# Formation of line Images Inkjet printed on polyester fabrics

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## 1. Introduction

Inkjet printing offers potential in augmenting traditional printing techniques to reduce inventory size, for example in garment label printing. Combining inkjet printing with traditional printing offers a new approach. An understanding of the effects of fabric structure and ink/substrate interactions with the fabric substrates is needed to facilitate the use of inkjet printing of labels[1].

The objective of the research is to develop a better understanding of the effects of parameters on inkjet print quality of line printed on polyester fabric. The effects of printing fabric structure, finishing and ink on line image quality was discussed.

## 2. Experimental Method

### 2.1 Materials and Equipment

The different fabrics were selected to study effects of yarn and fiber size, fabric surface roughness, and woven fabric structure, and is shown in Table 1. Printing tests were conducting using VersaPrint™ black ink, AllWrite™ black ink, and JetWrite™ black ink by Trident International[3]. Polyester fabrics were coated using two finishes. One was 24.5% acrylic emulsion(Hyunjin No. 6-pp), and the second was 17.5% polyurethane solution with N,N-Dimethylformamide solvent(Heungil No. HW 1840).

**Table 1.** Description of polyester fabrics.

| Style#[2] | | Fabric[a] | Yarn size[b] (㎛) F*W[c] | Fiber size[b] (㎛) | Roughness[d] (㎛) | PPI[e] | EPI[f] |
|---|---|---|---|---|---|---|---|
| Filament Polyester | 700-3 | Poly Taffeta(plain) | 200*250 | 16 | 1.32 | 88 | 79 |
| | 700-4 | Poly satin(satin) | 150*380 | 16 | 0.62 | 128 | 65 |
| | 700-5 | Poly Poplin(plain) | 380*390 | 17 | 1.75 | 60 | 43 |
| | 700-8 | Ply Duck(plain) | 380*570 | 26 | 2.13 | 48 | 28 |
| | 700-9 | Poly Pongee(plain) | 200*250 | 20 | 0.36 | 107 | 96 |

a. Information provided by Testfabrics, Inc., b. Data measured using SEM, c. Filling yarn * warp yarn, d. Data measured using KES system, e. Picks per inch, f. Ends per inch

## 2.2 Printing and Analysis

An Optica system with Utrajet II inkjet head was used to print on the fabrics. For quantitative analysis, the printed fabrics were scanned using a HP Scanjet 8250 scanner. The scanned images were analyzed using a MATLAB program. The output was print quality in terms of line width, edge blurriness and edge raggedness.

# 3. Results and Discussion

## 3.1 Fabric Structural Parameters

The effects of fabric structural parameters on line image quality for printed unfinished fabrics are discussed first. Line image quality for printed unfinished 5-harness filling-faced satin polyester fabric (#700-4) depends greatly on printing direction as shown in Table 2.The effect of fabric structure is illustrated by comparing image line quality for two plain weaves, #700-3 and #700-5. For fabric #700-3, when the ink drops fall on the filling yarns, the ink wicks in the filling yarn direction. The ink wicks far enough that it can be seen two warp yarns over (the filling is on the surface) in some cases. When the ink drops fall on the filling yarns in fabric #700-5, the results are different. The interlacing appears to limit the transverse wicking. In the case of fabric #700-3, the ink wicks further along the transverse yarn which increases line width.

**Table 2.** Line image quality for selected unfinished and finished fabrics

| Fabric | Finishing Material | Print Direction | Line width (mm) | Blurriness (mm) | Raggedness (mm) | Visual assessment[b] |
|---|---|---|---|---|---|---|
| 700-3 Plain Weave | Unfinished | Filling | 0.32 | 0.39 | 0.23 | 9 |
| | | Warp | 0.43 | 0.51 | 0.22 | 14 |
| | Acrylic Resin | Filling | 0.23 | 0.27 | 0.048 | 3 |
| | | Warp | 0.24 | 0.33 | 0.11 | 5 |
| | Polyurethane Resin | Filling | 0.40 | 0.32 | 0.07 | 10 |
| | | Warp | 0.40 | 0.30 | 0.06 | 18 |
| 700-4 Satin Weave | Unfinished | Filling | 0.57 | 0.45 | 0.062 | 21 |
| | | Warp | 1.42 | 0.98 | 0.43 | 25 |
| | Acrylic Resin | Filling | 0.36 | 0.40 | 0.26 | 13 |
| | | Warp | 0.37 | 0.35 | 0.079 | 16 |
| | Polyurethane Resin | Filling | 0.48 | 0.39 | 0.11 | 23 |
| | | Warp | 0.74 | 0.53 | 0.15 | 24 |
| 700-5 Plain Weave | Unfinished | Filling | 0.28 | 0.38 | 0.20 | 7 |
| | | Warp | 0.35 | 0.54 | 0.19 | 8 |
| | Acrylic Resin | Filling | 0.23 | 0.49 | 0.12 | 2 |
| | | Warp | 0.20 | 0.33 | 0.13 | 4 |
| | Polyurethane Resin | Filling | 0.47 | 0.46 | 0.10 | 19 |
| | | Warp | 0.38 | 0.45 | 0.10 | 12 |
| Control[a] | | | 0.17 | 0.094 | 0.012 | 1 |

