Student mentoring: the school–business partnership of the future

SHELLEY PROUTY

James River has developed a program which puts students through a realistic application and screening process, matching their potential career interests to a mentor in that field. Benefits include more knowledgeable and skilled students, a stronger relationship between the company and schools, and teachers with a better understanding of workplace requirements.

A recent issue of *HRMagazine* stated: "Some 98% of high school principals and small business owners believe the United States needs a better system to prepare young people for work."* Many at James River's Wauna mill would agree with that sentiment.

Employees' contacts with students and teachers over the last few years have them concerned that too many students think they don't need any math or science unless they are going to be an engineer, or they don't need to know how to write well unless they are going to be an English teacher or journalist, or they are going to graduate from high school and hire on at a mill the next day, working on the paper machines or in the maintenance department at top dollar, no less. Eventually, many of those students do learn they need basic math, science, and written communication skills in just about any good paying job, but all too often this lesson isn't learned until after graduation.

Additionally, James River—Wauna believes that many students make career choices blind to the realities of the world of work. No matter how many career classes and career research projects the schools require, students just don't get opportunities to see and experience what a person does in a particular field. By the time the students have graduated from high school and entered the workforce or gotten far enough into their major classes in college to know if they will like their chosen profession, many are financially unable to get additional skills and training to change careers or to spend the additional time required if they were to change majors.

*National Alliance of Business, survey quoted in the January 1994 issue of *HRMagazine*.

1. Student Ben Montgomery (seated) receives hands-on experience under the watchful eyes of mentor and instrument mechanic Phil Pedersen.

A number of employees at the Wauna mill who have strong interests in the local schools worked together to find ways to address these concerns—without spending much money. Their goal was to reach students and help them make these discoveries while it is still relatively easy for them to make changes to achieve their goals. The Student Mentoring Program is the outcome and is what James River wants to share with other companies in the hope they will implement programs at their facilities and share this knowledge with other businesses in their communities.

Program development

The mill started with a small core group of people strongly interested in a school–business partnership. Involvement from the local union was requested, and two members of the Execu-

tive Board were appointed by the local president to be members of the design team. For any company that works with a union, it is critical to the success of a program like this to have the union's involvement from the very beginning. The design team wanted to have some students work with mechanics in the maintenance departments and knew some employees would probably view that as displacing workers with students. Since the union was involved from the first stage of the design, they knew the program's goals and intent and were able to talk to union members who raised concerns as the program was rolled out. This stopped several problems before they could even get started.

The design team outlined what they wanted the program to look like and wrote out the purpose and goals.

Purpose:
To provide students with "real world" work experiences in a way that increases their understanding of the skills required on a job, of employers' expectations of employees, and of their own skills so they will be better prepared to make career choices and enter the work world.

Goals:

1. Students will get exposure to meaningful work experiences which will enhance their knowledge and skills and increase their understanding of the working environment and of career options.
2. Involve and educate the local communities, specifically: parents, students, teachers, administrators, and Wauna employees.
3. Positive exposure for James River to the local communities.
4. Strengthen local school programs through a partnership with the schools.

