Coating Technologies for Adhesive Applications

Presented by:
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Black Clawson Converting Machinery
CHOOSING THE RIGHT COATER

Coating heads have a variety of applications, strengths and weaknesses. How do you objectively select the right coating head for today's needs and tomorrow's potential needs?
The Coating Process
COATER SELECTION CRITERIA

- Coatweight
- Solids
- Viscosity
- Shear Stability
- pH
- Solvent Based
- Water Based
- 100% solids
- Hot Melt

- Linespeed
- Substrate
- Finished criteria
- End use
- Appearance
- Company’s Geographic Location
- State’s Regulations
- Quality of Workforce
## COATING PROPERTIES

### ADHESIVES

<table>
<thead>
<tr>
<th>Application</th>
<th>Coatweight GSM Dry</th>
<th>Viscosity CPS</th>
<th>Percent Solids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water based</td>
<td>1.0 - 80</td>
<td>50 - 1,000</td>
<td>20 - 70</td>
</tr>
<tr>
<td>Solvent based</td>
<td>2.0 - 60</td>
<td>200 - 50,000</td>
<td>25 - 50</td>
</tr>
<tr>
<td>100% solids</td>
<td>0.5 - 4</td>
<td>500 - 3,000</td>
<td>100</td>
</tr>
<tr>
<td>2 component</td>
<td>0.5 - 4</td>
<td>1,000 - 20,000</td>
<td>100</td>
</tr>
<tr>
<td>Gum</td>
<td>20 - 30</td>
<td>500 - 2,000</td>
<td>50 - 80</td>
</tr>
<tr>
<td>Starch</td>
<td>10.0 - 30</td>
<td>50 - 2,000</td>
<td>25 - 40</td>
</tr>
<tr>
<td>Latex</td>
<td>10.0 - 40</td>
<td>200 - 2,000</td>
<td>30 - 45</td>
</tr>
<tr>
<td>Hotmelt</td>
<td>5.0 - 100</td>
<td>1,000 - 200,000</td>
<td>100</td>
</tr>
</tbody>
</table>

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## COATER PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>Gravure coater</th>
<th>Rod coater</th>
<th>Knife</th>
<th>Die</th>
<th>Hot Melt</th>
<th>Reverse roll</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gravure Direct</td>
<td>Gravure Direct</td>
<td>Gravure Indirect</td>
<td>Single Rod</td>
<td>Die</td>
<td>Hot Melt</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Reverse</td>
<td>Forward</td>
<td>Rod or Smoothing Bar</td>
<td>Direct</td>
<td>3 Roll Pan Fed</td>
</tr>
<tr>
<td></td>
<td>Gravure</td>
<td>Gravure</td>
<td>Indirect</td>
<td></td>
<td>Contact</td>
<td>3 Roll Nip Fed</td>
</tr>
<tr>
<td></td>
<td>Indirect</td>
<td>Indirect</td>
<td>Reverse</td>
<td></td>
<td>Die</td>
<td>3 Roll Fountain Feed</td>
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<table>
<thead>
<tr>
<th>MAX SPEED</th>
<th>FPM</th>
<th>3280</th>
<th>3280</th>
<th>2000</th>
<th>490</th>
<th>2000</th>
<th>3280</th>
<th>985</th>
<th>820</th>
<th>1150</th>
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</thead>
<tbody>
<tr>
<td>SOLIDS</td>
<td>%</td>
<td>0.1-100</td>
<td>0.1-100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0.1-100</td>
<td>0.1-100</td>
<td>100</td>
</tr>
<tr>
<td>VISCOSITY</td>
<td>CPS</td>
<td>30-2000</td>
<td>30-2000</td>
<td>15-800</td>
<td>500-50000</td>
<td>500-20,000</td>
<td>up to 300,000</td>
<td>50,000</td>
<td>500,000</td>
<td>200-40,000</td>
</tr>
<tr>
<td>COATWEIGHT</td>
<td>Lbs/3000 SqFt dry</td>
<td>.6 - 18.4</td>
<td>.6 - 18.4</td>
<td>15.4</td>
<td>61.4</td>
<td>61.4</td>
<td>500-20,000</td>
<td>up to 250</td>
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</table>
Each of the coaters has the ability to apply most adhesives but each has different limitations.

