Winding Thin Films

AIMCAL - 2004

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From Kroenert Corporation - American Representative of Maschinenfabrik Max Kroenert
Bachofen+Meier of Bulach

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Agenda

- Technology Drivers
- Standard Designs
- Case Study Challenges
- Forward Direction
Customers Production Cost Reduction Trends

Lower Cost Feedstocks

- Thinner Web Materials
  - 3 micron PET
  - 5.65 Micron Aluminum
  - 30 gsm Decorative Paper

- Lower Performance Level of Films
  - Shape
  - Purity and Inclusions
Cost Reduction Trends cont.

- Higher Outputs - Gross
  Wider Web Machines – (up to 135 Inches)
  Faster Speeds – (up to 5300 fpm)
  Less Downtime
  More units per time – rolls or area
Winding Thin Films Technology Drivers

Cost Reduction Trends

- Higher Outputs – Net (Yield Optimization)
  - Improved Splice/Transfer Rates
  - No Fold Back Transfers
  - Short/Zero Tail Lengths
  - Fewer Wrinkles/Scratches
  - Splices to minimize materials left on core
Other Considerations
-Safety
  Shaftless Operation
  Optimization of Loading/Unloading of Rolls
  Core Stripping
-Environmental
  Gray Bin, Green Bin ….etc.
-Mass Customization
  Differing Downstream Processing Needs
Standard Unwind / Rewind Arrangements

- Splice or Core Preparation on a New Roll/Reel
- Diameter Detection of Expiring Roll
- Positioning of the New Roll into Splice or Transfer
- Speed Match
- Firing of Knife / Roll Arrangement – Bump and Cut, Static Knife Arrangements, Cut-on Roll Arrangements
Standard Rewind Arrangement

1. chuck 1 (blue)
2. application roller, guide roller
3. turnstile
4. application roller, guide roller
5. chuck 2 (yellow)
6. cutting knife
7. following roller carriage with splice roller
8. expander roller
Standard Winder
Standard Unwind
Case Study Challenge No. 1

• A vertically integrated Aluminum foil manufacturer requires high speed commodity production for unsupported, thin aluminum unwind and light weight papers

• Problem – how to eliminate the scratches and wrinkling that occur at high speeds when the reel diameter is constantly changing due to the pay-off of material and make a reliable splice at high speeds
Case Study No. 1 - OEM RESPONSE

- 3300 FPM – Requires optimized mechanical and electrical integration to minimize knife and bump roll firing times. 10 milliseconds = 6.6 inches of material
- Unwind Can Be Loaded With Two Full Rolls Weighing 5 Tons Each as required for rapid roll prep
- Thin Aluminum foil requires Wrinkle and Scratch Free achieved by Special Lay-on System Configuration From Full Roll To Core
Aluminum Unwind
High speed firing of bump roll requires dampening of the mechanical system and dead rubber to prevent bounce
High Speed Foil Unwinder Result

- Consistently runs 17 - 30 gsm paper and 5.65 micron foils at 750 mpm for laminating
- Consistently unwind 17 - 30 gsm paper at 1000 mpm
- Has been demonstrated to run unsupported 5.65 micron foils continuously at 1000 mpm over three day period
- Splice rate exceeds 99.8%
Case Study Challenge No. 2

- A manufacturer of a high margin, difficult to process material requires continuous splicing to facilitate yield and downstream processing (over coating by extrusion and calendaring)
- Problem – how to reliably join weak, but expensive materials on a continuous basis in a limited space environment
Most Cuts are Tension Bursting
Butt-Splicer

Splice Options

Standard Splice

Butt Splice

Butt Splice with 2nd Cover Tape
Case Study No. 2 - OEM RESPONSE

- Delicate material cannot be exposed to high forces of bump and cut arrangement at splicing
- Space vs. speed limitations eliminate the use of accumulators
- Extrusion and calendaring require minimal thickness joint
- Material cost mandates minimal scrap and no splice imprints in roll to roll arrangement
- Single -Sided Butt arrangement is preferred option
Butt Splicing Mechanics

Starting Situation

- Adhesive
- Reflecting Tape
- Sensor
- Turret Unwind
- Splicing Station
Unwind

Butt-Splicer

Transfer to Vacuum Roll
Unwind

Butt-Splicer

Cutting Operation
Unwind

Butt-Splicer
Result of Case Study No.2

- Successful design and implementation of continuous butt splicing system – requires low tension, precise speed matching, rolling contact rather than bursting
- Achieved speeds of 250 fpm
- Near Zero yield loss due to splice tails, calendar tear-outs and splice imprints
- Splice rate success at 99.0%
Case Study Challenge No. 3

A Fortune 500 Converting Company Challenges OEM to develop a wrinkle free, bubble free, non-telescoping winder for unsupported, thin film, adhesive coated tapes.

OEM Response – Ad Hoc Design Team Created a Special Winder on a fast track
Standard Winder
Standard Winder

Features in Special Tape Winder

- Dancer Control With Special Design, Covering a Wide Tension Range
- Shaftless With Two Full Roll Diameters at the Same Time
- Different Film Widths In Each Spindle Position
- Automatic Web Alignment
- Contact Or Gap Winding by follower at Outboard position
- Single Transfer at Outboard position
- Transfer lay-on rolls cause wrinkles but prevent telescoping
Thinfilm Winder

1. Frame Cross-Beam
2. Winder Position Yellow
3. Follow and Bumping Roller
4. Spreader Roll
5. Winder Position Blue
6. Follow and Bumping Roller
7. Spreader Roll
Thin Film Winder
Thin Film Winders

Differences

• Two Layon Rolls are in contact at a constant angular relationship relative to the roll while the reel is turret indexing – eliminates wrinkles

• Two Transfer Systems

• One Winding Direction

• Separate Positions For Core Loading and Roll Unloading

• All Idler Rolls Are Driven

• Two Spreader Rolls
Current Developments that will become part of the Standard Winder

- No-Fold-Over At The Core at $> 1000$ mpm
- No Tape Preparation At Core at $> 1000$ mpm
- Above Features Shaftless
- Different Core Lengths
- Without Sacrifice of Splice Rate Performance At High Speeds on thin film webs
Demonstration of New Technologies

Buyer should require trial of their materials on a trial process line before committing -

3 micron films, 6 micron foils, 17gsm papers and other specialities at 5300 fpm, 51 inches wide
Summary

• Thanks to my colleagues at MMK and BMB for their assistance

• Thanks to AIMCAL for allowing me to participate on short notice

• Most of all – Thank You For Your Time and Attention

• Contact Bob Dages at bdages@kroenert.com for copies of the presentation
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