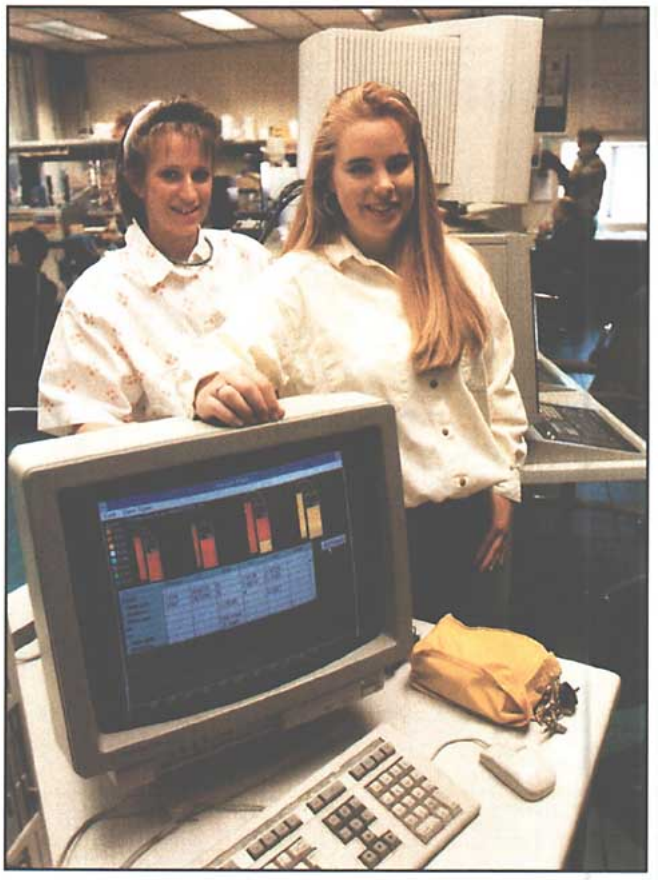
The team then identified concerns and questions that needed to be researched—workers' compensation, child labor, and minimum wage laws—if the students were to do actual hands-on work. As the program design is reviewed, the answers they found to these questions will be shared.

The next step was to meet with the principals and a teacher or counselor from each of the three local high schools to share ideas with them and get their input for improvements. They were wholeheartedly in support of the idea and made some good suggestions for improving the initial design.

Legal issues

One of the fundamental goals of the mentoring program is that students will get hands-on experience, and the design team wanted to be able to include the maintenance areas in the mentoring program. However, there was concern about possible legal problems in doing that, as "hands-on" experience would mean the student would be operating some power tools, which minors can't do under the child labor laws.

2. Mentor Kim Gantner (left), process control engineer, and student Talina Wieglenda display a kraft mill operator's screen that Wieglenda helped design and program.



The Oregon State Department of Education and the Oregon Bureau of Labor and Industries (BOLI) Apprenticeship and Training Division were very helpful and supportive of James River's efforts, providing much information and guidance. The mill mentoring coordinator learned that workers' compensation insurance is the responsibility of the school. The Bureau contact also told them that if a program qualifies as an unpaid work experience program there is no employment relationship and therefore the minimum wage, overtime, and child labor provisions of the law are not applicable.

There are 10 requirements that must be met for a program to qualify as an unpaid work experience program in Oregon. (Employers in other states will need to research their state's requirements.) These are listed in the BOLI Field Operations Manual policy statement and are as follows:

1. There is no promise of future employment.
2. Work in hazardous areas is incidental to their training. (Student is not engaged as a regular operator on a piece of equipment but learns a work process that may be in a hazardous area as part of their nonpaid experience. This suggests a minimal operation of power tools.)
3. Other workers are not displaced.

4. There is no pay.
5. Maximum participation is one semester, or one school year if the student is rotating departments or tasks to get new learning experiences throughout the whole time period. There is no specified maximum number of hours per week in the BOLI policy.
6. The work period is for a short duration of time.
7. Training is similar to that given in an approved training program.
8. Employer derives no immediate advantage from training activities, and, occasionally, operations may be impeded.
9. Training is for the benefit of the trainee or student enrolled.
10. The student is on the job primarily during the hours the school he or she attends is in session.
11. There cannot be an employment relationship at any time while a student participates in the program. That is, the student cannot be an eligible participant in the program during school hours, assume an employment relationship after school hours, then resume participation in the program the next day.

The mill's BOLI contact said that Oregon's requirements are more stringent than the Department of Labor's; if the program meets Oregon's requirements, it will meet federal requirements.

This information is reviewed each semester with the mentors, and the mill coordinator periodically reviews with the mentors what the students have been doing and what they have been learning.

Program overview

There is one designated mill coordinator, and each partner school has identified one program coordinator. The work experience is primarily for one semester, although this can be extended to a full school year—but that is discouraged. James River wants to give as many students as possible an opportunity to participate, and the mentors have found that it becomes increasingly difficult to meet the unpaid work experience requirement that the student be continually learning if the experience continues much beyond one semester.

