Fibers & Applications Committee

September 9, 2018

08:00 – 08:45
Fedora 4, Villa Rosa Kempinski Hotel
Nairobi / Kenya

Minutes

1. Opening Remarks
   The Chairman, Mr. Loek de Vries (Netherlands), opened the meeting with a few introductory remarks.

2. Presentation on Filament Cotton Yarn from Recycled Cotton (document no. 1)
   Gerrit Bouwhuis, Saxion - University of Applied Sciences, Netherlands

3. Presentation on Digital Printing & Finishing (document no. 2)
   Marc van Parys, UNITEX – TexZeppelin, Belgium

4. Activities in 2019
   The ITMF Secretariat will inform in due time about activities planned in 2019.

5. Any Other Subject
Domestic cotton waste based virgin fiber

Gerrit Bouwhuis
September 9th, 2018

World Population Growth

Prosperity +95% in 2050

Cotton stable around 25 mio ton

Regenerated cellulose: 50% up over last 10 years
Why SAXCELL?

Fibre & fabric production
Design & confection
Distributor & retail
Consumer use & discard
Collecting

Discarded textile

Sorting

Unraveling

Use phase

Retail

Design

Fabric production

Yarn production

Pulp preparation

Feed stock virgin fiber production

Fiber production

Feed stock preparation
SAXCELL Rating

Criteria:
- Mechanical properties
- Dye ability
- Process ability
- Environment

+50% over 10 year

Partnerships!

Collecting

Discarded textile

Sorting

Use phase

Retail

Unraveling

Pulp preparation

Feed stock virgin fiber production

Fiber production

Existing industrial equipment

+50% over 10 year

Fibres & Applications Meeting: Gerrit Bouwhuis
Collaboration with industry:

- production batch 5 ton
- design production facilities/ economics and environmental
- time to market: 4 years
Driver:

Textile industry: Greener

Many thanks to our:
students, researchers and partners
Digital Plugin for the Textile Factory of the Future

Prof. Dr. em. Marc Van Parys
UNITEX TexZeppelin
info@texzeppelin.be

Have FUN
With a smile under way to the ITMF-event 2018 ...
And if you do not have a smile, I’ll give you one of mine

Jambo
habari ya asubuhi

Fibres & Applications Meeting: Marc van Parys
Digital technologies

Printing

Digital Printers
• > 37,000 digital printers in operation worldwide
• 2,300 new printers in 1st half of 2017

Digital Printed Textile
• > 1.7 billion m² digital printed textile - expected: 2 billion m² in 2020
• > 4% of textile printing market

Applications
• Fashion – Apparel (> 40%)
• Hometextile (12 %) (carpet – upholstery – curtains...)
• Tech Textile (tents – automotive - medical – sails – parasols ...)
• Visual communication (Displays – Signage)

Ink consumption
• > 17 mio liters

Source: Smithers - WTIN – Zimmer - Dystar

Fibres & Applications Meeting: Marc van Parys
Why is growing occurring?

**Inkjet inks**
- Improved quality inkjet inks
- Better dispersion technology
- Broader range of inkjet inks
- White inks (pigment)

**New generation print heads**
- Higher firing frequency – speed
- High volume print heads
- Circulating print heads
- Self cleaning print heads

**New Digital Printers**
- Doubled-sided printers
- Printers for narrow fabrics - yarns
- Adapted printers for attributes (f.e. shoes, bags...)
- Width printers up > 5 -12 m

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With Digital technologies you backing the right horse...
If you looking ways to replace/increase capacity
pull ahead and acquire new business
## Digital Textile Printers -based

<table>
<thead>
<tr>
<th>Speed Range</th>
<th>Multi pass printers</th>
<th>Single pass printers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 sqm/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-50 sqm/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-650 sqm/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 650 sqm/h</td>
<td></td>
<td>&gt; 650 sqm/h up 4000 or more</td>
</tr>
</tbody>
</table>

85%

### Fast Fashion & Fast Deco

- **Double-sided printer for width fabrics (waterbased – UV-inks)**
- **Doubled-sided printer for narrow fabrics (Zimmer)**

