Inkjet Technology & Decorative Surfaces

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Global Inkjet Systems Ltd

TCM Decorative Surfaces Conference
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GIS – What We Do

- GIS products enable system builders to reduce development time and get products to market faster
- We provide powerful, flexible & adaptable integration tools to suit your system and application needs
Agenda

• **Printheads, inks & software enable applications**
  • Overview of latest industrial inkjet printheads
  • Trends in drop size, resolution & speed
  • Software innovations

• **Inkjet adoption in decorative surface applications**
  • Just a few system examples
    • Tile
    • Textile
    • Flooring
    • Laminate
    • Wallpaper/Wallcoverings
<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Type</th>
<th>Native Resolution (dpi)</th>
<th>Drop size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epson</td>
<td>TFP</td>
<td>25.4 mm piezo</td>
<td>720</td>
<td>1.5-32.5 pl</td>
</tr>
<tr>
<td>PrecisionCore</td>
<td>MicroTFP</td>
<td>33.8 mm piezo</td>
<td>600</td>
<td>1.5-32.5 pl</td>
</tr>
<tr>
<td>Fujifilm</td>
<td>StarFire Series</td>
<td>64.96 mm piezo</td>
<td>400</td>
<td>12/30/65 pl</td>
</tr>
<tr>
<td></td>
<td>Samba G3L</td>
<td>43 mm scalable piezo</td>
<td>1200</td>
<td>2 pl</td>
</tr>
<tr>
<td>HP</td>
<td>TU</td>
<td>108 mm thermal</td>
<td>1200</td>
<td>Not known</td>
</tr>
<tr>
<td></td>
<td>HDNA</td>
<td>2400</td>
<td>Not known</td>
<td></td>
</tr>
<tr>
<td>Kodak</td>
<td>Stream</td>
<td>108 mm continuous</td>
<td>600</td>
<td>2.5 pl &amp; 9 pl</td>
</tr>
<tr>
<td></td>
<td>Ultrastream</td>
<td></td>
<td>600 x 1800</td>
<td>3.75 pl</td>
</tr>
<tr>
<td>Konica Minolta</td>
<td>KM1800i</td>
<td>75.5 mm piezo</td>
<td>600</td>
<td>3.5 pl</td>
</tr>
<tr>
<td></td>
<td>ME130H</td>
<td>21.65 mm piezo</td>
<td>1200</td>
<td>3 pl</td>
</tr>
<tr>
<td>Kyocera</td>
<td>KJ4A-RH</td>
<td>108 mm piezo</td>
<td>600</td>
<td>3 pl</td>
</tr>
<tr>
<td></td>
<td>KJ4B-YH</td>
<td>108 mm piezo</td>
<td>600</td>
<td>5 pl</td>
</tr>
<tr>
<td></td>
<td>KJ4B-Z</td>
<td>112 mm piezo</td>
<td>1200</td>
<td>2 pl</td>
</tr>
<tr>
<td>Memjet</td>
<td>Pagewide</td>
<td>221 mm piezo</td>
<td>1600</td>
<td>1 pl</td>
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<tr>
<td>Panasonic</td>
<td>UH-HA800</td>
<td>56.3 mm piezo</td>
<td>360</td>
<td>3-30 pl</td>
</tr>
<tr>
<td>Ricoh</td>
<td>MH5440</td>
<td>54.1 mm piezo</td>
<td>600</td>
<td>7-35 pl</td>
</tr>
<tr>
<td></td>
<td>MH5220</td>
<td>54.1 mm piezo</td>
<td>600</td>
<td>2.5 pl</td>
</tr>
<tr>
<td>Seiko SII</td>
<td>Printek 508</td>
<td>72 mm piezo</td>
<td>360</td>
<td>12 pl</td>
</tr>
<tr>
<td></td>
<td>RC1536</td>
<td>108 mm piezo</td>
<td>360</td>
<td>13-100 pl</td>
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<tr>
<td>Toshiba Tec</td>
<td>CF1ou</td>
<td>53.7 mm piezo</td>
<td>300</td>
<td>6-42 pl</td>
</tr>
<tr>
<td></td>
<td>CF3</td>
<td>53.7 mm piezo</td>
<td>600</td>
<td>(3.5 pl)?</td>
</tr>
<tr>
<td>Xaar</td>
<td>1003</td>
<td>70.5 mm piezo</td>
<td>360</td>
<td>6-42 pl</td>
</tr>
<tr>
<td></td>
<td>5601 3p0</td>
<td>115 mm piezo</td>
<td>1200</td>
<td>3 pl</td>
</tr>
</tbody>
</table>