The students must complete an application packet consisting of:

- A standard James River application form
- Resume
- Brief essay (one page or less) stating why they want to participate
- Two recommendations: one from a teacher or school administrator and one from a community member
- Transcripts.

The school coordinator reviews the applications for completeness and refers the students' applications to the mill. The mill coordinator then screens the applications and decides which students to interview, looking for positive recommendations, a complete application packet, and a match of students' stated career interests with available mentors.

Students who are selected for an interview are contacted by the mill program coordinator to schedule the interview and drug screening. James River uses panel interviews with either three or four interviewers on the panel, one of which is the mentor that will potentially be paired with the student. The purpose of the interview is primarily for the student's benefit, giving the individual experience in a real interview situation similar to what will be found when searching for a job. The interview panel uses the interview to get more information about what types of careers the student is interested in exploring and to see if the student has a high level of motivation and interest in participating in the mentoring experience.

Final selection and placement decisions are made, drug screening results are reviewed, and the students are notified by the mill as to the selection decision.

All the students who are selected are scheduled for a general orientation, to which their parents or guardians and a mentor teacher are also invited. The orientation covers the pertinent safety information, where they are to meet their mentor their first day, where to park, etc. The group is taken on a brief mill tour, and any parents, guardians, or teachers who are able to attend will meet their student's mentor. James River wanted parents to be comfortable with the idea of having their child in a mill environment and believed the best way to do that was to have them in the mill and have them meet their child's mentor. So far, about 65% of the students have had at least one parent take advantage of this and all have greatly appreciated this aspect of the program.

Mentor's responsibilities

The mill coordinator meets with the possible mentors before the interviews are scheduled. The coordinator reviews the expectations and responsibilities of mentors and answers their questions. Applications are reviewed to see if the mentors agree with the coordinator that they might be a good fit for the area of interest expressed by the student. The mentors are given a handbook, and each part of it is reviewed.

Mentors are required to keep a log indicating what projects the students are working on, what they are learning from those projects, if the student was late or did not show at their scheduled time, things the student has done exceptionally well, copies of reports or printouts the student has done, etc. These logs are the basis for the periodic evaluations the mentor completes and reviews with the students, as well as the documentation supplied to the schools for them to award credit for the experience. Mentors are also required to complete learning plans for each project or task. This ensures that the mentors have things planned and prepared for the student in advance

and helps ensure that the program is meeting the unpaid work experience requirements.

The mentors are responsible for orienting the student to their department on their first day: making sure they know the department's evacuation route and meeting place, where the restrooms are, lunch areas, and introducing them to co-workers.

The students work a maximum of eight hours per week, split over two to three days a week. Students have worked in the maintenance department (with instrument, millwright, carpenter, and electrician mentors), in accounting, process engineering, process control engineering, MIS (mill information systems), and human resources. Some examples of the projects the students have worked on: helping to program user interface screens on computer systems in the operations departments, drafting using Auto CAD, working on portions of the general ledger, and helping design experiments and analyzing and reporting the results, among other things.

Costs and benefits

The costs to the employer are largely in the form of employees' time. Wauna has also paid up to US$ 55 to reimburse students for safety shoes that are required. The costs to the student are their time, some class time missed, and gas money, which can be a major factor in rural areas. One of the local schools has been reimbursing their students for mileage; the other schools are trying to identify grant money they could use to help defray the transportation costs. The schools' costs are the time of the coordinator and some additional work in helping students coordinate their class schedules with the mentoring schedule.

The benefits are tremendous. While not all of the benefits envisioned by James River and the schools have been realized immediately, it is our firmly held belief that they will be met in the future—in the form of better prepared candidates for employment at James River and other companies. Some of the benefits that have been seen thus far include:

- Students are expanding their understanding of work and employers' requirements.
- Students are expanding their understanding of at least one career option.
- Students have an opportunity to apply skills they have learned in school.
- Teachers are learning more about the requirements and needs in today's workplace.
- Teachers are getting new ideas to help their students apply skills.
- Teachers are developing relationships with people in the mill who can be used as resources.
- Mill mentors have the satisfaction of making an impact in a student's life and in the local schools.
- Everyone involved is having fun!

