THE ROLE OF BINDER TYPE IN DEFINING INKJET PRINT QUALITY

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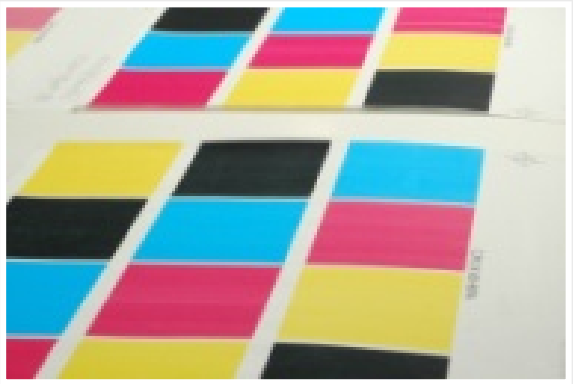
Business from technology

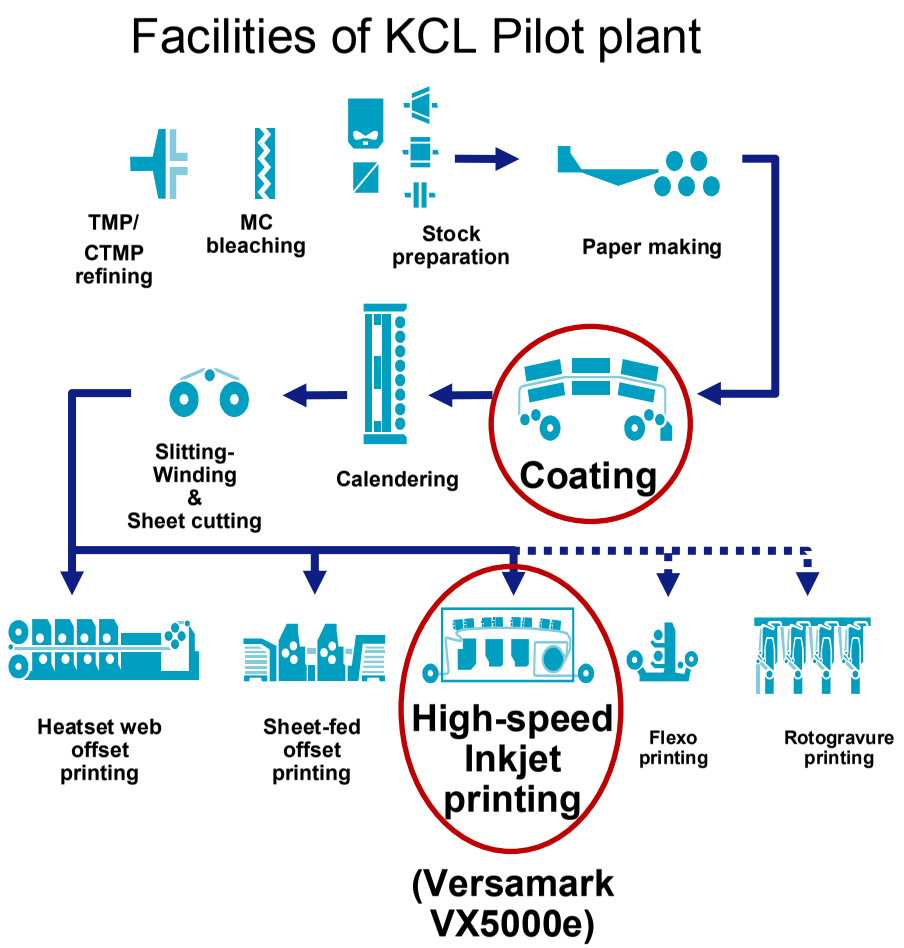
Motivation

- **Increasing trends** for high-speed inkjet commercial printing.
- **Challenges** the hydrophilic and absorptive properties of **surface**.
- In order to have optimal image quality in the inkjet printing, the high solvent amount of the ink should be **absorbed rapidly** into the paper structure.
- Need to further **develop** the coating layer properties on the mechanisms which control absorption of inkjet inks.



Aims

- To clarify the role of **polyvinyl alcohol** and **styrene acrylate latex** binder in the formation of $CaCO_3$ coating structure for the purpose of inkjet printing.
- To find out how dye-based ink **moves** in the coated paper structure.



KCL
re-inventing paper

Content

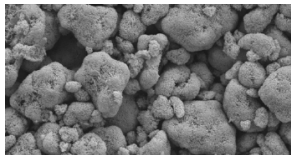
- Coating layer production
- Clara penetration tester
- Ink penetration in coated papers
- Printing with aqueous-based dyes
- Conclusions

Studied coatings

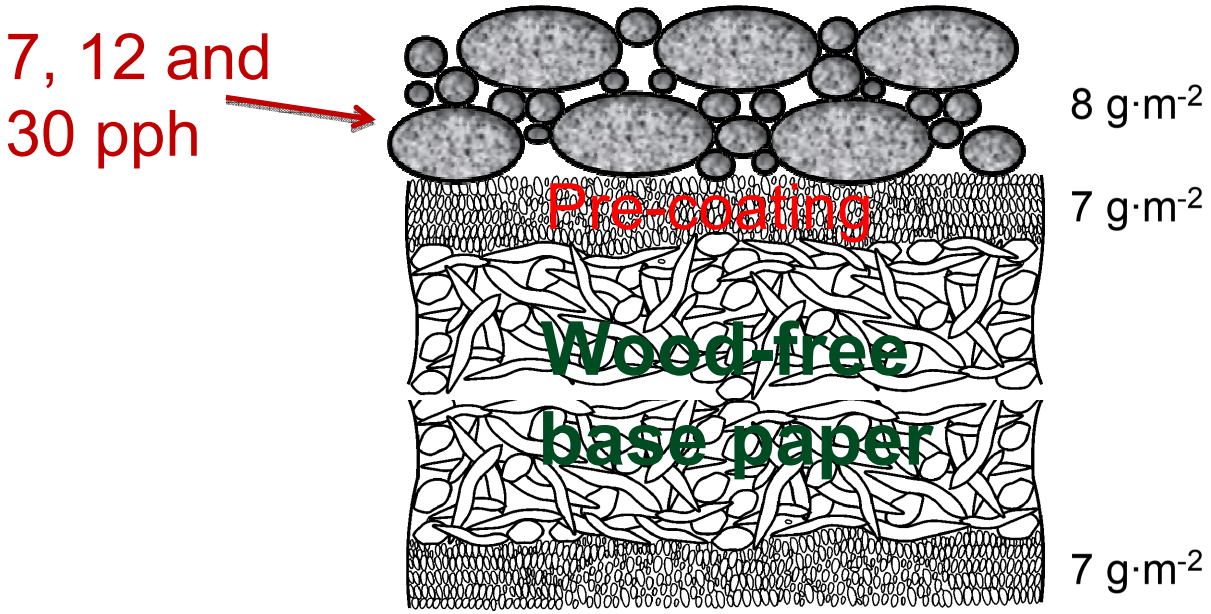
Binders:

