Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Today’s Presenter

Tom Gilbertson
Vice President Application Engineering

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Overview

Surface Treating Basics
Define your application
Specify the right corona treater
  - Electrode options
  - Roll coverings
Get the installation right-Optimize your line layout
Understand operating variables & Troubleshooting tips
Review
Final Questions

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Surface Treating Basics

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Surface Treating Basics

What is Corona Treatment?

• Corona treaters increase the surface energy of plastic film, foils and paper so that inks, coating and adhesives will “wet-out” and adhere to the surface.
• A Capacitor
Surface Treating Basics

What does corona do to the film surface?

- Forms low-molecular-weight (LMWOM) on film surface
- Oxidizes film surface
- Forms positive & negative sites by adding & deleting electrons
Surface Treating Basics

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Surface Treating Basics Questions?
Defining the Application

Equipment is defined by the application

- Types of film being treated (slip)
- Number of sides being treated
- Speed of line
- Goal of treatment/power required
- Web Treatment requirements
  - Lanes
  - Skip
  - Pattern
- Cost/performance roll coverings

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Defining the Application

Equipment is defined by the application

Example

- Line Speed
- Power Supply
- Roll Size
- System Cost
Defining the Application

Why defining the application is important.
Impact of Line Speed Requirement.
Defining the Application Questions?
Equipment Selection - Electrodes

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Equipment Selection - Electrodes

Two application issues which help define electrodes style

- Fixed width electrode?
  - Ceramic Electrodes
  - Metal Electrodes

- Variable electrode?
  - Metal Electrodes
  - Segmented

*Unless the lanes are across the width of the web & then skip treating can be used*
Equipment Selection - Electrodes

Three types of electrodes:

- Ceramic Tubes
- Stainless Steel Fixed Width
- Stainless Steel Segments
Equipment Selection - Electrodes

Fixed width ceramic electrodes

• Most commonly used in printing, coating & laminating
• May be used for blown and cast film lines
  • without lane treating requirements
Equipment Selection - Electrodes

Fixed width ceramic electrodes

- Bare roll
Equipment Selection - Electrodes

Fixed width ceramic electrodes

- Universal Roll
  - High Definition Corona
Equipment Selection - Electrodes

High Definition Corona
Atomic Force Microscopy (AFM) Three Dimensional View

RMS(Å)
HD = 182.2
STD = 214.8

High Definition Corona
Standard Corona

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Equipment Selection - Electrodes

High Definition Corona Benefits

• Extremely high dielectric constant
• Temperature stabilizing cooling system
• Superior capability for high power densities
• 50% more power per square inch to each electrode results is a higher treatment level
Equipment Selection - Electrodes

High Definition Corona Benefits

• Proprietary ceramic blend formulation optimized for numerous application challenges.
• Minimizes the chances of roll covering burnout
• Best insurance against pin holing, backside treatment and film wrinkling.
Equipment Selection - Electrodes

High Definition Corona

- when to consider
  • Downstream treating
  • Without lane treating requirements
Equipment Selection - Electrodes

Electrode Assembly Exhaust
- Air flow
  - Cools electrode
  - Removes ozone

OZONE EXHAUST AND COOLING AIR FLOW PATH

Grounded Aluminum Shield

ALUMINUM EXHAUST TUBE (CONNECTS TO EXHAUST DUCT)

Air Gap

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Equipment Selection - Electrodes

Fixed width electrodes with covered roll

- Use for blown and cast film lines
  - without lane treating requirements
Equipment Selection - Electrodes

Stainless Steel Segmented Electrodes

• Use for blown and cast film lines with lane or skip treating
• Available in ¼” and 1/2”
• Positive positioning
Equipment Selection - Electrodes

Covered Roll System Design

- Air flow
  - Cools electrode
  - Thermal stability
- Removes ozone
Equipment Selection - Electrodes

Stainless Steel Segmented Electrodes

- Aluminum electrodes create aluminum-oxide
  - Nasty compound which makes electrode segments stick
Equipment Selection - Electrodes

Stainless Steel

- Flip Segments
Equipment Selection - Electrodes

Enercon Easy Thread™ Corona Treater
Equipment Selection - Electrodes

- Aluminum thermal profile
  - Segments heat up
  - Thermal expansion
    - Can’t expand, so they twist
      - Inconsistent gap = Inconsistent treatment
        - Some operators will try to increase the gap, but the electrodes don’t expand the same & will stick together
      - Worse case scenario: scrape the roll
  - Don’t be fooled by coated aluminum coatings
  - For more on this topic e-mail me for a copy of a technical article - just mention “Rubber Mallet”
The Application
The Application - Pattern Treatment

Lane Treatment is the most common application

- In the web direction, only with metal segmented electrodes
The Application - Pattern Treatment

Pattern Corona Treating

- Ideal for heat seal bag applications
The Application - Pattern Treatment

Skip Treatment

- No treat zones across the entire width of the web
- Available with ceramic and metal electrode systems
The Application - Pattern Treatment

Pattern Corona Treating

- Skip Treat Controller
  - Programs corona treater to turn on and off for treat and no treat zones

![Skip Treat Diagram]

- Current Values
  - Bag Length = 1234 in
  - #1 Skip Length = 1234 in
  - #2 Skip Length = 1234 in
  - Printer to Treater Distance = 12345 in
The Application - Pattern Treatment

Pattern Corona Treating

• Virtually any treatment pattern
Electrode Selection Questions?
Equipment Selection - Roll Coverings

Considerations

- Typical Line Speed
- Power Supply kW
- Type of Dielectric
- Core Construction
  - Size of roll
    - Does the roll need to be driven?
    - Does it need to be water cooled
# Equipment Selection - Roll Coverings