Future

James River's goal for the mentoring program is to see it expand to many other businesses and schools. There are already a large number of schools and businesses doing things very similar to the mentoring program at our mill, but that participation needs to expand to every community and school. We encourage you to draw from the experiences of other school–business partnerships and be the leader in getting your facility to participate!

Resources

There are numerous resources for ideas and assistance in developing a mentoring program. One that James River's design team learned of and was very impressed with is in place in Redmond, OR, and is called the REDCAP Mentoring Program. They have developed a very good "course book" for students that James River hopes to help the local schools incorporate into their mentoring programs.

Resource contacts:

- REDCAP Mentoring Program
  Jan Erickson, Coordinator
  Redmond High School
  675 Rimrock Dr.
  Redmond, OR 97756
  (503) 923–3440
- Elsa Wooley
  Student Mentoring Coordinator
  Clatskanie High School
  Clatskanie, OR 97016
  (503) 728–2146
- Hank Anderson
  Student Mentoring Coordinator
  Rainier High School
  P. O. Box 280
  Rainier, OR 97048
  (503) 556–4215

I'd like to acknowledge the help of the following people in preparing this paper: James River Wauna mill management; Constance Rathfon, Jim Lepin, and Dave Hicks of James River; George Brajcich and Claude Weaver of the UPIU Local 1097; Hank Anderson and Hugh Fullerton of Rainier High School; Earl Fisher and Elsa Wooley of Clatskanie High School; and Glen Warriner and Bernie Reinbold of Knappa High School.

Prouty is the personnel supervisor at James River Corp., Wauna mill, Rt. 2 Box 2185, Clatskanie, OR 97016, (503) 455-3354.

PROCESS CONTROL

The digital future of process control: its possibilities, limitations, and ramifications

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Process control technology is quickly becoming increasingly digital as the distributed control systems of the 1980s give way to the fieldbus architectures of the 1990s. The authors believe that this evolution has been driven by technological "push" and not by user industry "pull." Thus far, the digital promise of "smarter" and "faster" has not been translated into better paper.

Mill variability audits in North American pulp and paper mills have found that, generally, process control unintentionally contributes to short-term process variability. Some of the reasons are a result of misapplied digital technology and a disregard for some fundamental principles of dynamics. One such area concerns the sampling of analog signals too slowly, with antialiasing filters. The result is the loss of signal integrity causing control to "chase" slow, yet fictitious, cyclic behavior. Another impact of slow sampling is that the true process dynamic behavior is lost and control cannot react properly.

It is important to ensure that the digital information that is acquired and transmitted adequately represents the process behavior so that process control and process troubleshooting can be accomplished effectively. The new technology must serve the needs of the end user without sacrificing performance.

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PULP TESTING

Testing pulp quality: an alternative to conventional laboratory evaluation

Wavell F. Cowan
Pulmac Instruments International

Advancing technology continues to improve quality management throughout the pulp and paper industry, but management of pulp quality remains problematic. Conventional methods of testing pulp quality in the mill laboratory have become a time-honored tradition after 50 years. The reliability of these methods is not in question. Their main drawback is that they are slow. Rapid feedback is key to effective quality management. This article describes a rapid method of measuring pulp quality.

Results presented in this report suggest that the rapid method is as reliable as conventional methods. A total of 24 bleached kraft pulps from six mills were tested in the laboratory. The rapid method, which measures pulp properties in terms of fiber strength and fiber length, showed a strong correlation with conventional measurements of tensile and tear strength.

A rapid method of testing pulp gives a mill the option of increasing the frequencyof testing, resulting in better quality management.

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TISSUE SOFTNESS

Softness properties of paper towels

Jong J. Kim, Itzhak Shalev, and Roger L. Barker
North Carolina State University

The surface feel and softness of tissues and paper towels are important product properties. Papermakers strive to produce a sheet with the required primary properties that offers satisfactory softness. Primary properties can be measured directly, but softness perception is difficult to quantify. If papermakers had the ability to measure the structural properties affecting softness perception, then they could target these areas and produce softer products.

