Digital Textile Printing Technology Overview

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SGIA Vice President-Technical Services

Agenda

• Global Print Drivers & Market Share
• Market Status of Digital Inkjet
• Review of Inks and Printer Categories
• Outlook
Global Print Drivers

- Decline in run length
- Shorter lead times
- Full color
- Variable data
- Personalization/Customization
- Web-to-Print
- Digital

Market Status – Digital Inkjet

- Increasingly important in a wide range of formats and applications
- Offers multiple benefits
  - On-demand
  - Variable data
  - Customization
  - Full-color
- Becoming the new decoration process
- Technology/consumable costs continue to drop
Current State of Digital Inkjet Technology

= Digital Penetration

15%-30% Growth/yr.

Textile
Packaging
Product Decoration

Graphics
Tile

= Digital Penetration

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Current State of Digital Inkjet Technology

Aqueous WF Graphics
WF Solvent
WF Eco

Mature Market
Accelerated Growth

Slow Growth
Emerging Market

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Textile Markets

- **Technical Textiles**
  - Automotive
  - Specially Designed
- **Home/Furnishings/Interior Design**
  - Drapery
  - Upholstery
  - Linens
  - Carpets/Rugs
- **Fashion Apparel**
  - Dresses, skirts, blouses, shirts, scarves, neckties
- **Graphic**
  - Sign/banner, trade show/exhibit, retail

Digital Textile Vertical Markets

- **Apparel**
  - Fashion Apparel – Women’s Wear, Men’s Wear, Children’s Wear
  - Sports Apparel – apparel/uniforms, active-wear, swimwear
Digital Textile Vertical Markets

• Flags – Feather/Teardrop, National, Car, Event, Advertising

Digital Textile Vertical Markets

• Industrial/Architectural – Automotive, awnings, tents
Digital Textile Vertical Markets

- Interior Décor – Window coverings, wall coverings, flooring, upholstery, outdoor furniture, bedding

Digital Textile Vertical Markets

- Soft Signage
- Indoor/Outdoor Advertising
- Fine Art
- Tradeshows
- Displays
- Events/Entertainment
Current State of Digital Textile Printing

- Growth in all vertical markets
  - Home Furnishings
  - Apparel
  - Flag/Banner
- Speed continues to improve
- Costs continue to drop
  - Ink
  - Hardware
- Production level printers are online

Technology Mix – All Textiles* (* = Approx.)

- Digital Inkjet (5%)
- Digital - Other (5%)
- Flat Screen (35%)
- Other Platforms (5%)
- Rotary Screen (50%)
Ink Chemistries & Compatible Fibers

<table>
<thead>
<tr>
<th>Fiber</th>
<th>Acid</th>
<th>Disperse/Dye Sub</th>
<th>Pigment</th>
<th>Reactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nylon</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nylon/Lycra</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Polyester</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Silk</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cotton</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cotton/Poly Blends</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Viscose/Rayon</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Linen</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Wool</td>
<td>●</td>
<td>○</td>
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<td>○</td>
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</tbody>
</table>

● = Recommended  ○ = Possible

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Ink Chemistry

- Pigment 2%
- Reactive Dye 28%
- Acid Dye 10%
- Dye Sub Transfer 52%
- Direct Disperse 8%
Ink Chemistries & Compatible Fibers

• Acid Dyes
  • organic acid (sodium or ammonium)
  • affinity for protein fibers like wool, alpaca, mohair
    • also effective on silk and nylon
    • does not work on other synthetic fibers

• Acid Dye Printers:
  • DigiFab (StampJet)
  • Konica Minolta (Nassenger)
  • SHIMA SEIKI (SIP)
  • Expand Systems (Diva)
  • Mutoh (1628TD, 2628TD)

Ink Chemistries & Compatible Fibers

• Reactive Dyes
  • most used method for the coloration of cellulosic fibers (cotton, Rayon, hemp, linen, bamboo)

• Reactive Dye Printers:
  • Mimaki (TX500)
  • Expand Systems (Diva)
  • Mutoh (1628TD, 2628TD)
  • d.gen (Teleios Grande, Hexa)
  • DGI (FD1908, FD1904)
Ink Chemistries & Compatible Fibers

• Disperse
  • limited to polyester
• Disperse Printers
  • low energy: Epson, Mimaki, Mutoh, Roland, etc., etc.
  • high energy: ATPColor Srl, d.gen, DigiFab, Durst, EFI, Expand Systems, Hollanders

• Pigment
  • Coated fabrics
• Pigment Printers
  • d.gen, Expand Systems, Kornit, MS Printing Solutions SRL, Reggiani Macchine SpA
Ink Chemistries & Compatible Fibers

• **Latex**
  - water based ink using latex as the pigment binder
  - comes out of the printer fully dried and “ready-to-use”
  - eco-friendly vs. solvent ink
  - “graphic” applications only (backlit, banner, signage)

• **Latex Printers**
  - Mimaki (JV400LX)
  - HP
    - Low-Volume: 110, 310, 330, 360, 370
    - Mid-Volume: 850, 3100, 3500

Ink Chemistries & Compatible Fibers

• **UV**
  - uses acrylic monomers with a photoinitiator
  - 100% solids
  - “graphic” applications only (backlit, banner, signage)

• **UV Printers**
  - EFI
  - Durst
  - Mimaki
  - Roland
Printer Categories

<table>
<thead>
<tr>
<th>Category I</th>
<th>Acid</th>
<th>Disperse</th>
<th>Dye Sub</th>
<th>Pigment</th>
<th>Reactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5-30 Linear m/hr.)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Category II</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>31-100 Linear m/hr.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Category III</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>*</td>
<td>X</td>
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<tr>
<td>101-400 Linear m/hr.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Category IV – Single Pass</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>*</td>
<td>X</td>
</tr>
<tr>
<td>(20-100 Linear m/min.)</td>
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<td></td>
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</tbody>
</table>

X = Available Now  * = In Development

Single-Pass

<table>
<thead>
<tr>
<th>Company</th>
<th>Model</th>
<th>Max. Width</th>
<th>Variable Drop Size</th>
<th>Ink System</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Printing Solutions</td>
<td>Lario</td>
<td>Up to 3,200 mm</td>
<td>4-72 pL</td>
<td>Acid, Disperse, Pigment, Reactive</td>
<td>75 Linear m/min.</td>
</tr>
<tr>
<td>Konica Minolta</td>
<td>Nasserger SP-1</td>
<td>Up to 1,830 mm</td>
<td>6-30 pL</td>
<td>Acid, Disperse, Reactive</td>
<td>6,400 m²/hr.</td>
</tr>
<tr>
<td>SPG</td>
<td>Pike</td>
<td>1,850 mm</td>
<td>2-10 pL</td>
<td>Reactive</td>
<td>3-40 Linear m/min.</td>
</tr>
</tbody>
</table>
Rotary Screen vs. Single-Pass Inkjet

What the Future Holds

• Single-pass
  • deliver operating speeds that are faster than rotary screen
  • 35-75 linear meters per minute
  • targeting rotary screen printers producing 3M-10M meters per annum

• Pigment
  • continued adoption, growth, falling ink/fabric prices
Thank You

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