### Double-sided Digital Printers

- **Digital Printers for narrow Fabrics @ Yarns**
**Waterborne Digital Inks:**
The selection is dictated by the textile material and the end-use (desired properties)

<table>
<thead>
<tr>
<th>Ink type</th>
<th>Fibre type</th>
<th>Chemical PTP treatment</th>
<th>Light fastness</th>
<th>Wash fastness</th>
<th>Rub fastness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive inks</td>
<td>CO – Vi - PA</td>
<td>yes</td>
<td>+/-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Acid inks</td>
<td>PA – WO - Silk</td>
<td>yes</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Disperse direct inks</td>
<td>PES</td>
<td>yes</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Sublimation inks</td>
<td>PES</td>
<td>no</td>
<td>+</td>
<td>+ (+)</td>
<td>+</td>
</tr>
<tr>
<td>Pigment inks</td>
<td>All fibres, incl. blends</td>
<td>yes</td>
<td>+++</td>
<td>+</td>
<td>+/- (wet)</td>
</tr>
<tr>
<td>Vat inks</td>
<td>CO - Vi</td>
<td>yes</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>

**VAT Printing**

- Home textiles
- Technical textiles
- Uniforms and workwear
- Camouflage prints

Digital Printing with VAT inks

Fibres & Applications Meeting: Marc van Parys
Sustainability in Digital Printing

**Water Consumption**

- **Rotary 6 color printer**
  - 50-60 liter water/lm

- **Digital printer**
  - 14-20 liter water/lm or a saving of 60-70%

Which equals over 300,000 Olympic swimming pools

Suppose all linear meters printed change from rotary to digital - This means a saving of 760 billion liters of water

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**Why is growing occurring?**

**Consumer Pull**

**Inkjet inks**
- Metallic inkjet inks
- UV/LED curable inks for textile

**Digital printers**
- Hybrid printers (enabling printing & finishing on one printer)
- Mobile printers for floor- & wall covering

**Digital technologies for**
- Pretreatment
- Dyeing
- Functionalisation (finishing – coating)

Fibres & Applications Meeting: Marc van Parys
Print heads enabling
Digital Dyeing – Finishing - Coating

• Common features of large volume print heads
  • Non-contact
  • Jetting higher viscous fluids
  • Higher solids loading
  • Jetting higher volumes up to µl or even nanoliters
  • Variable drop volumes
  • Higher printed thickness via larger drop volumes
  • Jetting of larger particles up to 20 µm (f.ex. microcapsules)
  • Fluid freedom
  • Print heads with circulating fluid (Piezo – DIMATIX)
  • Self cleaning system (TTS)
Large volume print heads

<table>
<thead>
<tr>
<th>Print head</th>
<th>Kyocera KJ4</th>
<th>Starfire SG1024 (L)</th>
<th>CIJ Osiris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pick-up ml/mm²</td>
<td>X 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 pass</td>
<td>9.97</td>
<td>61.5</td>
<td>30.2</td>
</tr>
<tr>
<td>2 pass</td>
<td>19.9</td>
<td>123</td>
<td>60</td>
</tr>
</tbody>
</table>

Creating

New generation large volume print heads

- The jet technology sets further boundaries for the material properties and fluid rheology of the formulation
- An ability to go beyond the inkjet boundaries to enhance application performance
Development of large volume PRINT HEADS

- Printing (lower resolution)
- Pretreatment
- Dyeing
- Functionalisation

Spot formulations
Process formulations

Digital technologies

1. Dyeing
Digital Dyeing - Benefits

- Dye savings > 25%
- "Water" savings > 25-30%
- Low waste

Digital Dyeing of PA-substrate
Acid inkjet inks (process colours)
Digital printer: Colaris – Dimatix print head
Source: Belgian Company

ESSENTIAL FEATURES
DIGITAL DYEING

- Uniformity in dyeing is a must!
- The difference of front- and back side of the fabric is depending on fabric and jet volume
- Acceptable fastness properties

- Enabling suppliers to use digital printer also as a Dyeing unit (some cases)
- Change of colour on the fly!
- Lower cost to change over
- Reduced minimum order quantity
- Higher margin
- Lower cost inventory

Are you allergic for good news?

