



TJ SUMMARIES

The papers summarized here are from the *TAPPI Journal* September 2018 issue, featuring special peer-reviewed content from PaperCon 2018; and the October 2018 issue. *TAPPI Journal* is an online publication of relevant and timely peer-reviewed research delivered via email and free to all TAPPI members. To receive *TAPPI Journal*, join TAPPI at www.tappi.org.

SEPTEMBER

MICROFIBRILLATED CELLULOSE

Mineral/microfibrillated cellulose composite materials: High performance products, applications, and product forms

David Skuse, Mark Windebank, Tafadzwa Motsi, and Guillaume Tellier



High solids mineral/MFC composite products prepared at full production scale.

When pulp and minerals are co-processed in aqueous suspension, the mineral acts as a grinding aid, facilitating the cost-effective production of fibrils. Furthermore, this processing allows the use of robust industrial milling equipment.

About 40,000 dry metric tons of mineral/microfibrillated (MFC) cellulose composite production capacity is in operation across three continents. These mineral/MFC products have been cleared by the FDA for use as a dry and wet strength agent in coated and uncoated food contact paper and paperboard applications. Here, the researchers: (1) report the development of new products that offer improved performance; (2) compare the performance of these new materials with that of a range of other nanocellulosic material types; (3) illustrate the performance of these new materials in reinforcement (paper and board) and viscosification applications; and (4) discuss product form requirements for different applications.

The benefits of using mineral/MFC composite materials can include cost savings by filler increase, optical and print quality improvements, coating holdout improvements, improvements in many mechanical properties, and improved wet strength and runnability. In addition, these materials offer opportunities for grade development.

PAPER TESTING

Dielectric spectroscopic studies of biological material evolution and application to paper

Mary Kombolias, Jan Obrzut, Karl Montgomery, Michael T. Postek, Dianne L. Poster, and Yaw S. Obeng

Current product composition and quality test methods for the paper and pulp industry are mainly based on manual ex-situ wet-bench

chemistry techniques. For example, the standard method for determining the furnish of paper, TAPPI T 401 “Fiber analysis of paper and paperboard,” relies on the experience and visual acuity of a specially trained analyst to determine the individual plant species present and to quantify the amount of each constituent fiber type in a sheet of paper. Thus, there is a need for a fast, nondestructive analytical technique that leverages intrinsic attributes of the analytes.

In this paper, researchers demonstrate an application of dielectric spectroscopy (DS) as a potential metrology to differentiate between nonwood pulp and wood pulp fibers. This in-situ, noncontact and nondestructive assessment method has inherent forensic capabilities and is also amiable to quality assurance techniques such as gauge capability studies and real-time statistical process control (SPC).

The dielectric spectroscopy results presented in this study can nondestructively determine the amount of lignin in paper products and are in principle comparable to the performance specifications of the TAPPI Standard Test Method T 401. This DS method should enable the sources of printing substrates to be both authenticated and validated in real time in a paper testing laboratory environment.

DRYING

Boosting the elongation potential of paper by mechanical refining and additives

Anders Strand, Jarmo Kouko, Antti Oksanen, Kristian Salminen, Annika Ketola, Elias Retulainen, and Anna Sundberg

The procedures used in restraining the web during drying will severely affect paper properties. In this work, researchers identify the main differences between restrained drying and unrestrained drying on paper properties. The mechanical properties of paper were studied as a function of low-consistency mechanical refining energy; wet-end additions of carboxymethyl cellulose (CMC) with cationic starches; as well as spray addition of alginate, chitosan, and cationic guar gum.

After restrained drying, the tensile index and tensile stiffness increased with increasing refining energy, but the elongation at break was severely limited. After unrestrained drying, the elongation at break increased linearly with increasing refining energy. However, unrestrained drying also resulted in significantly lower tensile index and tensile stiffness values. After restrained drying, the largest increases in tensile index and stiffness were obtained by sequential wet-end addition of CMC and cationic starches.

Certain combinations could mitigate all of the decrease in tensile index from unrestrained drying, while maintaining the distinctively high elongation potential of the paper. The same pulp treatment/additives will increase either stiffness or stretch, depending on the drying technique, but both properties could not be maximized simultaneously.

Increased elongation of paper could lead to new packaging products. Altering the drying technique increases elongation, but also affects other paper properties. Mills can benefit from understanding the effects of different treatments after unrestrained and restrained drying.

