Advancements of Inkjet in Product & Container Decoration

Debbie Thorp, Business Development Director

IMI Inkjet Printing Conference – Anaheim, USA
February 2016
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

- Why? How?
- Challenges for inkjet
- Market developments
  - Hybrid systems
  - Marketing & economic benefits
- System prototypes to production
  - What’s happening in the market
Decoration Today

<table>
<thead>
<tr>
<th>Sleeve</th>
<th>Self Adhesive</th>
<th>Cold Glue</th>
<th>Hot Melt Glue</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Sleeve Image" /></td>
<td><img src="image2.png" alt="Self Adhesive Image" /></td>
<td><img src="image3.png" alt="Cold Glue Image" /></td>
<td><img src="image4.png" alt="Hot Melt Glue Image" /></td>
</tr>
</tbody>
</table>

Labels

<table>
<thead>
<tr>
<th>Screen Printing</th>
<th>Pad Printing</th>
<th>Dry Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5.png" alt="Screen Printing Image" /></td>
<td><img src="image6.png" alt="Pad Printing Image" /></td>
<td><img src="image7.png" alt="Dry Offset Image" /></td>
</tr>
</tbody>
</table>

Direct Print
Personalisation & Engagement

- **Food products**
  - Nestle - KitKat/Google
  - #mybreak
  - Nutella
  - Heinz soups
  - My Muesli

- **Beverages**
  - Share a Coke
  - Heineken
  - The Famous Grouse
Personalisation & Engagement

• Other products
  • Kleenex
  • Dog food
    • Just Right – Purina premium brand

• Brand identity to small businesses
  • Printed Lids

As easy as...
Why Digital? Why Inkjet?

- Marketing benefits
- Design/image freedom
- Variable information capability
- Small batches/shorter runs
- Just in time production/shorter lead times
  - Zero change over time
  - Set up time savings
- Cost savings – no screens
- Non contact
- Materials savings
  - No label
  - Lighter weight plastic bottles
- Energy reduction
Inkjet Development Timeline

Flat & Semi-Flat

Today 15,000 units/hour

Future 36,000 units/hour
Marketing Benefits

• **Customisation**
  • Collector’s/special editions
  • Linked to events (films, sports etc)
  • Ultimate capability for every item to be different/individual
  • New private label/brand opportunities

• **Social media promotional links**
  • QR codes/Facebook etc

• **Localisation/regionalisation**
  • Languages
  • Regional image variations

Image source: Krones
Marketing Benefits

- **Ability to print onto structured surfaces**
  - Creating visual and haptic effects
  - Shelf appeal
  - Decoration in areas not possible with labels

- **Ability to print onto shaped products**
  - Cylinders/tubes
  - Conical objects
  - Tubs

Images source: Krones & Polytype
Challenges for Inkjet

• **Pre-treatment**
  • Alcohol, flame, plasma, corona, primers
  • Substrate dependent

• **Post-treatment**
  • Varnish

• **Wetting and adhesion**
  • Material surface energy vs. ink surface tension
  • UV curing delay
  • Pin or no pin

• **White ink**
  • Ink recirculation recommended
  • Thick layer hard to cure
  • Pin then overprint with CMYK
  • Final cure
Challenges for Inkjet

• **Throw distance**
  - Printheads designed to print onto flat surfaces
    - Drops only jet a few millimetres and decelerate quickly
    - Larger drops jet further
    - Smaller drops improve graphical image quality
  - Semi flat objects – machine panels/undulating surfaces
  - Container shapes – lips & ridges
  - Object tolerances
    - Surfaces not uniformly smooth
    - Product to product variation

Images courtesy of IIJ
Challenges for Inkjet

• Migration issues

<table>
<thead>
<tr>
<th>HOW DOES MIGRATION OCCUR?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENETRATION MIGRATION</td>
</tr>
<tr>
<td>Migration from the printed side through the substrate onto the unprinted side.</td>
</tr>
<tr>
<td>Penetration through the substrate</td>
</tr>
</tbody>
</table>

1. Physical Migration

2. CONTACT MIGRATION
   Migration from the printed side to the unprinted side of another sheet in a stack or roll (usually referred to as “Set-off”).
   "Set-off" migration to the reverse side of the stack

3. EVAPORATION MIGRATION
   Migration due to the evaporation of volatile materials by heating (e.g. cooking, baking, or boiling frozen products in their original packaging).
   Vapour phase transfer

4. CONDENSATION MIGRATION
   Migration through steam distillation during cooking, baking or sterilisation.
   Condensation extraction