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2. Functionalisation

- Finishing
- Coating

Digital technologies

NEW IDEAS never STOP!

Various developments are running to apply tailor-made functionalities via digital techniques replacing traditional finishing & coating processes.
Digital Finishing/Coating & Functionalisation Systems

TARGET APPLICATIONS
- Functionalisation
- Sealants
- Finishing - Coatings
  - Repellent
  - Antimicrobial
  - Antistatic
  - Chromic sensors
  - Electroconductive
  - Electroluminescent
  - ...

MATERIALS
- Wide range of viscosities, pH values and materials
- PU’s, Acrylates, silicones
- Pigments
- Nanoparticles
- Microcapsules
- Flame retardants
- Smart dyes
- ...

MARKETS
- Home Textiles and Apparel
- Attributes: belts, shoes ...
- Furniture
- Tech Textile
  - Medical textile
  - Automotive
  - Sport textile
  - ...

Advantages of Digital Functionalization

Green
- No waste, eco-friendly
- energy saving
- reduction of fresh water and waste water
- low water evaporation
- saving of chemicals...

Low cost
- Direct & partial application
- Less waste at application change
- Lower stock of finished textiles
- Minimal setup costs
- Short runs with many variations
- ...

Functional
- Local/patterned deposition or uniform application
- Multiple functions in a single process
- Front and back applications in one working pass (same or different functionality)
- Changing functionality on the fly
- ...

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The minimal amount jetted on the substrate must be sufficient to obtain the desired durable effects!
Inkjet Spot Formulations

Functional Chemicals
Processing additives
• Wetting/dispersing agents
• Viscosity regulators
• Adhesion promoters
• Binders

Formulation adapted for
Print head
Textile substrate

1st component 2nd component

• Uniform or
• Local/patterned
• 3D-effects
• Microporous membrane
• PUR
• Silicones

As soon as the 2 components get in contact, they will react.

Digital Coating of reactive two-component systems (PUR)
Application of Digital Functionalization

Digital Finishing

Surface Properties

- Repellent inks
- Antimicrobial inks
- Antistatic inks
- Optical Brighteners
- Stain-repellent

With acceptable fastness properties
Local - Patterned
Digital Finishing - Coating

Digital technology: versatile technique for realizing high-accuracy patterns in a cost-effective manner

Functional Textile

Digital printing e-circuits with conductive inks

Ag-doped Cu particles
PEDOT/PPSS

Inkjet gets traction in new applications
Resting needs Investing

Piezo-electric pads making music
Invisible encoding

Development of waterborne IR- and UV- invisible inks

→ Anticounterfeiting fabrics
→ For tracking and tracing
Fluorescent wall-covering textile

Visible light Black light

“Digital technology breathes life into our wallcovering” - Fibertex

Chromic Sensors

- **Indicator function**
  - Smart inks can have an *indicator function*, such as the display of a contamination level

- **Sensory function**
  - Smart inks can measure *stress, strain, humidity, temperature, pollution* ...

Already feasibility proven with *large volume print heads*!
Designing with Chromogenic inks

Fragrances
Thermochromics → heat
Photochromics → light
Hydrochromics → water
Piezochromics (research) → pressure

Smart textile, which interacts actively with its environment, i.e. it responds or adapts to changes in the environment.

Functions
Indicator
Sensor

COLOUR changing

Thermochromism
Piezochromic

High volume print heads: Jetting of microcapsules/binder

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Conclusions

- DISRUPTIVE - unlimited possibilities for Dyeing/Finishing/Coating
- Starting innovative incentives from suppliers, users & research institutes
- Offering Circular Production Advantages
- Anchoring glocal production & local economics are promoted

In short: Digital technology is FUTURE-PROOF

It’s all about: Excelling!

...and No Mediocrity!
Daily exercise

Every morning in Africa an antelope wakes up, it knows it must outrun the fastest lion, or it will be killed.
Every morning a lion wakes up, it knows it must run faster than the slowest antelope, or it will starve to die.
It doesn’t matter if you are an antelope or a lion, when the sun comes up, you’d better be running!

Daily exercise (new version)
ITMF Congress 2018 – Nairobi

Many Thanks
Asante Sana

Prof. Dr. em. Marc Van Parys
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