Increasing production through adhesive thermal conductivity

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Demand for corrugated boxes is intensifying and accelerating production speeds (while meeting and improving bond performance) is more critical than ever for corrugators.

**Increase production speeds & quality to raise output**

How can we speed up production and improve board properties?

- Improve drying rate of the adhesive
- Improve bond performance
- Reduce waste
The struggles with heat limited production

In multi-wall, heavy weight and specialty coated papers there are many situations where heat cannot effectively gel and dehydrate the adhesive before stress impacts bond quality.

• Most solutions are very complicated or capital intensive, such as:
  – Jet assist: Limited improvement
  – Application reduction (solids increase or reduce application)
    • Flexibility, costs, bond impact
  – Mechanical solutions (syphon, steam control, conditioning/hot plates)
• Heavy impact on product speed and quality
Now you can accelerate drying to maximize production speed

**How?** CORAGUM® TCE (Thermal Conductivity Enhancer)

- Revolutionary superconducting material based on nanoparticle technology
  - Dispersed short length fibers increase thermal conductance
  - Rapidly increases drying and dehydration of adhesives
- Additive is added directly into corrugating adhesive in very small doses
  - 10-35 oz. per 100 gallons, based on grade needs
Additive is easy & efficient to use: Automatically dosed at run tanks

- Minimize product usage to impacted grades by using only at the necessary addition points
  - Turn on or off by grade
  - Primarily target DB (double back) run tank addition
    - Single Face (SF) addition when necessary
- Can use existing resin/additive dosing
  - Optional: Integrate pump into run tank
- Can be formulated as needed to full batches if dosing or run tanks unavailable
Improving speed in double and triple wall

**Challenge:** Triple wall production speed issue in 55 and 82 lb. liners, 36 lb. mediums AAC
- Heavyweight production speed was limited due to DB bond failure

**Solution:** COARAGUM® TCE additive was added to double back only

**Result:** Increased speed by 30% with the additive at standard dose

**Challenge/Solution/Result:** Double wall production issue for 350BC, 23 and 33 lb. mediums
- 350BC (23 medium): 550 FPM increased to 700 FPM with TCE
- 350BC (33 medium): 500 FPM increased to 750 FPM with TCE

FPM: Feed per minute
Reducing edge delamination while using engineered medium at high speeds

**Challenge:** Fiber reducing medium has high stiffness, high density (high Gurley), requires higher conditioning and resists flute formation

- The bond on the edge of the sheet was disturbed by the blades at the slitter (slit from bottom) with immature DB bond

**Solution:** CORAGUM® TCE Thermal Conductivity Enhancer was made only in DB to reduce costs

- Hot plate temperatures were maintained to avoid over drying board
Reducing edge delamination while using engineered medium at high speeds

**Result:** Improved machine speeds on 44ECT and 55ECT and reduced delamination
Increasing speed in heavy weight single wall

**Challenge:** Speed limited heavyweight board issues in 90 lb. liner and 36 lb. wet strength medium

**Solution:** CORAGUM® TCE additive was dosed at both DB and SF

- Initially trialed only at DB, but SF bond suffered as speed increased
  - At first had a 25% speed improvement, but 20% dry pin reduction in SF bonds
- To maximize speed performance further optimized TCE additive dosage for each location
  - Full dose at DB, half dose at SF

**Result:** Achieved 30% speed improvement while increasing SF to run conditions
Reducing score damage and improving speed

**Challenge:** Double wall production issues in heavyweight grades

- Insufficient preconditioning heat and limited hot plate length
- Three Point Score stresses immature double back bond
  - Resulting poor fiber tear between the C flute and B flute web on the score line
- Machine speed needs to be reduced to avoid quality issues
- Significant waste from delamination
Reducing score damage and improving speed

**Challenge cont.**: Before treatment had poor fiber tear at normal operating speeds on Double wall, with delamination at scores
- Speeds had to be reduced by 40-60% to meet quality needs
- Dry pin values were acceptable except at score points

**Solution**: Treated with addition of CORAGUM® TCE additive at the DB station

**Result**: After treatment had solid fiber tear at full production speeds
- Grade speed increased 30-70%!
- Waste reduced significantly
Dry pin testing (including scored areas)

Board samples with and without CORAGUM® TCE additive showed good dry pin values over a range of speeds.

Dry pin testing of the scores showed marked decrease without CORAGUM® TCE additive as speed increased.

<table>
<thead>
<tr>
<th>Machine speed</th>
<th>Without TCE</th>
<th>With TCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500 FPM</td>
<td>45-55</td>
<td>45-55</td>
</tr>
<tr>
<td>&gt;700 FPM</td>
<td>0-20</td>
<td>45-55</td>
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</tbody>
</table>
Reducing score damage and improving speed

**Results cont.**

- Double wall speed increases of 25-75% led to an overall monthly production increase of over 10%
- Waste reduced by 20% overall
  - Primary - loose liner with double wall
- Production was so far ahead of conversion that plant was able to take additional downtime for needed maintenance

**Operator confidence**

- When you’re not afraid to run the way you can because you just know it will work
Improve speed and performance with less waste today

• Faster machine speeds
  – Improved thermal conductivity of corrugating adhesive, leading to faster drying and increased production speeds
  – Improved performance and efficiency on heat-limited production

• Improves board properties
  – Produces flatter, drier boards with improved printability and overall strength

• Reduced waste
  – Reduces blistering and delamination

Use CORAGUM® TCE additive in:
• Multiwall board
• High density paper
• Heavyweight paper
• Specialty paper
Let’s get started!

Let us help you solve your corrugating challenges

Contact us
1-800-713-0208 | ingredion.us/corrugating

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Thank you