1.Polyvinyl alcohol (PVOH),
Mowiol 40-88 (non-ionic)
2. Styrene acrylate latex (SA),
Latexia 212 (anionic)

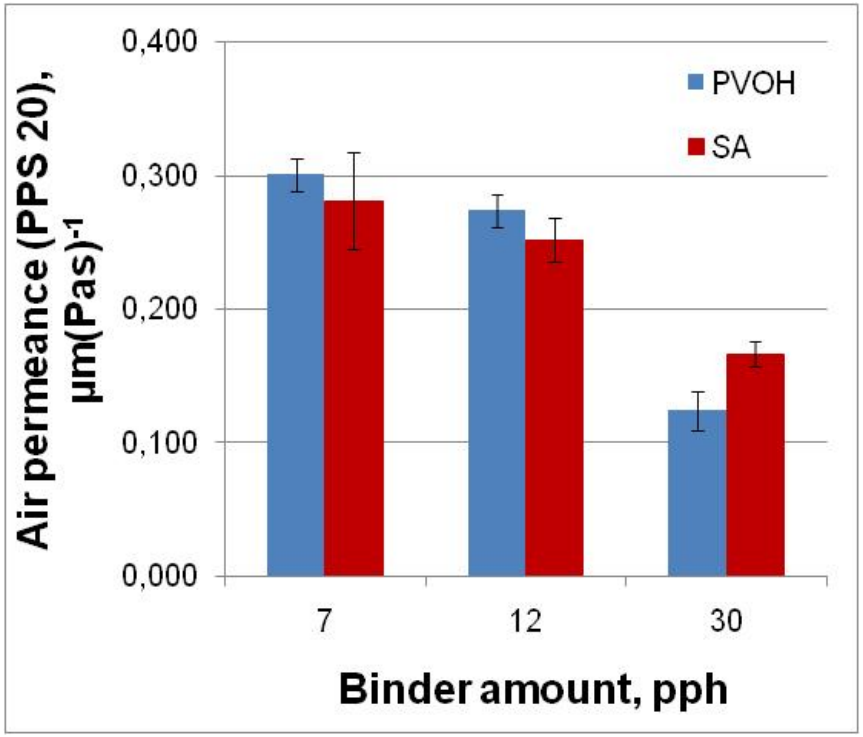
Pigment:



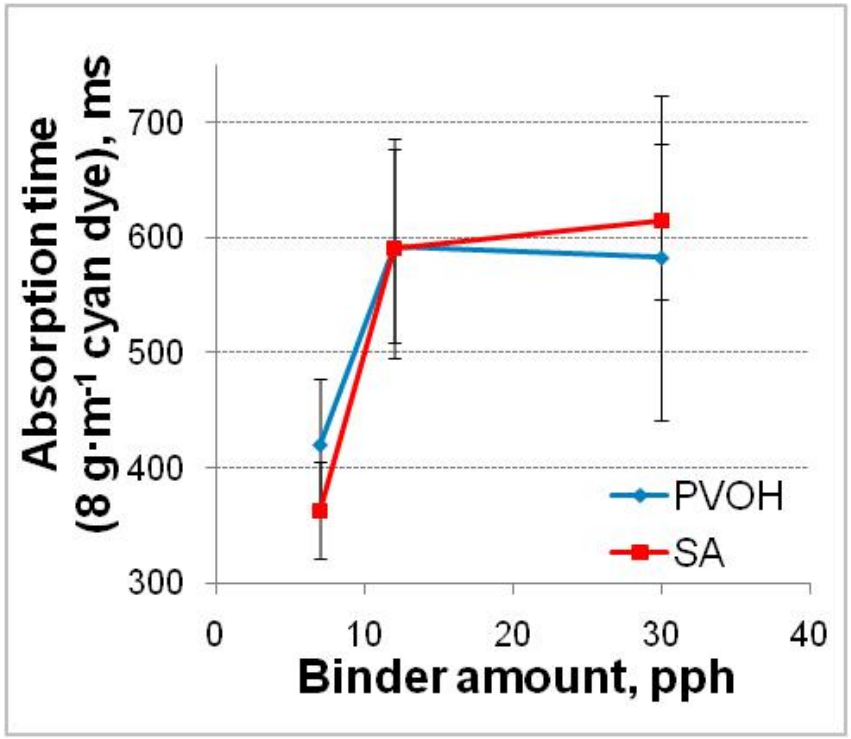
PCC,
OMYAJET B5260
Mean pigment diameter 2.7 µm
Specific surface area, 63.7 $m^2 \cdot g^{-1}$