a. HP premium inkjet paper, b. Ranking relative to control

## 3.2 Finishing

Finishing is usually required to improve the image quality of lines printed on polyester fabric. Finishing test results shown in TableIII reveal that line image quality of fabric finished with acrylic resin is much better than those of unfinished fabrics and fabrics finished with polyurethane resin(Figure 1). Image quality of fabrics finished with polyurethane resin is better for some unfinished fabrics.

Another difference between wicking in unfinished and finished fabric is that ink appears to wick through the yarns in the unfinished fabric and can be seen on the surface of the yarn, but in the finished fabrics, ink on the surface of the yarns is not apparent.

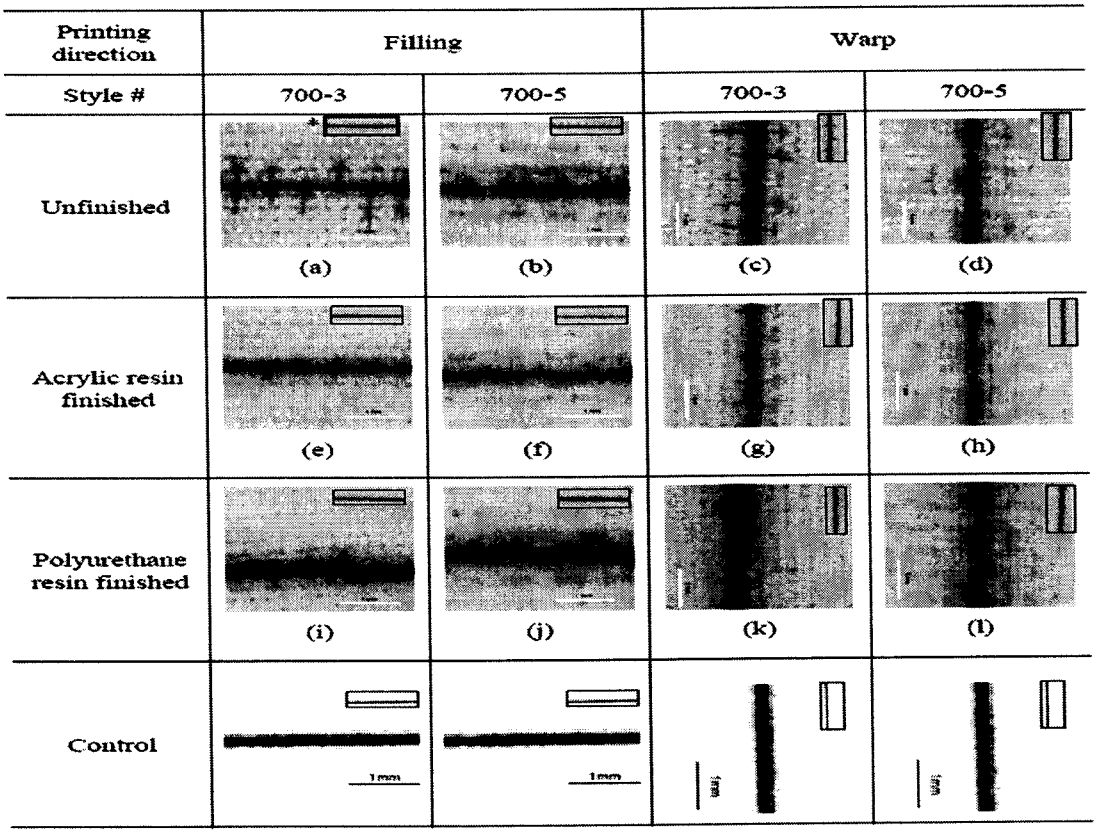


Fig. 1. Scanned images(×10) of lines printed on unfinished and finished plain fabric(#700-3 and 700-5) and control printed with VersaPrint™ ink.

## Acknowledgments

I wish to express my gratitude to Dr. Wallace W. Carr and H. Ok for frequent and helpful discussions of this work and their cooperation.

## Literature Cited

1) Rossman, M., Paxar Corporation, Private Communications, October 2003

2) Test Fabrics, Inc. "Technical Coating", 27-28 2003