Dielectric covering comparison

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness</th>
<th>General Guideline</th>
<th>Core Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone</td>
<td>.125</td>
<td>450 sq. inch/kw</td>
<td>Aluminum or stainless</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>steel</td>
</tr>
<tr>
<td>Epoxy</td>
<td>.125</td>
<td>450-500 sq. inch/kw</td>
<td>Aluminum or stainless</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>steel</td>
</tr>
<tr>
<td>Ceramic</td>
<td>.060-.080</td>
<td>250-300 sq. inch/kw*</td>
<td>Stainless Steel</td>
</tr>
</tbody>
</table>
# Equipment Selection - Roll Coverings

Dielectric covering comparison

<table>
<thead>
<tr>
<th>Material</th>
<th>Cost</th>
<th>Performance Wear Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone</td>
<td>Low</td>
<td>Basic</td>
</tr>
<tr>
<td>Epoxy</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>Ceramic</td>
<td>High</td>
<td>Better</td>
</tr>
</tbody>
</table>

When comparing system proposals be sure to evaluate all aspects of the treater: including roll coverings.

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
# Equipment Selection - Roll Coverings

## Dielectric covering comparison

<table>
<thead>
<tr>
<th>Material</th>
<th>Reasons for failure</th>
</tr>
</thead>
</table>
| Silicone | Soft - subject to physical damage (such as cutting)  
Failure also caused by ozone, heat, & time |
| Epoxy    | Resistant to physical damage  
Failure generally caused by ozone, heat, & time |
| Ceramic  | Subject to physical damage from collision  
Failure generally caused over time |

#1 cause of failure is lack of maintenance
Equipment Selection - Roll Coverings

How to Increase Roll Life

• Keep Roll Surface Clean
• Never Use a Metal Brush to Clean
• During Repairs, Remove All Carbon
• Don’t Overpower
• Proper Design & Construction
Roll Covering Selection Questions?

Q?
Optimizing Line Layouts

Blown and cast film line layouts

- As important as equipment selection
- Avoid problems by optimizing web paths
Optimizing Line Layouts

Blown Film applications

- Treating the outside of the film is straightforward.
- A two-sided covered roll system with stainless electrodes works well for this type of application.

Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines
Optimizing Line Layouts

Treating Slit Film

- Cleanest and simplest layout uses two single sided corona treaters
- Simple web path for threading
- Film follows relaxed natural path for reliable treatment results
Optimizing Line Layouts

Treating Slit Film

- More delicate than tube treating
- Careful handling required
- Tendency to wrinkle which leads to:
  - Backside treatment
  - Uneven treatment levels
- Figure 1 layout where treatment occurs after slitting is **not desirable**
Optimizing Line Layouts

Treating Slit Film

- Complex web paths after slitting permits use of one additional two sided surface treater
- Requires multiple idler rolls and nip rolls which add significantly to the cost and size of the station
- This concept is **not desirable**
  - Cost
  - Potential web handling issues causing backside treatment.

*Figure 2*

**Avoid**

_Mastering Corona Treaters, Roll Coverings & Electrodes for Extrusion Film Lines_
Optimizing Layout Questions?
You Control the Amount of Treatment
(aka watt density)

\[ Wd = \frac{PSO}{EW \times LS \times NST} \]

- **Wd** = Watt Density (W / ft² or m² / minute)
- **PSO** = Power Supply Output (W)
- **EW** = Electrode Width (feet or m)
- **LS** = Line Speed (ft or m / minute)
- **NST** = Number of Sides Treated
Troubleshooting Tips – Watt Density

Starting point…

- LLDPE… 1.5 to 2.0 w/ft2/min
- LDPE….. 1.5 to 2.0 w/ft2/min
- CPP……2.0 to 3.0 w/ft2/min
- BOPP…. 2.5 to 5.0 w/ft2/min
- BOPET….1.0 to 2.0 w/ft2/min

Variations in resin blend additives and process conditions will affect treatment results.
You can not use watt density to predict dyne levels
System parameters | Material parameters | Process parameters
Troubleshooting Tips

Most problems are identified because of an insufficient dyne level reading
Troubleshooting Tips

Dyne level measuring procedures

• Best procedures need to be followed by your team and your customer
• Results can be subjective
Dyne Levels Provide a Quick Check

Dyne levels do not guarantee adhesion!
Troubleshooting Tips

If the corona treater is responsible

- Check watt density levels
- Check air gap
- Check interlock faults
  (was the treater on?)
Troubleshooting Tips

Process inconsistencies…What Changed?

- Line Speed
- Film
- Resin
  - Recent change of additives?
  - Recent change of resin supplier?
- Temperature (chill roll or bubble cooling)
  - Variances in film temperature
  - Warm film has a greater responsiveness to corona treatment.
  - If film temperature is not properly maintained treatment results can vary
Troubleshooting Tips

Post Shipment dyne level changes

• Natural decay
  • Long inventory
  • Environmental conditions
• Additives rising to the surface
• Misreading of dyne level by the converter
  (remember dyne level does not equal adhesion)
Troubleshooting Tips

Your best customers are Smart Converters who bump treat!
Troubleshooting Tip Questions?

Q?
Summary

Define the Application
Affects equipment selection & ultimate ROI
Summary

Electrode Selection
Defined by the application
Fixed, Skip, Lane & Pattern
Summary

Roll Coverings
Trade-off between cost and life expectancy
Routine Maintenance
Summary

Troubleshooting Tips
Understanding dyne levels
Corona Treater Checks
Ask “What has changed?”
Summary

Installation Tips
Natural relaxed web path than a corona treater
Questions

Tom Gilbertson
Enercon Industries
+1 (262) 255.6070
tgilbertson@enerconmail.com
www.enerconind.com/treating
Thank you