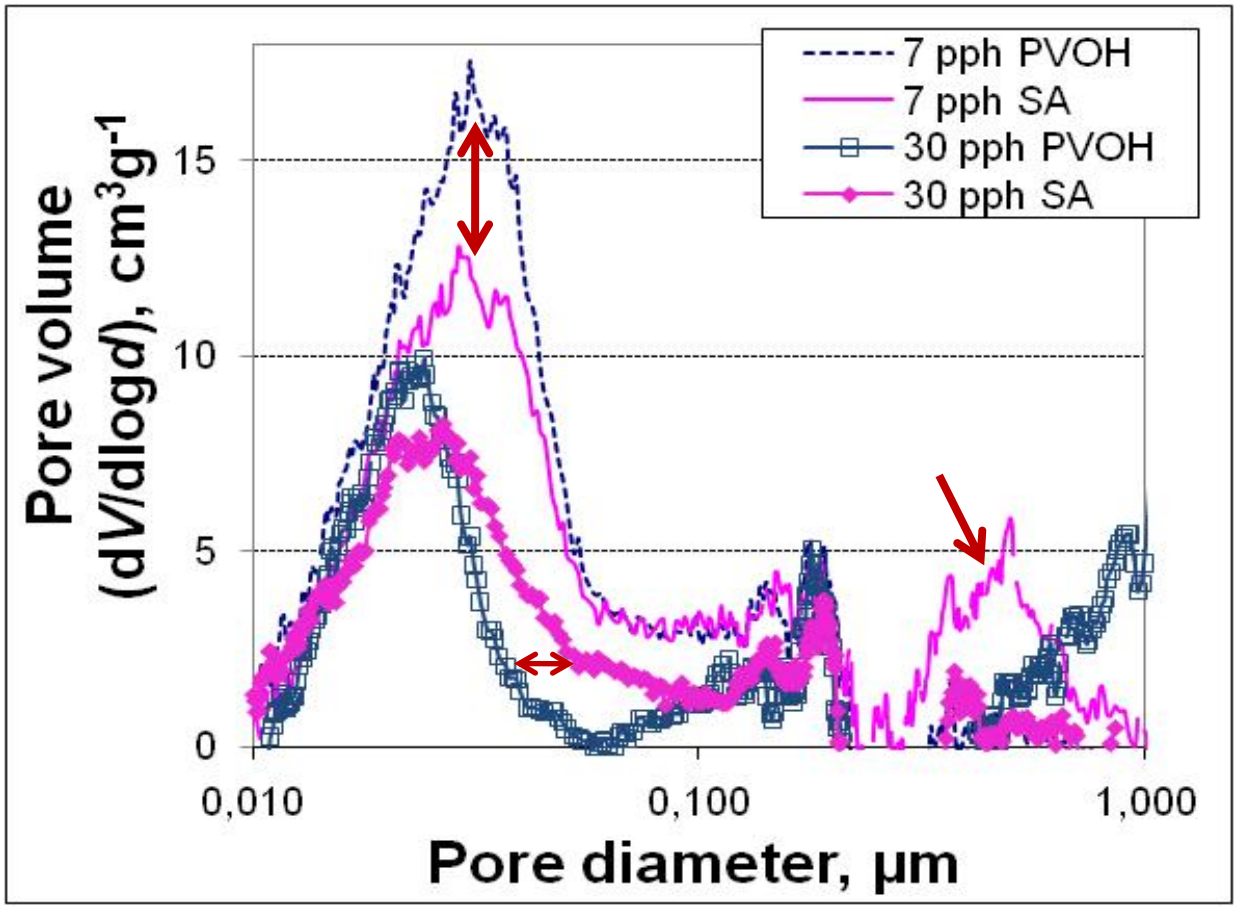
Air permeance and ink absorption speed



DIGAT



Pore diameter of coating layers



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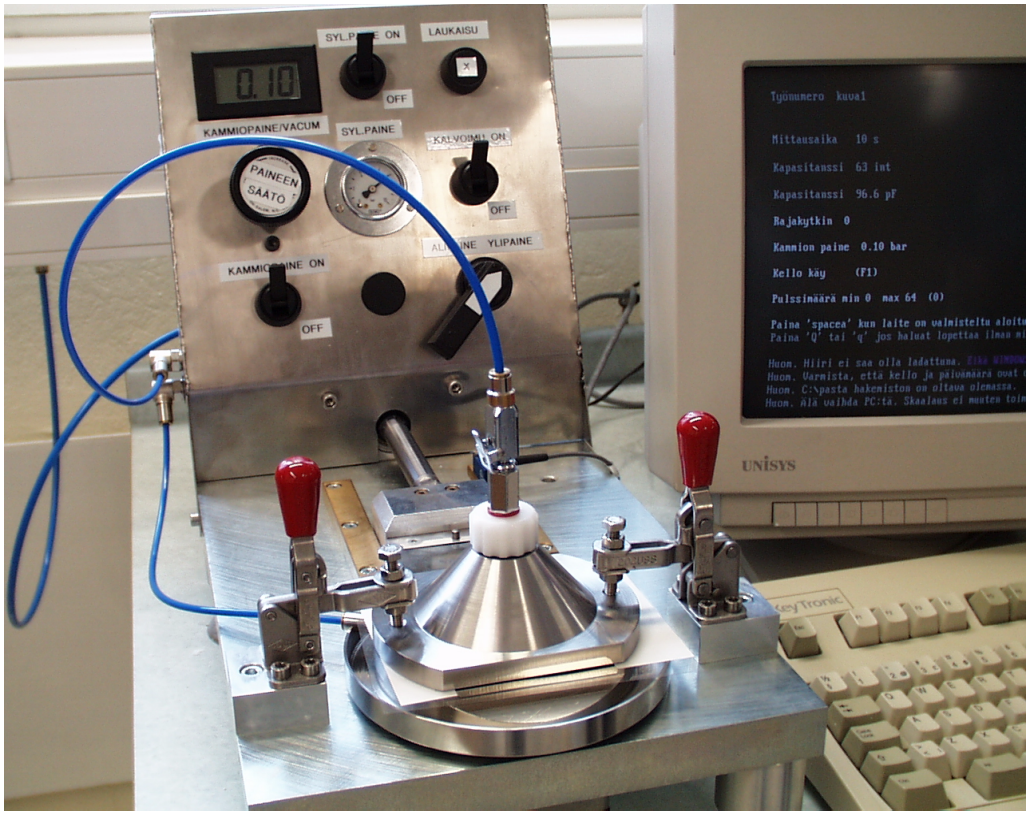
Capacitive method to detect liquid penetration