The Kawabata evaluation system is used to measure textile softness in the fabric industry. The system measures the subtle mechanical properties that correspond to deformation of materials in hand manipulation. Experimental results demonstrate that the system can be modified to measure softness in paper products.

A panel of 59 judges evaluated softness for a broad selection of paper towels. Identical samples were evaluated using the laboratory system, which measured 16 separate sheet properties on each towel. Comparison of the subjective perceptions with the objective measurements showed that towel softness was linked to surface roughness and extensibility under low stress. Using these data, the authors developed a reliable softness-predictive equation.

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PITCH CONTROL

A likely mechanism for pitch control

Chandrashekar S. Shetty, Carol S. Greer, and George D. Laubach
Nalco Chemical

In the papermaking process, wood pitch is released during both the chemical and mechanical operations. Pitch allowed to concentrate in a papermaking system agglomerates, leading to sheet defects and buildup on equipment which, in turn, results in lost or low quality production. This study investigated the mechanism of pitch deposition at the pitch/water interface.

The cationic polymers used in the study of the model pitch system proved to be active at the pitch/water interface. The polymers facilitated the coalescence of the pitch particles so that these particles became large enough to be retained in the matrix of the pulp fibers and removed from the papermaking system as part of the finished sheet. Contact angle measurement demonstrated that the polymers adsorb onto solid surfaces, rendering them hydrophilic and providing a barrier to pitch deposition.

Understanding the mechanism of pitch deposition could facilitate the development of new and improved products to inhibit pitch deposition during papermaking.

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K&N INK TEST

Relation between K&N ink test and printability tests for newsprint

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and Byron D. Jordan
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Papermakers and printers have long sought a fast, simple, and effective test to predict print quality. Ink stain tests, designed to measure the ink absorptivity of coated papers, have been used for newsprint despite the known influence of surface roughness on the test results. Some publishers have specified or suggested the K&N test for newsprint printability evaluation. This work investigates the ability of the K&N test to predict print quality.

Thirty-two newsprints from across Canada and the United States were tested. The K&N test was performed along with printability tests on laboratory proof presses, as well as non-printing tests such as roughness. Correlations between the K&N test and other print-ability tests were calculated. Subjective evaluation of the stains was also performed. The K&N test value is not strongly correlated with other print-ability tests where actual printing is per-formed. But an excellent correlation was observed between the K&N value and the subjective evaluation of the stain darkness.

From this study, the authors conclude that the K&N test is of limited use in predicting the print properties of newsprint. Only trends have been identified between the K&N value and ink requirement, print-through, and set-off at a target print density.

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SOFT NIP CALENDERING

A finishing alternative for offset LWC

Jeffery M. Groshek
Beloit Corp.

Soft nip calendering is a finishing process being used more frequently as papermakers look for ways to improve their product quality and production efficiency. Supercalenders usually do the finishing of traditional LWC grades, however is done with supercalenders. The author performed a pilot calendering experiment in conjunction with a commercial offset print trial to compare soft nip calendering to supercalendaring for finishing of LWC.

The study used commercially coated but uncalendered LWC paper. Pilot calendering equipment produced a variety of soft nip calendering conditions along with a supercalender condition for printing. Testing included nip load, number of nips, metal roll surface temperature, and speed. Depending on the severity of calendering, samples ranged from a smooth, gloss finish to a rougher, matte finish. Commercial mill supercalendered LWC was printed, too. The printing trial used a commercial four-color, heat-set, web offset press.

Measurements included optical, surface, and strength properties on the printed and unprinted samples. Image analysis quantified print mottle. Soft nip calendering can produce sheet properties and offset print quality equal to that of supercalendering for LWC even at operating speeds up to 4500 ft/min.

Paper begins on page 105.