Table: NOT exhaustive – but representative summary

- **Printhead trends**
  - Smaller drops
  - Higher firing frequencies
  - Higher nozzle density
  - Wider heads
  - Scalable heads
  - Ink recirculation
  - MEMs manufacturing developments
    - Higher quality output
    - Higher speed output
    - High data rates to manage
    - Drop management strategies
      - Small drops/high speed
      - Printhead linearization
      - Nozzle out compensation
    - Registration/substrate handling

TFP = Thin Film Piezo  
HDNA = High Definition Nozzle Architecture  
Table: Courtesy of Sean Smyth (with additions from GIS)
## Piezo Printhead Developments

### Some high resolution/small drop printhead examples

<table>
<thead>
<tr>
<th></th>
<th>Kyocera KJ4A-RH</th>
<th>Kyocera KJ4B-YH</th>
<th>Ricoh MH5220</th>
<th>Konica KM1800i</th>
<th>Kyocera KJ4B-Z</th>
<th>Fujifilm Samba G3</th>
<th>Xaar 5601 3p0</th>
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</thead>
<tbody>
<tr>
<td><strong>Nozzles</strong></td>
<td>2656</td>
<td>2656</td>
<td>1280</td>
<td>1776</td>
<td>5120</td>
<td>2048</td>
<td>5601</td>
</tr>
<tr>
<td><strong>Width (mm)</strong></td>
<td>108</td>
<td>108</td>
<td>54</td>
<td>75</td>
<td>112</td>
<td>43</td>
<td>115</td>
</tr>
<tr>
<td><strong>Resolution dpi</strong></td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600 (1200 module)</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td><strong>Grey levels (non zero)</strong></td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td><strong>Drop size pl</strong></td>
<td>6</td>
<td>6</td>
<td>2.5</td>
<td>3.5</td>
<td>&lt;2</td>
<td>2.4</td>
<td>3</td>
</tr>
</tbody>
</table>
Many Challenges…….and Solutions
Nozzle Out Compensation

- **Nozzle sizes are getting smaller**
  - More easily blocked

- **Large print bar arrays**
  - Many more nozzles
  - Higher probability of issues

**Strategy 1: Double Up - Redundancy**
- Add second row of printheads per colour so when one nozzle fails another can be used
  - Expensive

**Strategy 2: Hide the problem**
- Identify where a nozzle is faulty and spread the jetting responsibility to neighbouring nozzles and/or colours
  - Nozzle check pattern before print job
  - Inline with vision system

4 Level CMYK
Magenta nozzle out on line 511
Nozzle Out Compensation

• Many different strategies to share data between nozzles
  • Image processing technology
    • Error diffusion screening & contone/grey level data modification
      • GIS believes most effective in contone data
    • Hide error in same colour plane to neighbouring nozzles
    • Hide error in other inks - in multi-ink backgrounds
      • If Cyan nozzle fails - could add a little black to hide white space
  • Works best in mid and light mid tones
  • Helps disguise or make the missing nozzle less visible – less white space
  • Clusters of nozzles much more difficult to hide than individual or isolated nozzles
  • Substrate plays a part
    • Technology works best where there is some dot gain
  • Numerous patents exist
Printhead Linearization

• Small amount of non-linearity in their drop volume across the length of head creates challenges
  • Stitching printheads without visible joins
  • Printing large areas of solids/flat colours

• Causes of drop volume inconsistency
  • Printhead manufacturing issue
    • Ejection of drops may not be constant along the piezo
  • Ink system
    • Temperature variation can affect ink viscosity and therefore drop volume
  • Piezo activity
    • Heavy use of some sections of printhead can result in areas of warming and changes in volume
  • Electronics
    • Damaged or degraded electronics may affect drop volume
  • Printhead position
    • System architecture may require heads to be angled creating slight pressure gradient which may affect drop volume
Printhead Linearization

