Innovative Digital Textile Printing Applications – A Contribution to Sustainability and Customization
Innovative Digital Textile Printing Applications – A Contribution to Sustainability and Customization

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Research Institute for Textile and Clothing (FTB), Hochschule Niederrhein
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Traditional and Digital Textile Printing – Global View

Traditional Textile Printing
28,000 Mio. m² (2011)
Annual Growth: **2.5 %** since 2010

Digital Textile Printing (DTP)
300 Mio. m² * (2011)
Annual Growth: **22 %**

* Digital Figures exclude Seiren Japan, DTG (Garment Printing), New Grand Format Signage, Carpets/Tiles

Traditional vs. Digital Textile Printing

Eco Efficiency Fingerprints – Radar Chart
Saving / Reduction of ...

- Water
- Energy
- Chemicals

- Less costs!
- Less time!
Ecological and Economical Aspects

A) Reactive Print

Print → Dry → Steam (10 min, 102 °C) → Wash → Dry

1-2 kg/kg

B) Pigment Print

Print → Dry → Cure (5 min, 150 °C)

Waterless fixation

Versatility (print on different substrates)
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JP5 evo
Modern Inkjet Technology (MS PRINTING SOLUTIONS SRL)

<table>
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<tr>
<th>Printing Application Fields</th>
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<tbody>
<tr>
<td><strong>Inks</strong></td>
<td>Reactive, Antelos® R-KY (Solunaris)</td>
</tr>
<tr>
<td><strong>Fiber Types</strong></td>
<td>Celulosic, Cotton, Silk</td>
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B-STeaM
Steamer (SETeMa B.V.)
**Breeze 921**

**T-Shirt Printer** (Kornit Digital Europe GmbH)

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PiXDRO LP50
Hotmelt R&D Printer (Roth & Rau B.V.)

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<tr>
<td><strong>Inks</strong></td>
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<tr>
<td>Hotmelt, TonerPearls™ CMYK (Océ)</td>
</tr>
<tr>
<td><strong>Fiber Types</strong></td>
</tr>
<tr>
<td>All Fiber Types Possible</td>
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Digitalization of Textile Chain

→ Acceleration of fashion cycles
→ Quick changing designs
→ Low volume printing

ZIM-Project (2013-2015)
“Development of an innovative digital printing unit for total process chain digitalization of clothing production covering natural fibers”
Prof. Dr. Michael Ernst, Dorothee Güntzel

Partner

bianca.
Fashion and Clothing
Digital Workflow Combination of Clothing and Textile Industry

1. Design
   - Design Development
   - Pattern Development
   - Combination Design and Pattern

2. Digital Printing
   - Selection of Fabrics
   - Digital Printing
   - Aftertreatment
   - Manufacturing

3. Pretreatment
   - Profiling
   - Color Management
   - Design Prints

4. Posttreatment
   - Steaming
   - Washing

5. 3D-Visualization
   - 3D-Software
Design and Pattern Combination

Visual bodyshaping

→ Applying visual perception rules into the design

scattered pattern → pattern arrangement → background coloring → shading → silhouette tapering at the waist
Controllability of Whole Digital Printing Process

Fabric selection (woven and knitted fabrics)
- Different surfaces (light reflection)
- Different color effects
→ Color management/print profiles

Fabric 1 (C1) = CO voile, fine (100 % CO) plain weave
Fabric 2 (C2) = CV/EA single Jersey (96 % CV / 4 % EA) knitted fabric
Fabric 3 (C3) = CO satin, fine (100 % CO) atlas weave
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SITex-Print – A New Textile Printing Technology?

Project (2012-2015)
SITex-Print – Solid Inks for Textile Printing

Partners

- Printing Technology Inks
- Inkjet Printing Fashion / Decoration
- Technical Textiles Signage / Advertising / Automotive

→ Development of a sustainable hotmelt printing technology for textiles:
   Waterless!
   VOC- and O₃-free!
   HSE friendly!

Pre-treatment → Print → Drying/Fixation → Washing
SITex-Print – Project Overview

Printing Technology

→ Evaluation of different application fields (soft signage, home textiles, automotive, fashion)

→ Investigation and improvement
  • Ink adhesion (washing, rubbing)
  • Color fastness (light)
SITex-Print – Project Results and Outlook

✓ Unique contour sharpness on entire textile media range

✓ Addressed applications could be **soft signage** and **interior decoration**
  → Textile displays, banners, flags, wallpapers (monthly change)

- Individual interior design
- Roller blinds (PES Mediatex® Presto)
Very good de-inkability at higher temperatures
   → Resist printing (removing the print afterwards)

Potential for alternative textile applications (3D printing)

- Big demand for flexible & 3D structured textiles
- High contour sharpness, “high-value” look
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3D Printing in Textile Fields

F. Bitonti, Verlan Dress, 2013 (MakerBot Replicator 2, FDM)

Iris v. Herpen, J. Koerner, VT071, Voltage Collection, 2013 (TPU, SLS)

Nike Vapor Laser Talon, source: nikeinc.com

C. Davies, 3D printed Cortex Exoskeleton concept could crack plaster casts, 2013
Workflow 3D printing

- First approach: application of 3D structures on textiles by FDM technology
  - New design concepts
  - Replacement of traditional process steps (sewing, sticking)
  - Prototyping / production on demand & on site
3D Printing Research at FTB

FDM 3D printed structures on textiles

- Reinforcement with retaining flexibility (safety clothing)
- Integrated customized functionalities

→ Good adhesion needed

FDM 3D structures (PLA soft) printed on cotton fabric (photographs: M. Lutz, 2015)
3D Printed Surface Modification – Application Fields

Model of a FDM printed design for women’s sportswear

- Use in multifunctional clothing
- Supporting effect (bra substitute)
- Protective function
- Individual design applicable

FDM printed pattern
"filament area",
material: PLA soft

Summary

Sustainable Digital Textile Printing Applications

✓ Digital workflow implementation in clothing production
  • Traditional → Digital
  • Saving of water, energy and chemicals

✓ New sustainable “add-on” digital printing technologies
  ► Hotmelt printing
    • No water and no drying process
  ► 3D printing
    • No waste generation
Acknowledgement

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