PRINTER ROLL QUALITY

Printer roll quality requirements on winding technology

John J. Lefkowitz
and David F. Boino
Beloit Corp., Lenox Division

By understanding the requirements facing printers, suppliers of winding equipment can design to meet those needs. But first, manufacturers of this equipment must understand and classify all defects being caused by today's winders.

By analyzing the total breaks being caused by individual defects, it is possible to begin to define those contributing to the most breaks. With this information the mill and pressrooms, working as partners, have been able to reduce the total number of breaks by over 50%.

Defects that are introduced during the winding process are often not found until a break occurs in the pressroom. Then, operators in the pressrooms must make several adjustments to keep proper register control. These adjustments waste time and add cost to the printer's operation.

Using defect analyses, it became evident that modifications to two-drum winders would allow mills to provide consistent roll structure for all rolls without assuming that a more expensive single-drum winder was required.

The authors describe the various defects being caused and the modifications available for two-drum winders. Both new equipment and rebuilds to existing machines are considered in a cost-effective approach.

Paper begins on page 111.

NEWSPRINT TRIALS

The *Dagbladet* full-scale printing trials, part 4

Simon Papworth and Klaus Moller
Norske Skog Teknikk

Although roll quality is a crucial factor in runnability on high-speed web-fed presses, there are almost no international standards for roll quality.

The *Dagbladet* project—a series of 27 full-scale printing trials on a modern four-color press—provided a unique opportunity to study roll quality for a wide range of newsprints. Static out of roundness (OoR) and roll hardness—common indicators of roll quality—were measured in the pressroom for each of the 176 rolls used in the trials. Dynamic OoR was measured as each roll unwound in the roll stand. The three measurements showed no significant correlation, possibly reflecting the unknown effects of roll handling between the mill and the pressroom.

A followup study with controlled roll handling showed that

- Roll hardness was higher in the mill than in the pressroom.
- The *level* of OoR was related to the position of the roll in the winder set, with the edge rolls showing less OoR.
- The *shape* of the OoR was determined by the way the clamp truck grips the roll. Clamping force and frequency did not affect the level of OoR.

These observations are of interest to those responsible for measuring the quality of delivered rolls. Pressroom measurements of static OoR and hardness are unreliable. Measurements of hardness in the mill and dynamic OoR on the press are better indicators of roll quality.

Paper begins on page 117.

WEB OVEN PARAMETERS

The impact of web oven parameters on 20° print gloss

Steven W. Hachey, C. David Niles, and Susan P. Robie
S. D. Warren Co.

The process parameters of web printing as well as the ink and paper chosen for the printed piece have a significant impact on print quality as measured by ink gloss. The purposes of this study were to define the extent to which web oven conditions affect 20° gloss and to relate the variables of press speed, oven temperature profile, and web exit temperature to the observed changes in gloss.

A marked trend was shown toward decreased print gloss with increased drying rate. Both increased press speed and increased web exit temperature decreased print gloss. However, the effect of increased press speed in decreasing print gloss was small when the profile was high to low in a two-zone oven.

The experimental work included bench experimentation and full-scale print trials. Variations in paper substrate and ink type were studied using a three-factor, two-level experimental design of web oven drying process conditions. A computer model was used to simulate the removal rate of solvent and water from the printed sheet. SEM photomicrographs were used to illustrate the effect of drying intensity on the ink film surface topography and to examine the defects introduced by the experimental drying conditions.

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TiO_2 APPLICATION

Titanium dioxide performance comparison between coated paper basesheets and coatings

Robert A. Kwoka and T. Wayne Logan
DuPont Co.

Many lightweight coated paper producers use titanium dioxide (TiO_2) to achieve target opacities at high brightness. The location of TiO_2 in the sheet varies widely from mill to mill. Some producers put the TiO_2 in the coating, others add it to the wet end, and still others split the TiO_2 between the basesheet and coating. The authors undertook this study to gain some understanding of the effects of varying TiO_2 location on the overall TiO_2 efficiency and coated paper properties. The laboratory study and mill experience demonstrate that overall TiO_2 efficiency is often improved by splitting the TiO_2 between the basesheet and coating.

