Advanced Printed Electronics laboratory exercise, Inkjet printing.

Purpose of the exercise: Students will learn the Dimatix Fujifilm DMP-2831 inkjet printing design and use of rules. Students analysing how the printing parameters are affect for the quality of the print.

Exercise execution: Short design rules theory, practical printing exercise. Every team will analysing the results of the printing and return the written report.

Exercise:

1) Filling the ink cartridge

Silver nanoparticle ink, Harima NPS-J

Fill the cartridge with 0,2 µm filter and 2,5 ml syringe, volume 0,1 ml / cartridge

Connect cartridge onto the 10pl nozzle head

2) Substrate

200HN Capton (PI), thickness 50 µm

Cut and clean the PI film with isopropanol

Turn the oven on, what is the temperature?

3) Starting the Dimatix

Turn on the PC and the printer. Double click the DMP application shortcut from the desktop. Wait for a little while, system running the initialization sequence.

Connect the cartridge into the system

Place the PI substrate onto the vacuum plate, vacuum table temperature should be about 50 °C

4) Processing the print file.

Convert the gerber CAD-file to the bitmap format (tif). Use for example the Gerbmagic program.

Convert the *.tif file to the *.bmp format (1 bit), use the Photoshop program. Calculate and set the optimal resolution. The drop size for the one 10pl drop is about 60 µm.

$$\mathrm{ds} = \frac{25400\ \mu\mathrm{m}}{dpi}$$

ds = drop spacing

Dimatix can not drive *.bmp file, create the dimatix's own pattern file tools→pattern editor (bitmap images). Set the drop spacing also.

5) Nozzle selection and properties of the nozzle jetting

From the drop watcher menu, select the print nozzle, check and adjust the optimal nozzle jetting properties.

6) Printing

Make test print, if quality is not okay check the nozzle and jetting properties from the drop watcher window.

Exercise 1: two printings with optimal parameters

Exercise 2: Keep optimal resolution. Change the drop spacing half-smaller and half-higher and make one printing for both.

Exercise 3: Keep optimal drop spacing. Change the image resolution half-smaller and half-higher and make one printing for both

Exercise 4: Let's make the "stupid user error". Think that drop size for the one drop on the substrate is about 20 µm so the drop spacing must be 10 µm. Calculate and save the optimal resolution for the image, prepare the file for the printing and print.

7) Curing/drying

Check the curing time and temperature from the ink technical datasheet

Put the prints on the oven.

8) Shut down the system

Remove the cartridge from the printer

close the DMP program and turn of the Dimatix printer

remove the dirty cleaning pad from the printer

9) Measurements

Physical dimensions

Electrical measurements -> resistance

Optical inspection and surface profile measurements

10) Summary

Analyze:

Exercise 1?

Exercise 2?

Exercise 3?

Exercise 4?

11) Report

- Abstract
- Theory
- material, device and accessory list
- analyse the results (exercises 1-4)
- Conclusion