OTHER RESEARCH APPEARING IN TAPPI JOURNAL'S SEPTEMBER 2018 ISSUE:

PAPERMAKING

Rewet in wet pressing of paper

J. David McDonald and Richard J. Kerekes

SUSTAINABILITY

Regulatory and sustainability initiatives lead to improved polyaminopolyamide-epichlorohydrin (PAE) wet-strength resins and paper products

Mark T. Crisp and Richard J. Riehle

OTHER RESEARCH APPEARING IN TAPPI JOURNAL'S OCTOBER 2018 ISSUE:

RECOVERY CYCLE

A review of green liquor scale formation

Peter W. Hart

PAPER PHYSICS REPRINT

A theory for the tensile strength of paper

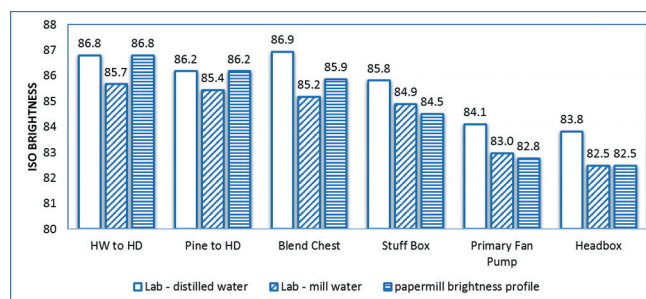
D.H. Page

OCTOBER

BLEACHING

Laboratory method for determining the source of brightness loss at a southern US bleached paperboard mill

Aru Tiwari, Ashok Ghosh, and Peter W. Hart



The laboratory method matched the relative drop in pulp brightness loss to that in the mill and suggested the largest drop was from addition of rosin and dyes, correlating to the fan pump location.

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Bleached pulp is known to lose some brightness between the end of the bleach plant and the paper machine reel. An ISO brightness drop of 1–3 points is often experienced. There are many reasons for the brightness loss; however, the usual suspects tend to be water quality, metallurgy, and process chemicals.

One bleached paperboard mill in the southern US had been experiencing brightness losses in the 6–8 point range for several years. A systematic study was conducted to determine the potential sources for this brightness loss. A laboratory simulation technique was developed to demonstrate the potential causes for the brightness loss along the process.

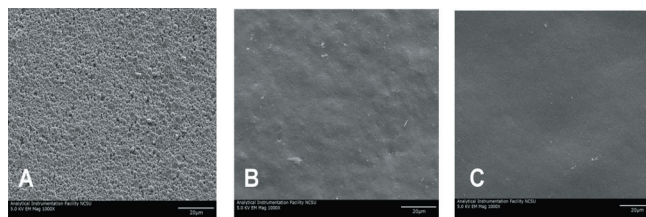
This study examines how to define the relevant aspects of a pulp/papermaking process, followed by systematically modeling the effect of process chemicals on paper brightness. Process engineers may use the concepts of this study to model their process in a laboratory, and to investigate the root cause for changes in many paper properties.

PACKAGING

Production of polyhydroxyalkanoates (PHA)-based renewable packaging materials using photonic energy:

A bench and pilot-scale study

Michael Joyce, Lokendra Pal, and Tom Tran



SEM images of A) non-cured PHA coating, B) oven-cured PHA coating, and C) photonic treatment PHA coating differences show effectiveness of heat treatment on film formation and the two heat treatments as comparable.

This work describes the use of a new photonic heat treatment technology in combination with polyhydroxyalkanoates (PHA) materials for the development of biofriendly packaging and coated substrate materials. This technology advances the use of aqueous PHA coatings as a replacement for less environmentally friendly extruded plastic and fluorotreated packaging papers and boards. The new technology uses short burst photonic energy to heat PHA latex coatings. Using a rapid pulse of photonic energy enables PHA particles to melt and form a film within milliseconds, as compared to conventional equilibrium drying that takes several minutes.

Coatings were applied to commercially produced papers to validate the combined use of photonic treatment technology with PHA materials for commercial applications.

By combining aqueous based PHA coating with photonic drying technology, it is now possible to implement PHA in commercial applications pertaining to environmentally friendly barrier coatings for the manufacture of functional paper and paperboard products, specifically for moisture vapor, moisture, and grease resistance. It presents an alternative to conventional non-renewable extruded polyethylene, petroleum-based latex coatings, and fluorochemical and chromium-containing coatings. Industry impacts for the introduction of this technology include: introduction of green chemistry formulations into coating processes, reduction of plastic waste in the recycle stream, increased use of renewable and sustainable product lines, and decreased carbon footprints. 