Four basesheets containing 0–5% TiO_2 were prepared on a pilot paper machine, and five coatings containing 0–20 parts TiO_2 were applied to each of these basesheets on a cylindrical laboratory coater. Coated paper samples of 20 different basesheet TiO_2 – coating TiO_2 combinations were produced for optical analysis. The results showed that basesheet TiO_2 develops coated sheet opacity more effectively than coating TiO_2 when the basesheet TiO_2 concentration is low or the coating TiO_2 content is high. Brightness, whiteness, and shade are affected more by changes in coating TiO_2 content than basesheet TiO_2 concentration.

Paper begins on page 136.

DECORATIVE LAMINATES

Materials science approach to product development in decorative surfaces

William S. Kohl,
Bruce R. Trethewey Jr.,
and Mark J. Hattemer
Ralph Wilson Plastics Co.

Process and product improvement are the lifeblood of a competitive company. In an aggressive environment such as the plastic laminates market, dedication to product development must be tied to efficiency of effort. Postforming-grade, high-pressure decorative laminate was used as a case study of how material science techniques may enhance the understanding of existing products and contribute to product and process improvements.

The authors used thermomechanical and dynamic mechanical analysis techniques to analyze a postforming-grade laminate. The results demonstrate how the properties of the constituents of a plastic laminate combine in the finished product to define the performance characteristics of the material system.

The study detailed in this paper is intended to provide an example of how modern laboratory capabilities, combined with an appreciation for the behavior of the constituent materials, can increase the efficiency of product development efforts. Continuing work is addressing the transition from laboratory efforts to production processes.

Paper begins on page 136.

HOT MELTS

High-performance reactive hot melts

John Zimmel, Fred K. Meyer,
and John Greenzweig
H. B. Fuller Co.

Reactive hot-melt adhesives have gained wider market acceptance in recent years. Concurrently, adhesive users have demanded performance improvements in reactive hot-melt technology, specifically, increased initial handling strength (or green strength). The need for improved green strength also led to a need for improved methods to test and characterize green strength.

This paper examines different test methods used to characterize initial handling strengths. The performance of different formulating approaches is compared. The interesting aspect of the comparisons is a conclusion that no single formulating approach always provides the best results. There is a need to match the requirements of the application with the appropriate adhesive and green strength needed.

Paper begins on page 145.

OZONE BLEACHING

Laboratory-scale medium-consistency ozone bleaching system

Sreeram Chivukula,
V. S. M. Sundaran, Hasan Jameel,
and Hou-min Chang
North Carolina State University

Worldwide concern over the environmental impact of chlorinated organic compounds from bleach plant effluents has stimulated great interest in the development of nonchlorine bleaching agents such as oxygen, ozone, and hydrogen peroxide. Ozone is a promising agent to replace chlorine-based compounds in a bleaching sequence, due to its ability to remove lignin efficiently. However, the radicals generated by the decomposition of ozone have a detrimental effect on pulp properties.

It is important to understand the interactions of the various operating variables to improve delignification and selectivity. A laboratory medium-consistency ozone bleaching system using a high shear mixer was designed to study the impact of the operating variables.

The optimum operating conditions in this bleaching system were low temperatures and low pH. An increase in the mixing speed improved delignification but decreased pulp viscosity and freeness. It was noted that ozone bleaching efficiencies are comparable between 5% and 10% consistency if sufficient mixing is provided. With the available high shear mixers it may be possible to provide the high mixing speed desired at 5% consistency. Bleaching at 5% consistency avoids additional capital expenditure for medium-consistency pumps and thickening devices after high-density

Paper begins on page 155.

ENZYME DEINKING

Factors influencing enzyme deinking of recycled fiber

Christian Zeyer, Thomas W. Joyce,
John A. Heitmann,
and James W. Rucker
North Carolina State University

Whether cellulase enzymes can be used to enhance deinking is under intense investigation. The authors researched the influence of mechanical conditions and, more generally, the influence of the accessibility of the fiber/ink complex for cleavage by enzymes.