<table>
<thead>
<tr>
<th>Adhesive</th>
<th>Gravure</th>
<th>Die</th>
<th>Rod</th>
<th>Reverse Roll</th>
<th>Flex Bar</th>
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<tbody>
<tr>
<td>Water Based</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Solvent Based</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hot Melt</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
GRAVURE COATERS
**GRAVURE CELL PATTERNS**

**Pyramid**
Mechanical engraved cell - the traditional and original shape.

**Quadravigravure**
Mechanical engraved cell - which has a flat bottom to help promote good ink release. Used in printing and coating applications.

**Rotoflo™ Pyramid**
Mechanical engraved cell - specially designed by Pamarco. It offers an offset and linked cell structure to promote excellent ink release and eliminates striation.

**Rotoflo™ Quadravigravure**
Mechanical engraved cell - used in the Printing industry particularly the corrugated market due to its high volume and good ink release characteristics.

**Tri-Helical**
Mechanical engraved cell - helicoidal engraving used for high viscosity and high volume applications.

**PGCH™**
Mechanical engraved cell - excellent release characteristics, primarily used in gravure coating and laminating industries.
## Gravure Coatweight Charts

### Quadrangular Cell

<table>
<thead>
<tr>
<th>Cell Depth</th>
<th>Volume</th>
<th>5% Solids</th>
<th>15% Solids</th>
<th>25% Solids</th>
<th>35% Solids</th>
<th>45% Solids</th>
<th>50% Solids</th>
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<tbody>
<tr>
<td>0.0012</td>
<td>5.7</td>
<td>0.22</td>
<td>0.32</td>
<td>0.48</td>
<td>0.71</td>
<td>1.05</td>
<td>1.31</td>
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<tr>
<td>0.0015</td>
<td>7.5</td>
<td>0.27</td>
<td>0.40</td>
<td>0.60</td>
<td>0.89</td>
<td>1.31</td>
<td>1.63</td>
</tr>
<tr>
<td>0.0018</td>
<td>9.4</td>
<td>0.33</td>
<td>0.48</td>
<td>0.72</td>
<td>1.07</td>
<td>1.58</td>
<td>1.96</td>
</tr>
<tr>
<td>0.0022</td>
<td>10.9</td>
<td>0.30</td>
<td>0.49</td>
<td>0.80</td>
<td>1.30</td>
<td>1.93</td>
<td>2.39</td>
</tr>
<tr>
<td>0.0025</td>
<td>13.3</td>
<td>0.46</td>
<td>0.68</td>
<td>1.00</td>
<td>1.48</td>
<td>2.19</td>
<td>2.72</td>
</tr>
<tr>
<td>0.0028</td>
<td>15.0</td>
<td>0.51</td>
<td>0.76</td>
<td>1.12</td>
<td>1.66</td>
<td>2.45</td>
<td>3.05</td>
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<tr>
<td>0.0030</td>
<td>16.0</td>
<td>0.55</td>
<td>0.81</td>
<td>1.20</td>
<td>1.78</td>
<td>2.63</td>
<td>3.26</td>
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<tr>
<td>0.0032</td>
<td>17.2</td>
<td>0.59</td>
<td>0.87</td>
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<td>1.89</td>
<td>2.80</td>
<td>3.48</td>
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<tr>
<td>0.0039</td>
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<td>0.71</td>
<td>1.05</td>
<td>1.56</td>
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<tr>
<td>0.0044</td>
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<td>1.19</td>
<td>1.76</td>
<td>2.61</td>
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<tr>
<td>0.0049</td>
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<td>0.90</td>
<td>1.32</td>
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</tr>
<tr>
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<td>0.98</td>
<td>1.46</td>
<td>2.16</td>
<td>3.20</td>
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<tr>
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<td>1.62</td>
<td>2.40</td>
<td>3.55</td>
<td>5.26</td>
<td>6.53</td>
</tr>
<tr>
<td>0.0065</td>
<td>40.4</td>
<td>1.19</td>
<td>1.76</td>
<td>2.60</td>
<td>3.85</td>
<td>5.69</td>
<td>7.07</td>
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<tr>
<td>0.0068</td>
<td>44.5</td>
<td>1.24</td>
<td>1.84</td>
<td>2.72</td>
<td>4.03</td>
<td>5.96</td>
<td>7.40</td>
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<tr>
<td>0.0070</td>
<td>46.6</td>
<td>1.28</td>
<td>1.89</td>
<td>2.80</td>
<td>4.14</td>
<td>6.13</td>
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<tr>
<td>0.0090</td>
<td>58.7</td>
<td>1.64</td>
<td>2.43</td>
<td>3.60</td>
<td>5.33</td>
<td>7.88</td>
<td>9.79</td>
</tr>
<tr>
<td>0.0120</td>
<td>81.0</td>
<td>2.19</td>
<td>3.25</td>
<td>4.80</td>
<td>7.10</td>
<td>10.51</td>
<td>13.06</td>
</tr>
<tr>
<td>0.0170</td>
<td>117.0</td>
<td>3.11</td>
<td>4.60</td>
<td>6.80</td>
<td>10.06</td>
<td>14.89</td>
<td>16.50</td>
</tr>
</tbody>
</table>
Gravure Coating Example

