Press and Dryer Roll Surfaces and Web Transfer Systems for Ultra High Paper Machine Speeds

Quarterly Status Report For the period October 1999 through December 1999

On

Project DE-FC36-99GO10384

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The purpose of this quarterly report is to provide an overview of the project including key tasks, schedules for completion of tasks and to document accomplishments.

Project Overview

Project Staff: Timothy Patterson is principle investigator of the project. Jere Crouse, recently retired from Beloit Corporation, and Fred Bloom, Professor, Northern Illinois University, are consultants. The IPST Staff working on key aspects of the project are:

Fred Ahrens, Professor	Task 1, 2, 3, 4, 5, 6
Hiroki Nanko, Associate Professor	Task 1, 2, 3, 4, 6
Yulin Deng, Associate Professor	Task 1, 2, 3, 4, 6
Shana Mueller, Assistant Engineer	Task 3,4

Project Objective: The objective of the project is to provide fundamental knowledge and diagnostic tools needed to design new technologies that will allow ultra high speed web transfer from press rolls and dryer cylinders.

Fundamental Questions: From a fundamental standpoint, we expect that roll surface performance depends on the composition of contaminants that deposit on those surfaces during use, as well as the materials and finishing techniques used in manufacturing these surfaces. We need to understand; the contamination process, the influence of contamination on work of adhesion, the roles of surface topology, film splitting, and process conditions on web transfer.

1. What is the status of the technical scope of work? Answers should be tailored to the tasks in the Statement of Work that are being performed.

Task 1.

The techniques and procedures described under sub-tasks 1 and 2 were developed during the last quarter of FY 1998-99. These techniques were refined during the quarter covered by this progress report - 1st quarter 1999-00. During the past two quarters four mills, comprising three different grades (coated, liner, and medium) were visited. Personnel from IPST collected dryer surface topology data using an epoxy replicate technique, measure dryer surface contamination density, and collected contamination samples. The contamination samples were subjected to chemical analysis at IPST. One of the most interesting findings from this work is that all dryer cylinders have some form of contamination. While the samples collected provide a suitable data base, one or more mills may be visited in the coming quarter to widen the scope of the data base. This task will be completed by the end of the second quarter of this FY.

Task 2.

During the last quarter, the shakedown process for the CTS began. There were several problems uncovered. The induction heater used to heat the roll, a requirement for dryer can simulation, had previously been returned to the manufacturer for reconditioning. Upon testing, it did not operate properly and had to be sent back to the manufacturer. It has since been returned, installed on the CTS, tested, and shown to operate properly. The contamination system was tested. It was found that lower than expected flow rates were needed to keep the felt wetted with the contamination solution. The flow loop is being modified to incorporate a higher resolution flow meter. Contamination studies will begin by March 1.

The topology of the coupons, that will be used in both the contamination studies and the web adhesion studies, were compared to those obtained from the dryer cylinders examined as part of Task 1. There was a reasonable correlation between the two sets of data. Thus, the test coupons should provide a representative surface for the contamination work.

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Task 3.

The design and fabrication of the WADS is complete. Shakedown testing was begun in December. The shakedown work used a clean coupon. The clean coupon produced relatively low levels of sticking across a wide range of sheet moisture levels and coupon temperatures. This somewhat complicated the work. The shakedown work showed that to obtain accurate local peel angles, essential to calculating work of adhesion, the peel process had to be video taped and a post test image by image analysis performed. The test method and machine operation procedures are now finalized. Testing of various paper grades using clean coupons is in progress. Two apparatus improvements are in progress - a dryer felt loading/applicator system that allows for greater dwell times and a press roll applicator system. The fabrication work on the parts for these improvements is in progress and the installation on the apparatus is scheduled for late March/early April. The installation of those parts will complete this task.

Task 4.

A model contamination system for light weight coated grades was obtained from a IPST chemical vendor member company. The data collected from the Task 1 visits to liner and medium machines is being used to develop a model contamination system for those two grades.

Web adhesion and picking experiments using uncontaminated coupons are in progress. This data will be used as a control for later tests using coupons that will be contaminated using the CTS. Completion of the task will occur late summer 1999.

Coupon contamination under controlled conditions using the CTS will begin by March 1. This is will be an ongoing task, as there are a number of variables to be evaluated. Completion of the task will occur mid summer 1999.

Task 5.

Preliminary work in this area was initiated during the last quarter. During the upcoming quarter currently operating pilot and production machines will be surveyed to identify the machine with highest speed. Web transfer on both press rolls and dryer cans will be video taped using a high speed digital system. This will serve as a baseline for understanding web geometry during the transfer process. This task will be completed during the 3rd year of the project.

Task 6.

No progress to date. This task will be completed during the 3rd year of the project.

2. What is the completion status for each task and/or subtask? Provide an estimate of completion dates for each task and/or subtask.

Task 1

Will be completed by the end of the 2nd quarter of this FY.

Task 2

This task will be complete by March 1, 2000.

Task 3

The basic device is complete, completion of two add-ons, by the end of the 2nd quarter of 2000, will complete the task.

Task 4

In progress.

Task 5

In Progress.

Task 6

No progress to date. This task will be completed during the 3rd year of the project.

3. **Are there any significant program/project tests or demonstrations in the next four months? This pertains to work outlined in the Statement of Work.**
Testing on the CTS and the WADS will begin (Task 4)
4. **Are there upcoming conferences at which project related papers will be presented? This pertains to work outlined in the Statement of Work.**
None planned at this time.
5. **If there are any variances to cost or schedule, what are the reasons for these? If the project schedule has changed submit an updated schedule with dates referring to each task.**
None planned at this time.