The enzymes were shown to enhance deinking significantly but only if a certain amount of surface friction is present. The authors suggest that the ink must be slightly raised by friction to allow the enzymes to cleave the cellulose chains that attach the ink to the fiber. Modifications of the fiber surface, such as sizing and coating, were also important. In general, the authors suggest that the accessibility of the cellulose chains that anchor the ink to the fiber determines the removal rate.

For this study, printed cotton fabric was used as a model system. The fabrics were printed by screen printing. The enzyme treatments were made in rotating steel containers at a temperature of 40°C. Steel beads were added to provide additional friction. Ink removal was measured by image analysis. Treatment time was 3 hours. The importance of the enzymatic activity was demonstrated by deactivation using silver ions. The surface modifications were achieved by appropriate treatment before printing the cotton.

Paper begins on page 169.

TENSILE CREEP

The mechanics of moisture accelerated tensile creep in paper

Henry W. Haslach Jr.
University of Maryland

Variable moisture content over time magnifies the mechanical response of paper to loads. Paper subjected to a cyclic variable humidity environment and a constant load is a simple example. The strains observed, which are larger than would occur at any constant relative humidity, are called moisture accelerated creep. Such creep can be expected in the web as it moves through the papermaking machine and in converted uses such as stacked cardboard cartons. Knowledge of the physical mechanisms underlying this behavior would permit improved design of paper for use in variable humidity environments.

Thus far, no published hypothesis is believed to exist that accounts for all known aspects of the interaction of moisture and loads. Haslach presents a hypothesis developed from work published in the literature and his experiments with moisture accelerated creep. This hypothesis relates creep under variable moisture content to the action of free volume-induced swelling of the pulp fiber on microcompressions. Anisotropic swelling explains why this occurs in hydrophilic materials such as paper and not in others such as nylon. The behavior is an example of delayed creep.

Additional experiments could both investigate the mechanisms that create moisture accelerated creep and serve as a model for further study of variable forces on paper and their interaction with changing humidity and temperature variations.

Paper begins on page 179.

FORMING FABRIC

Effects of forming fabric structural parameters on sheet properties

Sabit Adanur
Auburn University

The design, properties, and applications of forming fabrics affect paper properties and the papermaking process. The effects of structure and properties of forming fabrics on process and product are the subject of this work.

A mixture of bleached hardwood and softwood was used to make pulp, and several forming fabrics were used to make handsheets. After forming, the sheets were pressed and dried at room temperature. Fabric air permeability, drainage index, thickness, fiber support index, density, and percentage open area were used as independent variables. The dependent variables were arrived at by testing the sheets produced from each fabric. Sheet properties tested were tensile strength, burst strength, tear strength, uniformity, and thickness. Tests were done on each sheet in the machine and cross machine directions.

Paper properties such as strength, thickness, uniformity, density, and bulk were found to be related to forming fabric design. The author believes that the experimental relationships established in this study would be helpful to forming fabric manufacturers in designing the proper fiber structure to meet certain paper requirements. The results should be useful to papermakers in selecting the right fabric design for their needs.

Paper begins on page 187.

Using treated municipal wastewater in a linerboard mill: legal, political, and technical issues

Whitman Bowen
Montville Water Pollution Control Authority

Robert Scogin
Rand-Whitney Containerboard, L. P.

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An inadequate supply of process water threatened to derail the proposed renovation of an antiquated mill. The owners decided to use finished effluent from the town's water-treatment system, but found there was little information about the implementation of such systems.

This article outlines the legal, technical, and political issues encountered in developing a plan that enabled the mill to use treated effluent as process water for manufacturing quality linerboard.

The project required cooperation and communication among the mill, the town, regulatory agencies, and the paper-machine manufacturer. The principals established a baseline level of water quality that was acceptable for use on the paper machines and allocated liability for conceivable contingencies.

The mill owner and the town agreed to develop a closed-loop system that delivers treated effluent to the mill. Effluent from the mill is diverted to the water-treatment plant for reprocessing through a dedicated pipeline.

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