Example: **Protective Film**

- Pressure Sensitive Adhesive
- Reverse Gravure with PGH
- Coater Setup:
  - Backup Roll - 65 Shore ‘A’ Buna N
  - Gravure Roll - 110 TH vol. of 23.0 BCM
  - Backup / Gravure Nip = 1/8”
  - Gravure Speed = 110% of Linespeed
  - Coatweight = 3 lbs. / Ream
  - Substrate - Film
Die Coaters
Die Coating Example

Example: Label Product

• Pressure Sensitive Adhesive @ 56% solids
• Substrate - 40# SCK Release Liner
• Laminate Web - Face Stock

Coater Setup:
• Backing Roll - 70 Shore ‘A’
• Die Slot Height = .010”
• Bottom Lip Step = .005”
• Die Lip width = ¼”
• Die Angle = -3 degrees from tangent
• Die to Web Gap = -.003”
Rod Coaters
WET FILM THICKNESS

\[
\frac{\text{DRY COATWEIGHT} (\#/\text{ream})}{\text{PERCENT SOLIDS}} = \text{WET COATWEIGHT} (\#/\text{ream})
\]

\[
\text{if 1 mil} = 15 \text{ pounds}
\]

\[
\frac{\text{WET COATWEIGHT} (\#/\text{ream})}{15 (\#)} = \text{WET FILM THICKNESS (mils)}
\]

**NOTE:** 15 pounds is a generality, the density of the coating may change this number. However for most coatings it provides a good starting point.
HOW TO SIZE THE ROD

SAMPLE CHART

- Wet film thickness = rod size
- Engraved rods use the same charts
- Laboratory draw down rods available for screening

chart from Consler Scientific Design, INC.
Rod Coating Example

Example: Packaging Tape

- Solvent Based Natural Rubber Adhesive @45% solids
- Substrate - Paper of Film
- Coater Setup:
  - Backup Roll - Kiss coat with hold down rolls
  - Applicator Roll - Precision Chrome Plated
- Pan Fed
- Coatweight = 25 lbs. / ream
- Rod size #34 Rod
Reverse Roll Coaters
Reverse Roll Coating Example

Example: Label Product

- Pressure Sensitive Adhesive 56% solids
- Substrate - 40# SCK Release Liner
- Laminate Web - Face Stock
- Coatweight = 16 lbs. / ream

Coater Setup:
- Backing Roll - 70 Shore ‘A’
- Applicator Roll - Precision Chrome Plated
- Metering Roll - Precision Chrome Plated
- Applicator / Metering Gap + .002”
Flex Bar Coater
Flex Bar Coating Example

Example: Tape

- Solvent Based Adhesive @ 37% solids
- Substrate - Film
- Coater Setup:
  - Backup roll - 65 Shore ‘A” Buna N
  - Applicator Roll - Precision Chrome Plated
  - Flex Bar @ 6 o’clock position
- Coatweight = 22.9 lbs. / Ream
- Flex Bar / Applicator roll Gap = .004”
# SELECTING THE CORRECT COATER

<table>
<thead>
<tr>
<th></th>
<th>Gravure</th>
<th>Die</th>
<th>Rod</th>
<th>Reverse Roll</th>
<th>Flex Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Based</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Slovent Based</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Hot Melt</strong></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Viscosity</strong></td>
<td>&lt;2000 CPS</td>
<td>1-100,000 CPS</td>
<td>&lt;2000 CPS</td>
<td>1-100,000 CPS</td>
<td>1-100,000 CPS</td>
</tr>
<tr>
<td><strong>Thickness</strong></td>
<td>.1-2mil</td>
<td>.1-30 mil</td>
<td>.1-5 mil</td>
<td>1–30 mil</td>
<td>1-30 mil</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>&lt;1250 fpsm</td>
<td>Up to 3000 fpsm</td>
<td>&lt;1000 fpsm</td>
<td>Up to 2000 fpsm</td>
<td>Up to 2000 fpsm</td>
</tr>
</tbody>
</table>
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THANK YOU