreover, strength, smoothness and basis weight measurements, in tandem with caliper measurements, enable efficient basis weight optimisation.

Overall, this paper provides a comprehensive overview of how AI can be applied for predictive analytics in papermaking operations and discusses its potential benefits for improving machine efficiency and optimising quality control. It is intended for those who are interested in understanding the impact of advanced technologies on modernising papermaking.

Introducing the development of KAWANOE`s pilot facility, which evolves "together with our customers"

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Kawanoe Zoki Co.,Ltd. has a wide range of products, from papermaking machines to converting machines, and has delivered a large number of production equipment for the manufacture of toilet paper, tissue paper, and towel paper. In recent years, the toilet paper marker has been on the rise in long products, and we have delivered the TR-8 toilet winder and CLC-200 log cutter as suitable equipment, and in the towel paper market, we have delivered the IF-200 interfolder and random cutter due to the increase in soft pack products.

As a product market that cannot be handled by existing equipment is forming, in order to quickly respond to customer requests as an equipment manufacturer, we have begun an initiative to install various pilot equipment at our technical center in 2020, conduct tests with customers and develop products together.

Each pilot equipment is designed based on actual production equipment, but the sheet width is 500 mm for easy handling, and it is compact and has the potential to be easily expanded so that functions can be easily added.

For customers to create new product samples and conduct basic testing in-house, there are various conditions to meet, such as adjusting production plans, considering modifications, and purchasing new test equipment, making it difficult to simply turn an idea into a sample.

In this context, we would like to raise awareness of our pilot equipment, which can quickly respond to various sample production needs, and to find opportunities to use it, so we would like to explain our pilot equipment and introduce our current efforts.

Introducing stock preparation system for tissue according to raw material

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In this article, we will introduce our recommended three stock preparation systems for tissue depending on the kinds of raw material and quantity of contaminants such as plastic, sticky, metal pieces. Also, we will introduce latest systems called detrashing system, protector system and screen system with fiber recovery basket(FRB). Detrashing system consists of IntensaPulper, IntensaMaxx and ScreenDrum. It enables to get not only defibering effect but also screening effect and contaminants' detrashing effect during continuous operation. Protector system including 2 stages HC cleaner with continuous reject as 1st stage and batch reject as 2nd stage enables higher cleaning efficiency. In stock preparation system for tissue, there are washing, dewatering and flotation machines in main line. Water and sludge coming from these machines include reusable short fibers like white water. By using screen with FRB in relatively small flow ratio, short fiber can be recovered and it can help to save fiber loss.

-Cleaner and Greener Future-
Pitch Solutions! A Sustainable Chemical Approach to Improving Productivity, Quality and Working Environment in Household Paper Mills

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In recent years, paper production has been declining due to the progress of information digitization and the establishment of telecommuting and web conferencing due to the new coronavirus, but demand for household paper has remained strong due to increased demand for towel paper and other hygiene paper as people become more hygiene-conscious due to the coronavirus. However, the weak yen and increased exports to foreign countries have made it difficult to procure high-quality recovered paper, and there are concerns about a decline in the quality of recovered paper materials.

In addition, the increased use of plantation trees such as Acacia has increased the amount of resin pitch in the raw materials, which has led to an increase in pitch problems. The pitch problem has become one of the most troublesome issues for papermaking engineers who aim for stable operation and quality improvement.

In this paper, we describe our proposed NISSIN-Pitch Control Method (NISSIN-PCM) for improving productivity, quality, and the work environment at a household paper mill.

Operating experience of №1 and №2 Tissue Machines

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Crecia Kasuga Industries is a joint Venture between Nippon Paper Crecia and Kasuga Paper Industries, and manufactures toilet paper for the parent companies. We are located in scenic Fuji City, which is rich in blessings of Mt. Fuji`s underground water and Suruga Bay. We are renting a building at the Nippon Paper Fuji Mill which used to have a paper machine. We removed the existing equipment and built a new tissue machine in its place. We opened Shinfuji Mill in 2018. The reason for expanding into the Nippon Paper Fuji Mill was because of favorable conditions, such as the location near the metropolitan area, solid building, cheap utilities, and human resources ready to work immediately.

This Report is about the operating experience of No.1 and No.2 Tissue Machines, which started operation in 2018 and 2020, respectively.

Comparison of pulp properties and bleachability between *Acacia crassicarpa* and *Eucalyptus grandis* × *pellita* hybrid kraft pulps

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In Indonesian pulp and paper manufacturing, *Acacia* and *Eucalyptus* spp., particularly *A. crassicarpa* and *E. grandis* × *pellita* hybrid woods are used as materials. This study compares fiber characteristics, pulp properties, and bleachability of the two species. The possible advantages of fractionation and laccase treatment for the acacia and eucalyptus kraft pulps were investigated. The fiber morphology of acacia pulp showed that longer fiber length, thinner cell wall thickness, lower kink, higher fines and smaller fiber population, resulting higher sheet strength properties than that of eucalyptus pulp. Comparing between the fractions, the short-fiber fraction contained more fibrillated fibers and the sheet strength increased. The total chlorine dioxide consumption in ECF bleaching was 23.3 kg/adt for acacia pulp. That of eucalyptus pulp was 15.5 kg/adt, and the bleachability was better than that of acacia. The difference in bleachability is thought to be due to the differences in the pulp brightness and the structure of residual lignin. Laccase treatment of pulp prior to ECF bleaching reduced the total chlorine dioxide consumption, especially in the medium and short fiber fractions.