Image source: Sun Chemical
Challenges for Inkjet

- **Odour**
- **Regulatory issues**
  - Pharmaceutical & food products
    - Medical syringes
    - Tablet blister foil
    - Sweet wrappers
- **Image durability/adhesion**
  - Scratch tests
  - Sunlight fading
  - Temperature
- **Recyclability**
  - Essential for PET market
- **Environmental issues**
  - Noise (electro-magnetic radiation) - impact of other equipment in a production environment
Challenges for Inkjet

- **Tubes, cones, tubs**
  - Symmetry
  - Distance between nozzle banks
    - The narrower the better
    - Time of flight
  - Nozzle alignment issues
  - Number of rows

- **Printhead orientation**
  - Printing downwards or skyscraper mode

- **Image compensation software for cones, tubs**
  - Resolution changes
  - Density correction
  - Screening more complex
  - Mainly single head height today

- **Full product coverage challenge**
Challenges for Inkjet

- Nozzle misalignment
- Increasing density
- Screening issue - changes in dot gain
- Time of flight differences
- Image printed without correction

High Resolution

Low Resolution
Challenges for Inkjet

- Correct nozzle alignment
- Density correction
- No dot gain issues
- No screening artefacts
- Image distortion – typically managed in original artwork
Challenges for Inkjet

- **Full height printing**
  - Exists already on tubes
  - Different stitching strategies

One head – wet on dry curing – lower throughput

Two heads – wet on wet printing – higher throughput
Challenges for Inkjet

- Full height printing on cones
  - Small images - minor distortion correction

- For full height - next generation image compensation software required
- Same issues as before - with added complexity of multiple printheads
- Stitching software critical
  - Now available from GIS
- More complex shapes will be next...
Hybrid Systems

• Combine the strengths of analogue and digital technologies
• Advantages of screen/dry offset printing
  • Lower ink cost vs. whole job done by inkjet
  • Pantone/spot colours
  • High density ink laydown
  • Homogenous/smooth surface printing
  • Sharp text
• Hybrid screen & inkjet
  • Kammann K15
  • Dubuit 972 concept
• Hybrid dry offset & inkjet
  • Wifag-Polytype RDA 24-165 & MHA
Example Hybrid Systems

• **Kammann K15**
  • Screen printing & inkjet
    • Screen: Spot colours & White
    • Inkjet: CMYK

• **Wifag-Polytype – RDA 24-165**
  • Dry offset printing & inkjet
    • 2014 Tube of the Year*
    • All text & Pantone logo colours – dry offset
      • Up to 8 colours
    • Photorealistic image – inkjet
      • Up to 6 colours

* North American Tube Council – Best Innovative Component or Process
Marketing/Economic Benefits

- **Hinterkopf D240 & Ritter GmbH**
  - Plastic cartridges
  - Photorealistic images and variable data
  - Energy savings
    - Save >450,000 kWh electrical power per year
    - Reduction of CO2 emission by 270 tons
  - Supported by German Department of Environmental Affairs with grants from the Environmental Innovations Program
  - Replacing screen & thermo-transfer printing
    - “One D240 machine delivers the same output like three screen printing lines” - Ralf Ritter, CEO
Marketing Benefits

• My Muesli & Heidelberg JetMaster Dimension
  • Web to print – now print in store
  • Individually printed tubes
  • https://www.youtube.com/watch?v=vS6ZzSQy1A8
Marketing Benefits

• **KHS Innoprint & Martens Brouwerij**
  • PET beer bottles
  • 12,000 bottles/hour
  • Dagschotel beer brand – linked to Belgian sitcom FC De Kampioenen
  • Promotion for release of second film
  • Different actors on each bottle
    • Special smartphone app
    • Characters interact with each other
    • Augmented reality example
Prototypes to Production

• During 2013/2014 many product introductions

• Two years on – large scale systems installed and in production

• Examples of who’s doing what
Object Decoration Systems

- Roland VersaUV LEF-300
- Mimaki UJF-3042
- INX Evolve CP100
- Azonprinter RZR Rotax
Object Decoration Systems

IDS – Revolution 360

IDS – Mach 1

EPS - XD070

IIJ - ColourPrint

Cyan-Tec Cyjet

ITW Transtech/Morlock
Dubuit 9150

• 800 pcs/hour (dimension dependent)
  • Diameter: 10 to 100mm
  • Height: 40 to 200mm
• Flat or curved surfaces
• Plastic, glass
• CMYK + W
• Small system footprint
• Concept 972 and 9964
  • Up to 4,000 pcs/hour
  • Hybrid screen/inkjet systems
• www.dubuit.com
Hinterkopf D240