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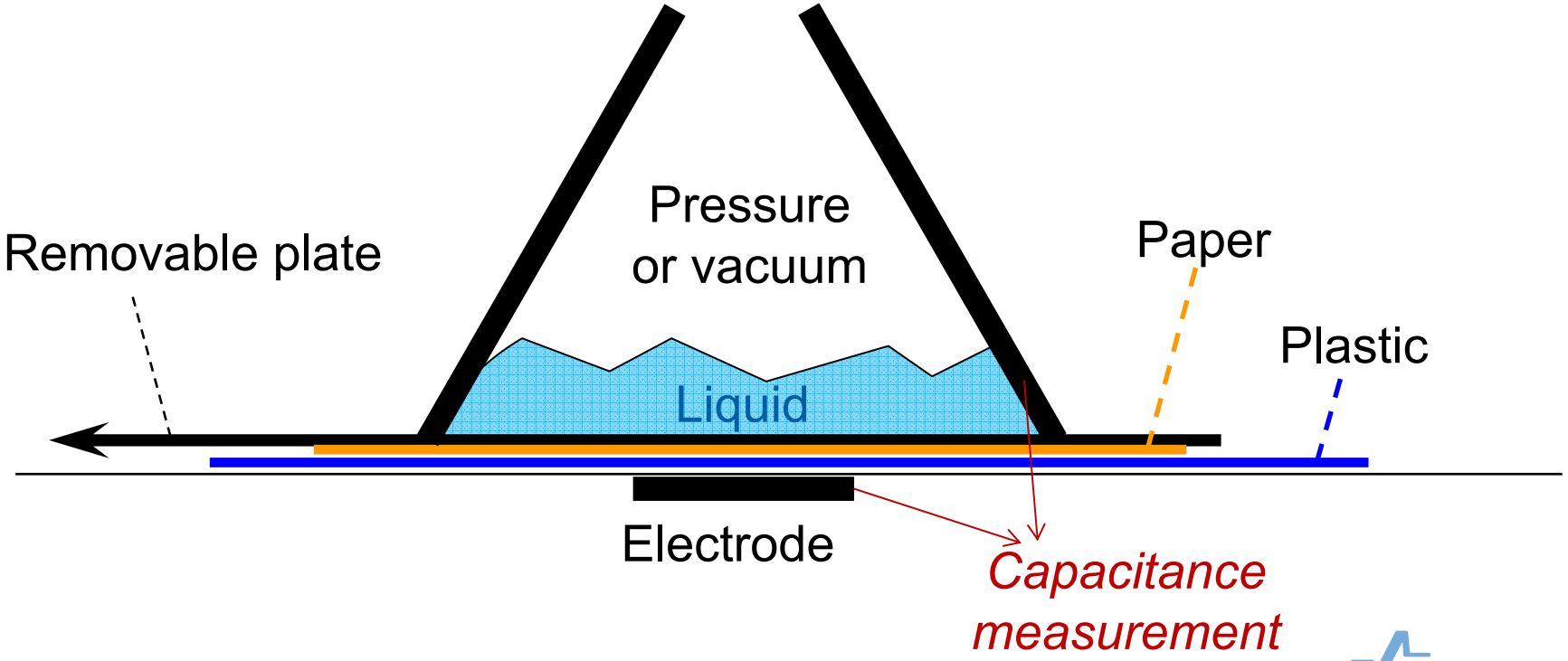
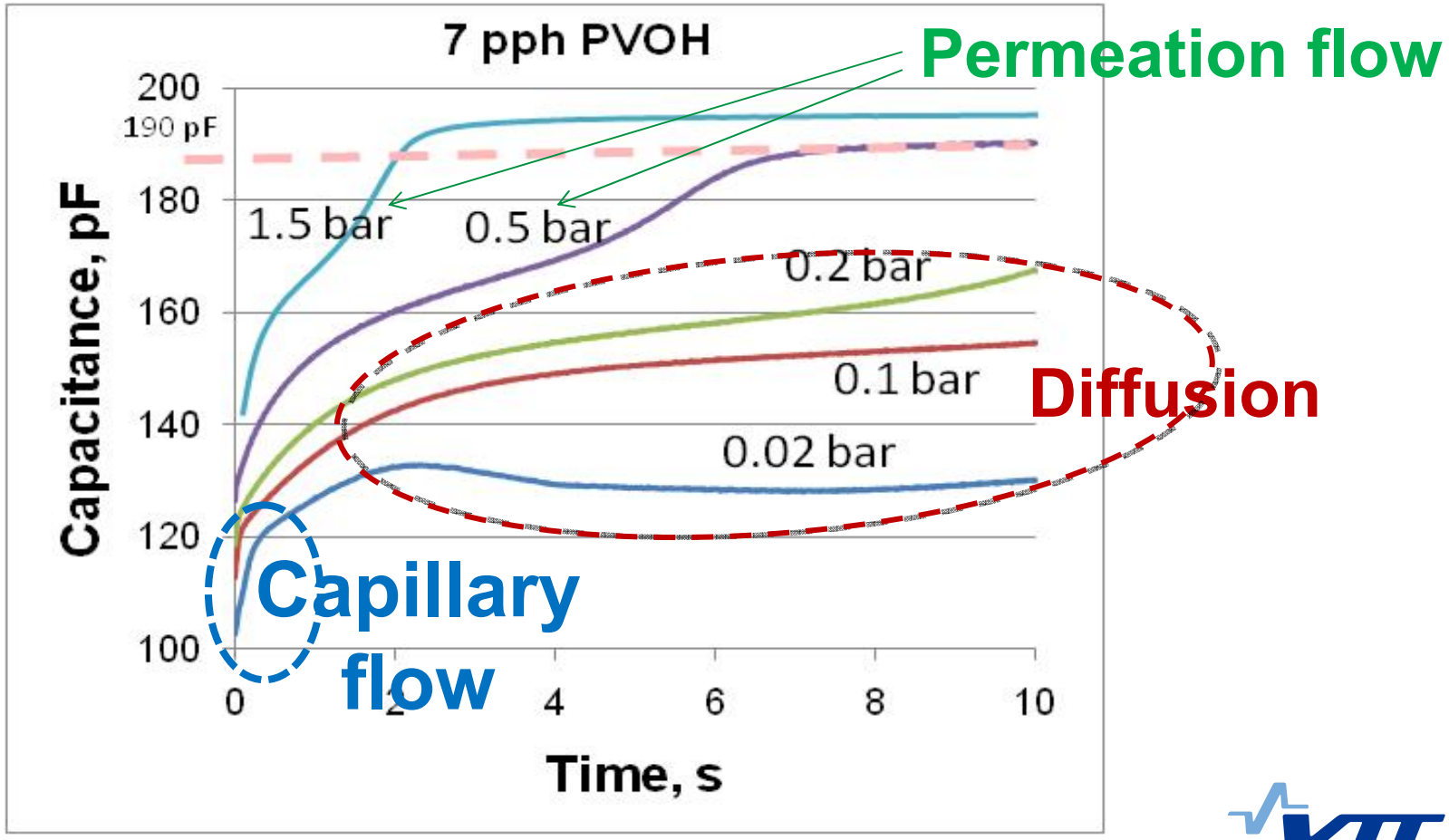
Variables:

- external pressure (-0.5 …+5 bar)
- liquid (conductive)
- material



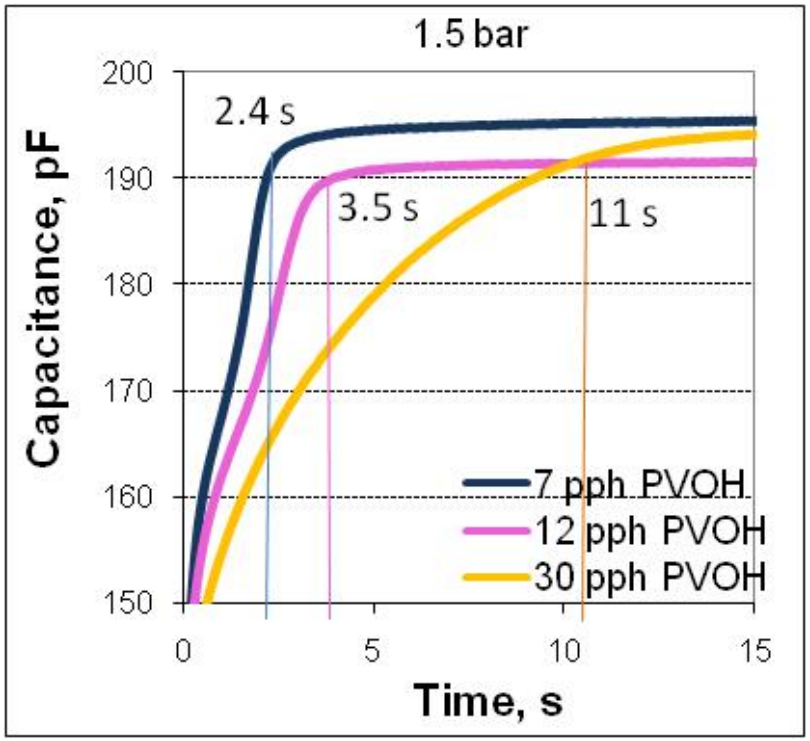
Inkjet ink penetration through $CaCO_3$ coating CLARA

Anionic cyan ink

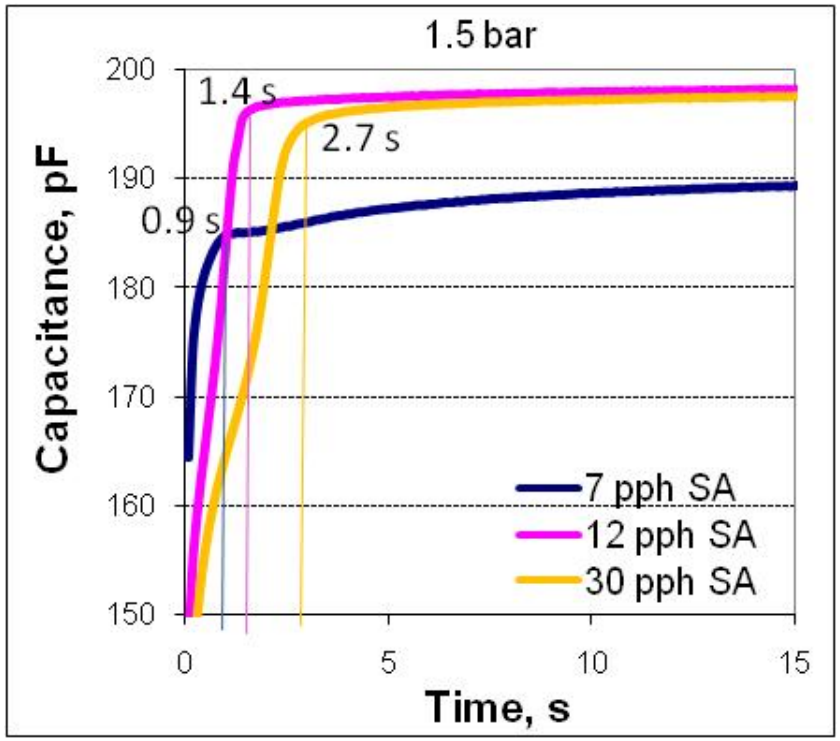


Inkjet ink penetration as a function of time at 1.5 bar external pressure

PVOH



SA



- Inkjet ink needs more time to penetrate through PVOH coatings than through SA coatings

