

2013 LINERBOARD/MEDIUM & CORRUGATED BOX MANUFACTURING TENTATIVE COURSE SCHEDULE

Day 1 Monday, April 15

8:00 – 8:30

Welcome, Introductions, Learning Objectives

8:30 – 12:00

The Corrugating Process (overview & focus on how to improve bonding)

- Double-Wall Corrugator Wet End Summary
Identify main components of a Corrugated Web:
Liner, Medium, Adhesive

- Lay-out of Equipment (Numbering/Stations)
 - Single-facer #1
 - Liner Splicer (position 3)
 - Liner roll stand (position 3)
 - Preheater
 - Medium Splicer (position 2)
 - Medium roll stand (position 2)
 - Medium pre-conditioner
 - Bridge Elevator Belt.
 - Double-face
 - Double-facer Liner Splicer (position 1)
 - Double-face Liner rollstand (position 1)
 - Triple pre-heater
 - a. Function
 - b. Wrap-arms
 - Glue Unit
 - a. Function
 - b. Additional preheaters

- Corrugator Terms and Variables
 - Corrugated Board
 - Web
 - Single Face
 - Single Wall
 - Double Wall
 - Triple Wall
 - Paper Grades
 - Basis Weight
 - Standard weights
 - Construction of Box
 - Box Blank
 - Paper Characteristics
 - Liners (Two sides), Medium
 - Moisture
 - Basis Weight

- **OPTIMIZING BONDING IN THE CORRUGATOR**

The five steps to a strong mechanical bond

- a. Application
- b. Wetting/ Penetration
- c. Gelatinization
- d. Green-Bond
- e. Drying/Fully Cured

- a. Application step

Application is the first stage of the adhesive bonding process. The applications differ slightly for the single-face liner and the double-face liner. The application stage relates to the amount of starch applied to the flute tips. Application terms & technology topics to be covered include:

1. Applicator roll surface design
2. Distance from applicator roll to flute tip.
 - i. Single-facer
 - ii. Double-facer
3. Mechanism for applying starch to DF flute tip
4. Metering roll
5. Glue gap settings
6. Applicator roll to flute tip speed variables
 - i. Correct placement on flute tip.
 - ii. Starch formula, biorax, Viscosity, Directional bond
 - iii. Verification of placement
 - a. Light Strobe (*best method*)
 - b. Iodine soak test (*acceptable method*)

- b. Wetting and Penetration step

Critical to the strength of the bond. *Several variables can affect this phase. (more on this topic in Process Control section)*

1. Both medium and liner papers must have the starch penetrate their surface.
2. Two types of wetting/penetration
 - Single-face Pressure Bond (SF Bond)
 - Double-facer Evaporative Bond (DF Bond)

- c. Gelatinization & Green Bond steps

This Green Bond holds paper together, but still contains a significant amount of moisture.)

- a. Starch is applied
- b. Starch absorbs into the medium
- c. Flute tip is against corrugating roll Primary Starch begins gelling.
- d. In the Pressure roll Corrugator roll nip, the Primary Starch penetrates/wets the liner and medium and initiates Green Bond.
- e. Gelling raw starch and wetted paper fibers swell into each other (Cross-linking) as web goes up to bridge.
- f. Cross linking (once on the bridge)

d. Evaporative Bond - Wetting/Penetration (DF) steps

Controlling factors: temperature, pressure, speed

Evaporative bond mechanisms during the first 2-3 seconds

e. Gelling & Green Bond for Pressure Bond (DF) steps

Mechanisms during bond formation

f. Drying/Fully Curing step

Final Evaporative bond formation in the final 1-2 seconds.

12:00 – 12:45 LUNCH

1:00 – 4:00

Linerboard & Medium Performance Properties & Tests

Sheet Structure & why it's important, MD/CD Fiber Orientation, Formation, etc.

Properties & Tests, what they are telling us, and what contributes to their values:

Stiffness, Ring Crush, Mullen, Concora

Edgewise Compression Test, STFI

Tensile, Modulus, Stretch

Liquid Absorption, Porosity, Adhesion

Sizing tests, Cobb, Water drop, etc.

Moisture & Humidity Effects on Performance Properties

Causes of Curl, Warp, & Wash Boarding

Viscoelastic Creep Failure of Boxes

Runnability on the Corrugator

Smoothness and Printability

Others, as per survey of participants

5:30 Adjournment

Day 2 Tuesday, April 16

Pulp & Paper Mill Operations

8:00 – 9:30

Fiber Raw Materials, Pulp Mill, Recycling

- * Fiber Properties & Effects on Sheet Structure
- * Pulping Processes for Liner & Medium
- * Recycled Fiber Processing, Problems, Improvement

9:30 – 10:00

Stock Prep Refining

- Refining mechanism & variables; effects on sheet and properties
- Improving Refining for Linerboard & Medium
- Plate pattern, intensity, other variables; Case study

10:00 – 12:00

Chemical Additives & Effects

- pH control, Alum, Sizing Chemicals, Fillers, Strength Adhesives
- Formation Aids, Retention
- Wet End Chemistry

12:00 – 1:00 LUNCH

1:00 – 3:30

Paper Machine Wet End Operations

- BW control, White water, Cleaning, Screening, effects of Air
- Headbox & Sheet Forming operations
 - Pressure/Hydraulic Headbox operations
 - Importance of and Variables affecting Formation
 - Microturbulence Strategies
 - Jet/Wire Velocity Strategies
 - Fiber MD/CD orientation strategies, TSI / TSO Analysis
 - Crossflows & BW profile control
 - Forming fabrics
- Top Sheet Forming; Secondary Headboxes, Top Fourdrinier;
- Hybrid Formers, Twin Wire Gap Formers

3:30 – 5:00

Pressing, Drying, Calendering, Winding

- Pressing Mechanism of Water Removal; Effect on Sheet Properties
- Shoe Pressing & other developments
- Effects of Drying and Shrinkage & Moisture profile on
 - Liner & Medium sheet & properties
- Variables affecting pick up in Size Press
- Types of calenders & variables affecting calendering
- Calender box surface treatments
- Winding operations

5:00 Course Evaluation & Adjournment