• Up to 8 inks
  • CMYK+W plus 2 special inks + lacquer
• Low migration UV inks for plastics
• Up to 1200 dpi
  • 2pt font (positive) or 3pt (negative)
• Up to 240 pieces/min
• Precision rotary indexing machine with 16 stations & 32 spindles/holders
• [www.hinterkopf.de](http://www.hinterkopf.de)
Kammann K15 CNC

- Inkjet only – W+CMYK
- Hybrid - screen and inkjet
  - 2 x screen stations
  - Pre-coat white with screen or inkjet
  - Spot colours with screen
- Printing height up to 200mm
- Diameter 120mm, length 350mm
- Xaar 1002 printheads
- www.kammann.de
• CMYK+W
• Low migration UV inks (Agfa)
• Xaar 1002 printheads
• PET bottles
  • 0.33 to 1.5 litres
  • Container diameters 40 and 120 mm
• Each colour carousel has 12 printing units
• Modular configuration
• 15,000 bottles/hour
• www.khs.com
KHS Innoprint

- Bottles enter via air conveyor
- Sterile air or nitrogen pumped in for stability
- Clamping units (pucks) transport bottles to 5 colour carousels – lock in place magnetically
- Bottle mouth sealed during printing, preventing any contamination
- Each colour carousel applies one UV ink WCMYK – then UV LED curing
Krones DecoType R

• PET, PP, glass
• Cylindrical and odd-shaped bottles
• UV ink – up to 6 colours
• Oscar dell’Imballagio 2015*
• In field test
• Next gen system – Drinktec 2017
• www.krones.com

<table>
<thead>
<tr>
<th>Output (cph)</th>
<th>Number of colours</th>
<th>Printing level (mm)</th>
<th>Number of print heads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speciality shaped containers</td>
<td>up to 12,000</td>
<td>up to 6</td>
<td>up to 70</td>
</tr>
<tr>
<td></td>
<td>up to 24,000</td>
<td>up to 6</td>
<td>up to 70</td>
</tr>
<tr>
<td>Cylindrical containers*</td>
<td>up to 7,800</td>
<td>up to 6</td>
<td>up to 70</td>
</tr>
<tr>
<td></td>
<td>up to 15,600</td>
<td>up to 6</td>
<td>up to 70</td>
</tr>
</tbody>
</table>

*Italian Packaging Institute

*) All around print, diameter = 60 mm

Higher system performance will be ensured in future by the development of additional design sizes.
Till Rotary (Krones)

- Modular/extendable system
- Glass, plastic, metal
- Xaar 1002 printheads
- UV inks
- CMYK+W+Varnish
- Field test units installed
- Next gen – Drinktec 2017
Martinenghi – Michelangelo KX48P

• UV curable inks – up to 7
• Diameter range 13.5-66mm
• Length range 50-280mm
• 1st installation – ALM, Spain
• www.martinenghi.com
Polytype RDA 24-165 & MHA Hybrid

• **RDA 24-165**
  • Plastic tubes/sleeves
  • Hybrid Inkjet & dry-offset
  • 4-6 inkjet printheads
  • Up to 8 dry offset stations

• **MHA**
  • Metal tubes
  • Hybrid inkjet & dry offset
  • Up to 6 inkjet printheads
  • Up to 9 dry offset stations

• [www.wifag-polytype.com](http://www.wifag-polytype.com)
Polytype – DigiCup40

• Standard cup in-feed and pre-treating stations
• Various shapes can be handled and decorated
  • Round, oval cups and multi-sided cups (tubs)
  • Including bottom decoration
• UV-dryer for scratch resistant surface - then restacked on restacker
• 40 to 120 cups/min
• The rise of robotic systems....
New Market Emerges

• Technologies
  • Printheads - drop size: resolution: print quality
  • Inks - low migration: low odour
  • Processes
    • Pre-treatment: curing: post-treatment
    • Adhesion: recyclability
  • System reliability

• Software
  • Cones: tubs: more complex shapes...

• Potential technology synergy of hybrid devices

• Proven production systems
  • Meeting industry demands
  • Creating new market opportunities
Contacts

Nick Geddes, CEO  
nick.geddes@globalinkjetsystems.com  
Debbie Thorp, Business Development Director  
debbie.thorp@globalinkjetsystems.com

Global Inkjet Systems Limited  
The Jeffreys Building  
Cowley Road  
Cambridge CB4 0DS  
Tel: +44 (0)1223 733 733  
Web: www.globalinkjetsystems.com

Technical support offices in UK, Japan and China