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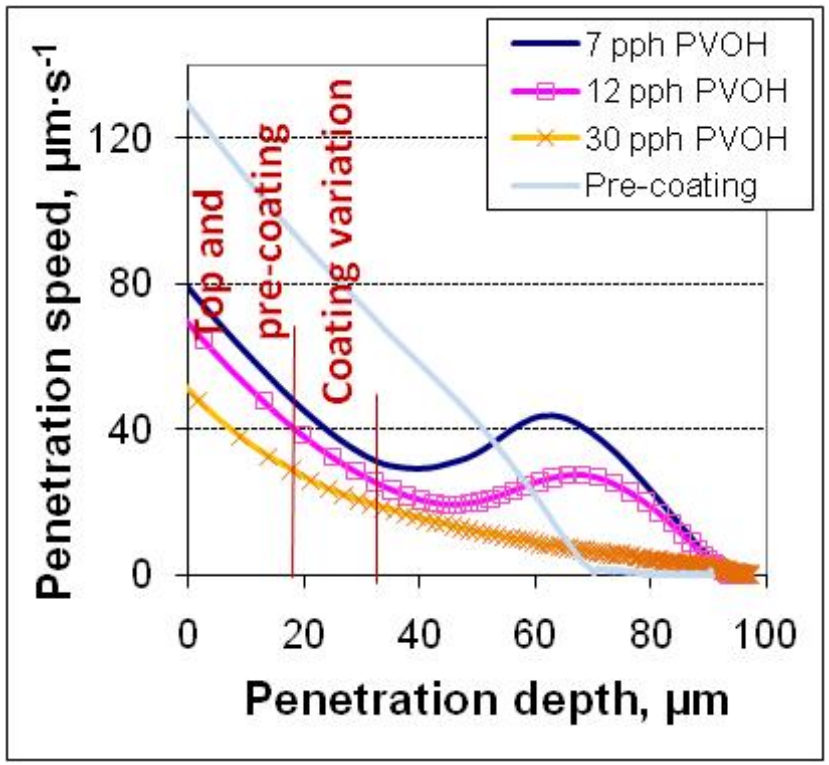
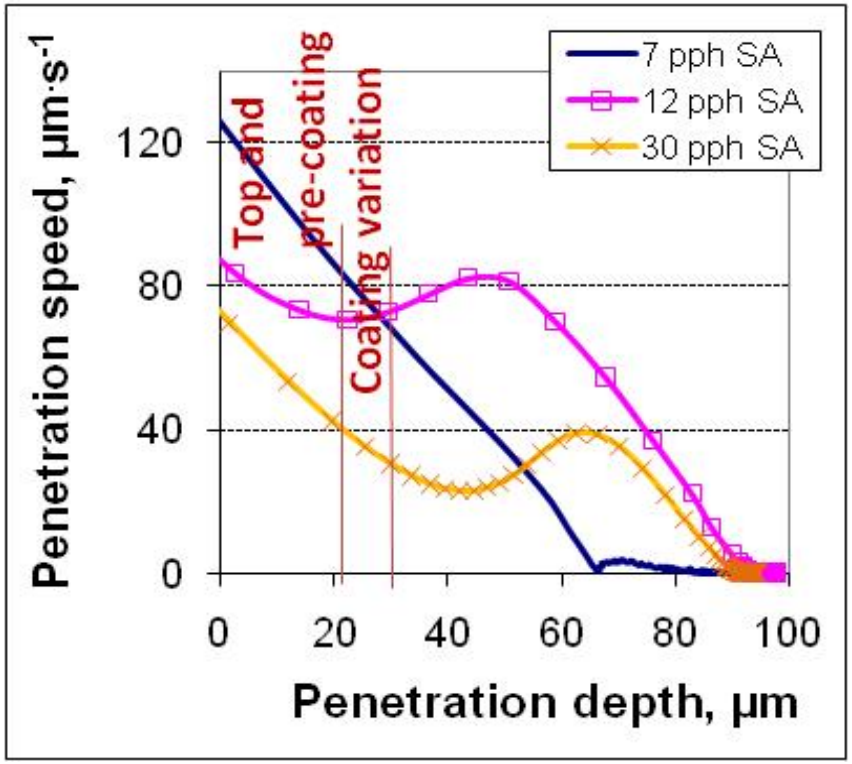
Inkjet ink penetration at 1.5 bar external pressure

PVOH



SA



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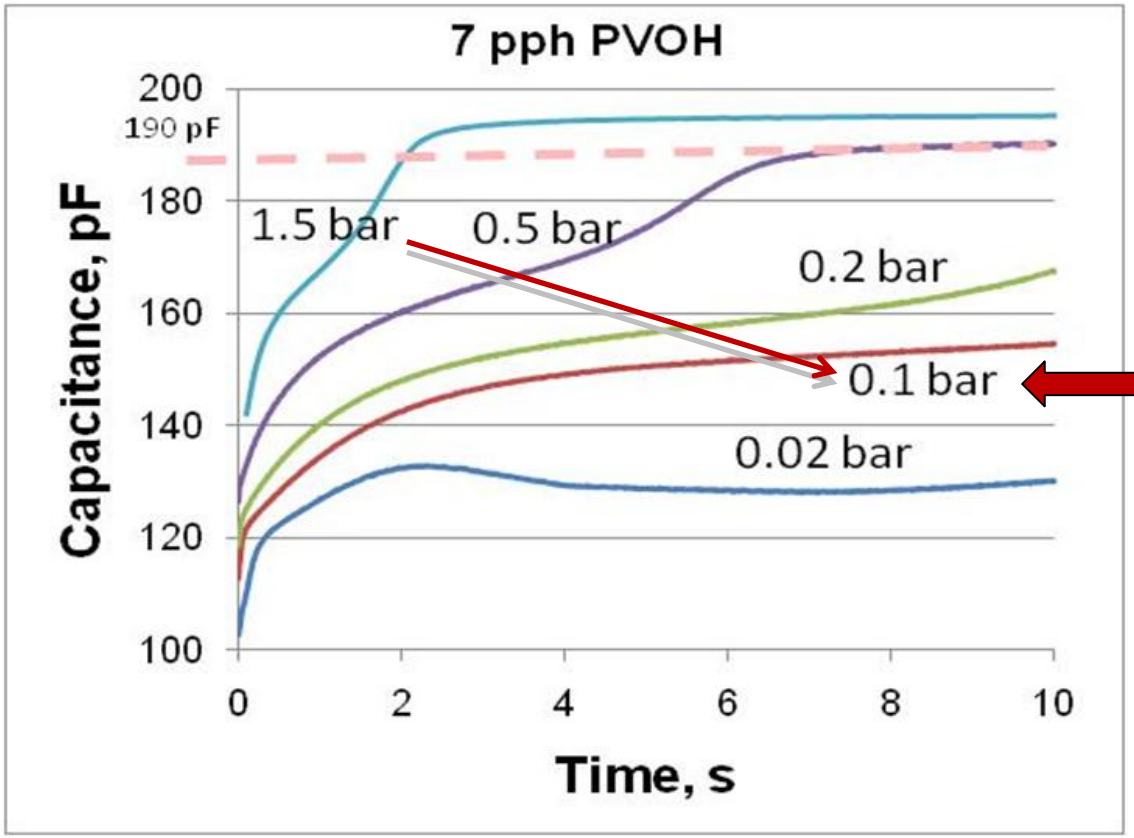
Effect of external pressure