• **Possible solutions:**
  • Electrical per nozzle trimming
  • ASIC trimming
  • Bank trimming
  • Screened (error diffusion) data modification
  • Contone data modification

Linearized printhead
Inkjet Presses Today

- 4,000 – 20,000 nozzles
- Narrow width
- 300 - 600dpi native
- 10 – 100m pixels/sec

- 100,000 nozzles
- Medium width
- Up to 600dpi native
- 100m – 1bn pixels/sec

- >500,000 nozzles
- Wide width >1.5m
- 1200dpi native
- ~18 bn pixels/sec

System Size, Resolution, Data Rate and Productivity (Uptime)
Ceramic Tiles

System Ceramics – Diversa

Launched Tecnargilla 2014

Fujifilm StarFire & Polaris heads

Up to 70m/min
Up to 16 heads per bar
Potentially 100’s heads per system
- Glazes
- Decoration
- Gloss effects
- Matt effects
- Metallic effects

Glaze x 2  Decoration & Effects x 6  Glaze x 2
SPG Prints – Pike

Launched ITMA 2015

Fujifilm Samba G3L printheads

1200dpi x 1200dpi
1.85m wide
Up to 40m/min
6-9 print stations
43 printheads per bar
2-10pl drop size
Barberan (E)

• Design & manufacture high precision machines for doors, boards, furniture, flooring, profiles, drawer sides, marble, stone, glass etc.

• **Jetmaster 840 - 105 – 1260**
  • 210mm to 1890mm
  • CMYK + LC + LM or O + V
  • KM printheads
  • UV inks

from roll to roll
for PVC panels
up to 630 mm
panels up to 1890 mm
Cefla Finishing (I)

• Acquired >60% Jet-Set(I)
  • Pixart Plot
  • Pixart Single Pass
    • Xaar 1003
    • UV inks
Hymmen (D)

• Technology for large volume production of board materials – surface finishing of board (MDF etc.) or roll materials
• Digital printing lines since 2008 – series of Jupiter (JPT) systems

• **JPT W 1400 for laminate**
  - 25-50m/min
  - 2.17mm wide
  - CMYK
  - UV LED inks
  - Xaar 1003 printheads
  - 45gsm paper for dry pressing process

• **JPT WS 230/550 for edge banding**
  - 10-50m/min
  - Up to 540mm wide
  - CMYK (Light colours possible)
  - UV LED inks
  - Xaar 1003 printheads
  - ABS, PVC or PP
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**Wemhöner Surface Technologies (D)**

- Produces machines and systems for upgrading of wood based panels
  - Product range includes digital and direct printing systems, lacquering lines, lightweight panel systems, throughfeed press lines, special plants and special press lines

- **MasterDigital - part of MasterLine range**
  - Surface finishing of MDF, particle board or other flat materials
  - Décor paper
  - Multipass XY roll to roll/flatbed
  - 600dpi
  - 24 heads per system typically
  - Up to 6 colours – CMYK ++
    - Have own special red for furniture
  - Up to 790m2/hr

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• **KBA RotaJet168**
  • Printing décor paper
  • Up to 150m/min
  • 1.68m wide
  • 600dpi
  • CMYK
  • Water based inks
  • Processes 2.2 terabyte/sec
Palis & Schattdecor (D)

• Schattdecor has had inkjet strategy since 2009
• Collaboration 2013 between Schattdecor, Padaluma (Palis Digital) & Rotodecor
  • Joint development of Palis 2250 for décor paper printing
    • 2250mm width
    • 75-150m/min
    • Designed to print with pigments identical to those used in rotogravure printing
Zeescape (AUS)

• Direct to wall printer using inkjet
  • CMYK
  • Portable system
  • Residential, commercial, hotels etc
  • Franchise business
Summary

- **Inkjet entering more industrial/manufacturing/volume production applications**
  - Typically not a direct replacement for analog technologies – but enlarging the application space and creating new markets and new capabilities
  - Large (>1m wide) print bars becoming commonplace
  - Technologies now exist to overcome many application challenges - driving the acceleration of inkjet adoption in production

Formica Envision

North American Plywood

Juicy Walls

Image source: company web sites & InfoTrends
Thank you

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