Building Micro Surface Texturization For White Inks And Coatings In Flexo

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Introduction

- Issues with white ink
- Why is white ink so important?
- Initiation of project to address white needs
- Lessons along the way
  - Size Matters!
  - Measurement Parameters & Bounce
- Custom target and results
- Conclusion
Issues With White Inks

- **Color / Appearance**
  - *White inks are the foundation of many colors for packaging*
  - *Pinholes in the white result in inconsistent color for inks overprinting it, and traditional “muddy” colors in Flexo*

- **Economics / Productivity**
  - *50% of ink spend in most flexible packaging facilities is white today*
  - *White is the heaviest ink deposit, requires most drying, so controls press speeds*
Pinholes Relate To The Color, Color Cleanliness And Final Tonal Range

- Image shows 2 pictures of same white over a black background, one with pinholes, one without
- Color overlay with 50% transparency illustrates the effect caused by pinholes
- Circle represents spectro aperture – do the measurements change?

Pinholes affect the measured color, effectively turning it darker, and increasing variability in the measurements e.g. $\Delta E = ??$
Development Project – Not So Easy

- Q4 2012 initiated by 2 printers using NX plates
  - One using Kodak for all plates
  - One using Kodak for all but white
- Project looked for how to optimize press conditions for white using standard DigiCap NX
- Press / component variables tested included:
  - Ink pigmentation, grind levels, ink viscosity, ink temperature
  - Anilox volume, anilox lpi, anilox format (60°, E-Flow, GTT, etc)
  - Tape compressibility, press speed, press formats, substrates, etc.
Progressive Development Of Patterns

- Results highlighted importance of size, mottle, and controlled flow
- Resulted in development of custom patterns and features to optimize ink laydown
- The steps were:

![Progressive Development Of Patterns Examples]

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## Initial Checkerboard Patterns & White Images

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Magnification</th>
<th>440 LPI</th>
<th>7 bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.2 167.65</td>
<td>50X 1:1 200X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52.0 152.94</td>
<td>50X 2:2 200X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52.1 200.00</td>
<td>50X 3:3 200X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51.6 182.35</td>
<td>50X 4:4 200X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51.2 176.47</td>
<td>50X 5:5 200X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Size Alone Was Not Enough – What Next

- Utilizing the SQUAREspot head using the 5x10 micron feature (½ pixel) in DigiCap NX
- Applied for mottle reduction
- Applied various shapes to evaluate a variety of properties
- Unmatched consistency and repeatability in fine details
Test Target Using 5x10 Micron Features

- Sample pattern structures with DigiCap NX applied to address mottle
- Improved results but still not satisfied
## Pictures & Measurements @ 50X

- Opacity measurements aligned with expectations.
- Ink film weight did not follow same logic.

### Measurement Table

<table>
<thead>
<tr>
<th>DIGICAP 50X</th>
<th>0.5x1</th>
<th>1x1</th>
<th>1.5x1</th>
<th>2x2</th>
<th>2.5x3</th>
<th>3x3</th>
<th>3x3B</th>
<th>4x4</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.3</td>
<td>48.3</td>
<td>49.2</td>
<td>49.0</td>
<td>48.4</td>
<td>47.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78.0</td>
<td>66.6</td>
<td>220.2</td>
<td>118.2</td>
<td>98.4</td>
<td>106.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Pictures & Measurements @ 200X

- 200X magnification shows greater details
- Pin-holes were not solved in any case
- 3x3B vs 3x3 showed promise
- Highlights use of high magnifications around 200X to gain greater understanding and optimization

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Lessons Learnt Along The Way

- Size matters
  - *The pattern structure must match the anilox volume range*

- What to measure
  - *Dry ink film weight is not reliable enough, don’t use it*
  - *Opacity is a good guide but not enough alone*
  - *Visual inspection for mottle / pin holes is required*
  - *Mottle can be measured for verification*

- Bounce is extremely important
  - *Need to address bounce in the design of the targets*
  - *Need sufficient measurements to eliminate effect*
3D Representation Of White Opacity From A Solid White Patch

400 Measurement Per Patch
Multiply Vertical Scale by 100 For Opacity
Press Harmonics Around The Cylinder Also Needs To Be Addressed

- Image shows white opacity around a print cylinder
- Range of measurements is often bigger than normal difference in tests
- Need to take sufficient measurements to average results
- Highlights that spot opacity measurements alone is not sufficient

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**Resulted In A Unique Banded Plate Test Target**

<table>
<thead>
<tr>
<th>Web Print Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>9x250mm solid strips with each DigiCapNX pattern going around repeat</td>
</tr>
<tr>
<td>9x250mm 110lpi tint strips with each DigiCap NX pattern</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pattern ID label:</th>
<th>Plate type ID label</th>
</tr>
</thead>
<tbody>
<tr>
<td>50x50mm squares of each DigiCapNX pattern including pattern ID label</td>
<td>50x50mm squares of each DigiCapNX pattern including pattern ID label</td>
</tr>
</tbody>
</table>
Sample View Of The Surface Patterns

- Limited set of custom patterns developed for use with high volume anilox rolls
  - *Initially suited to white solvent based inks and coatings*

- Simple process to identify correct pattern for ink and anilox combination
  - *Uses opacity measurements and magnified visual inspection*

SEM Image At 500X

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Real White Ink Print Example @ 200X

Low Volume
Opacity = 56.2

Mid Volume
Opacity = 58.5

High Volume
Opacity = 62.7

Low Volume
Opacity = 58.1

Mid Volume
Opacity = 60.2

High Volume
Opacity = 64.1
Conclusion

- Pin-holes are a critical factor in the performance of inks, especially white inks and coatings
- White is the foundation for all other colors and should be a key focus for color and consistency
- Kodak have developed specific plate surface technologies to allow minimized pin-holes and increased opacity with the same or less ink
  - *Focused on simple application based on anilox volume range used*
- This technology provides benefits in terms of:
  - *Color gamut, color cleanliness, shelf impact*
  - *Productivity and press efficiency*
Any Questions?

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