Anionic cyan ink

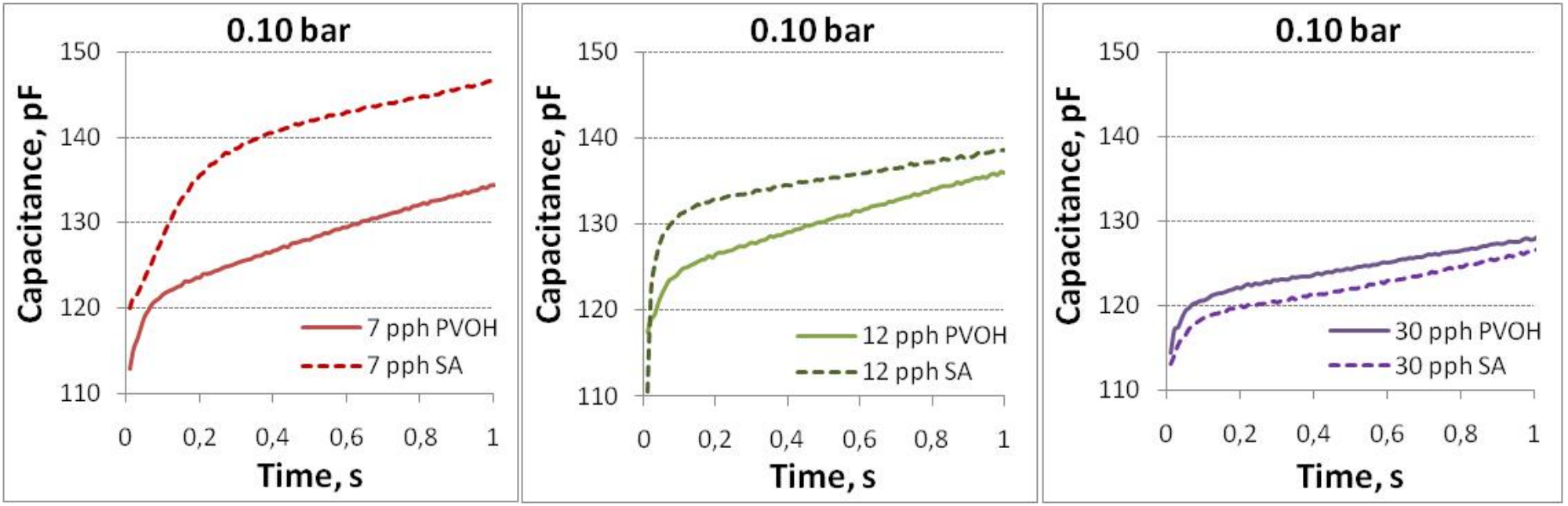


Pressure caused by inkjet droplet

- At lower pressures, ink has not penetrated so far into the structure at a particular time

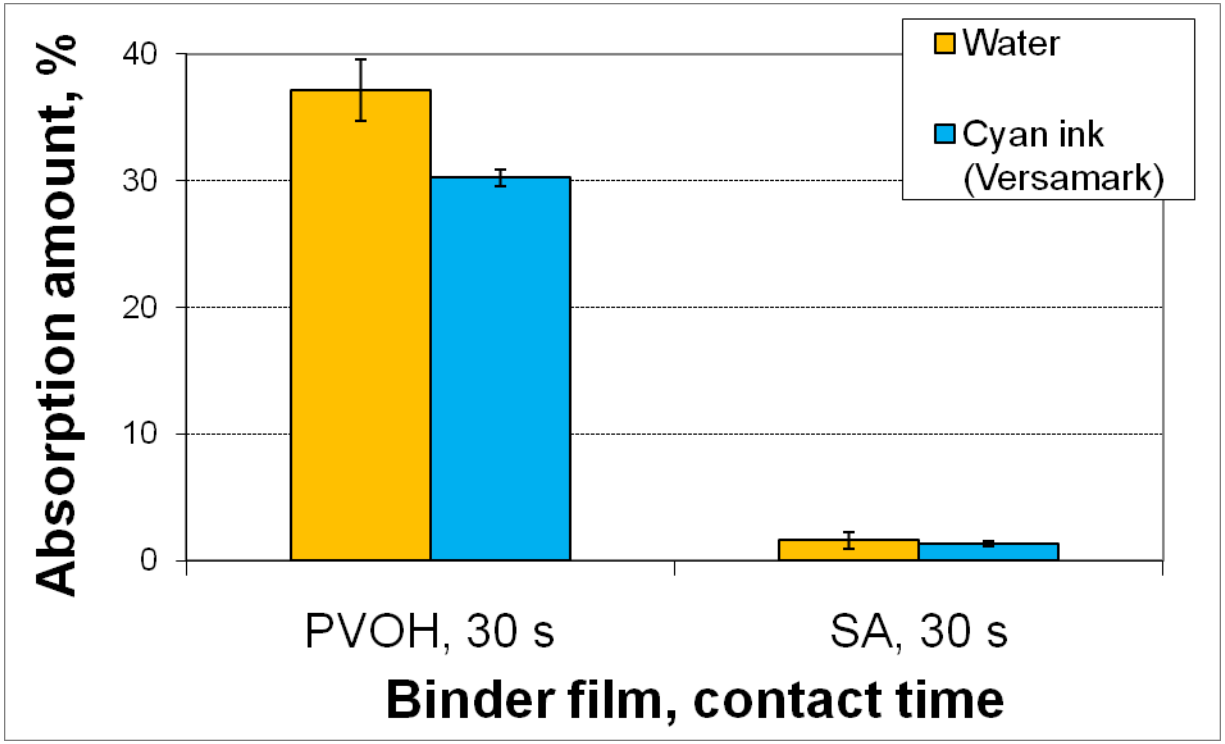
Effect of PVOH vs. SA latex levels

Anionic cyan ink



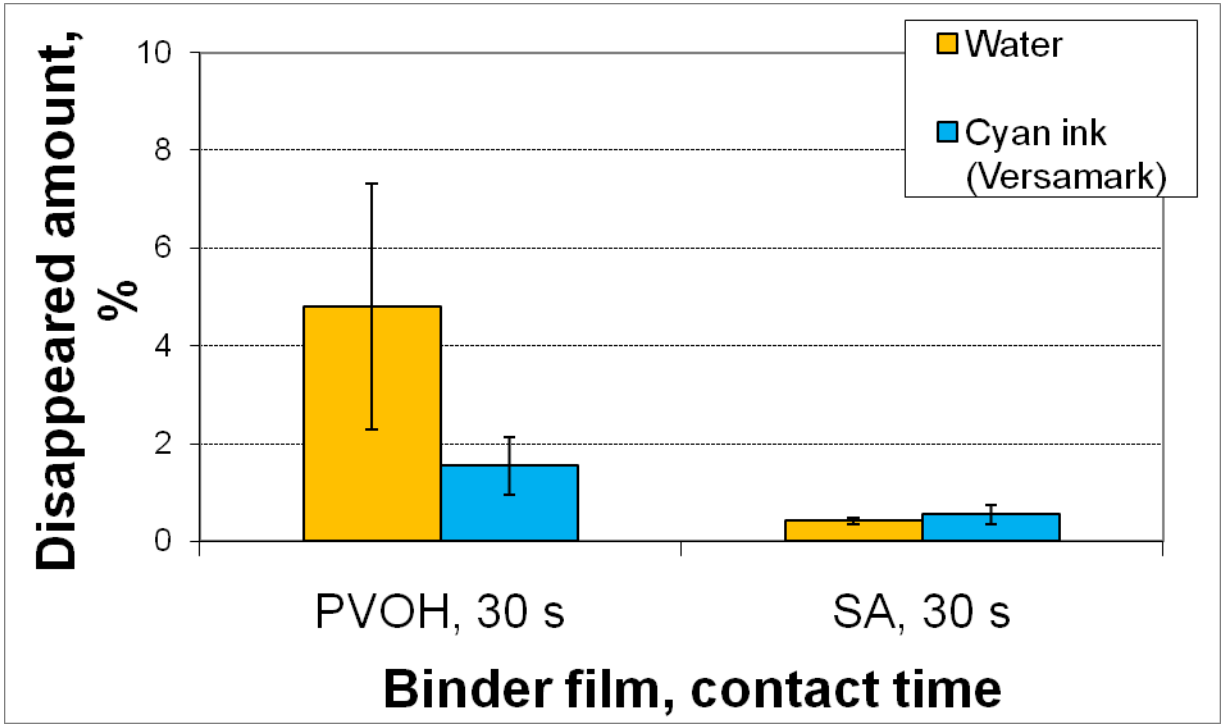
- Ink penetrates more quickly into SA coatings than into PVOH coatings at an external pressure 0.1 bar

What is happening during inkjet ink setting process? – Binder absorption



- PVOH absorbs inkjet ink clearly more than SA latex – binder swelling

What is happening during inkjet ink setting process? – Binder dissolving



- PVOH dissolves to the inkjet ink more than SA latex

What is happening during inkjet ink setting process? – Colourants fixing

PVOH

- colourants are transported during the diffusion into the binder film, but only in the top part of the film

SA latex

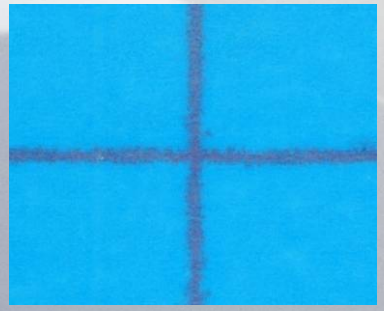
- colourants do not diffuse into the binder film or fix to the film

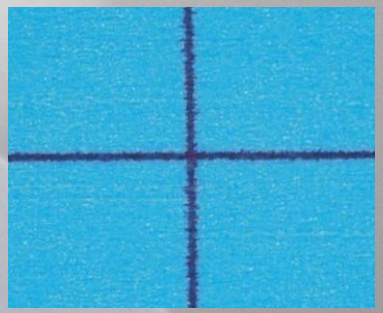
PVOH

PVOH

SA

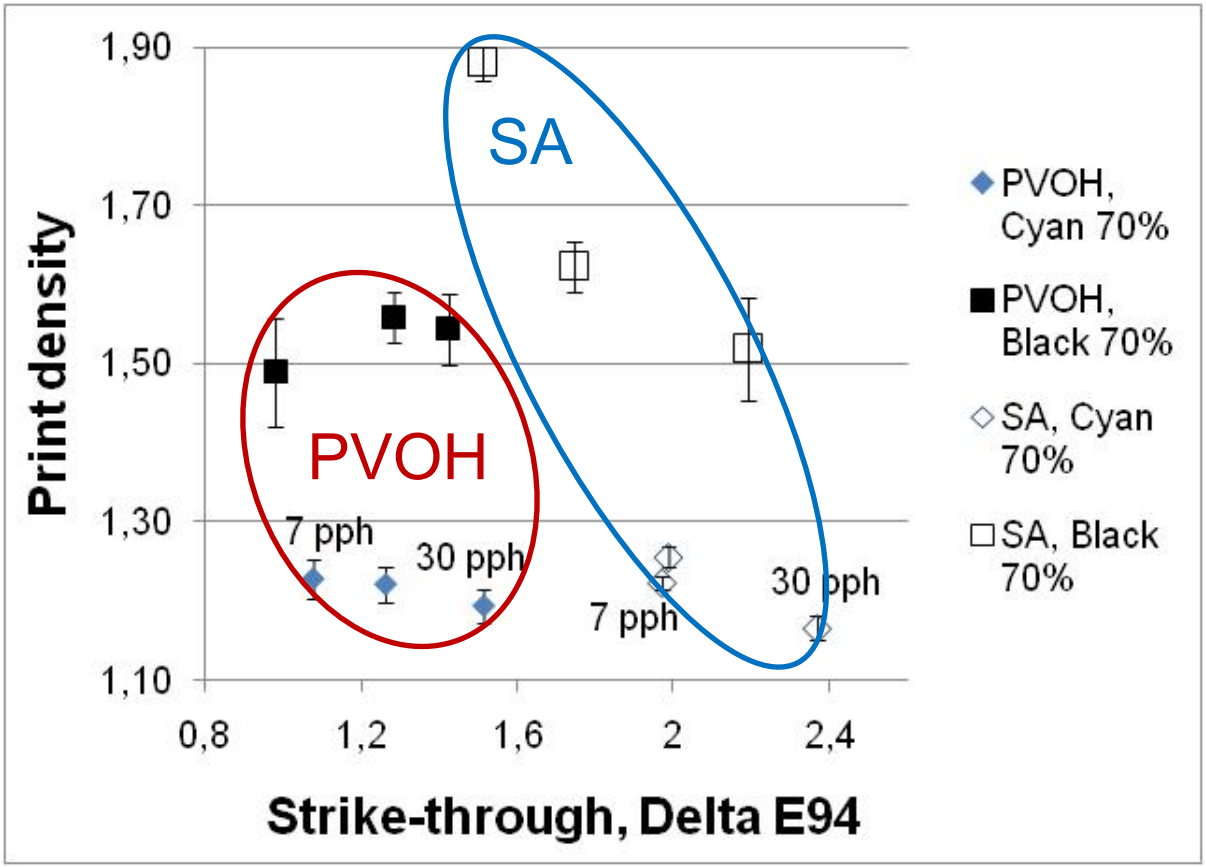
Printing with aqueous-based high-speed inkjet printing press - VERSAMARK VX5000e





Print density

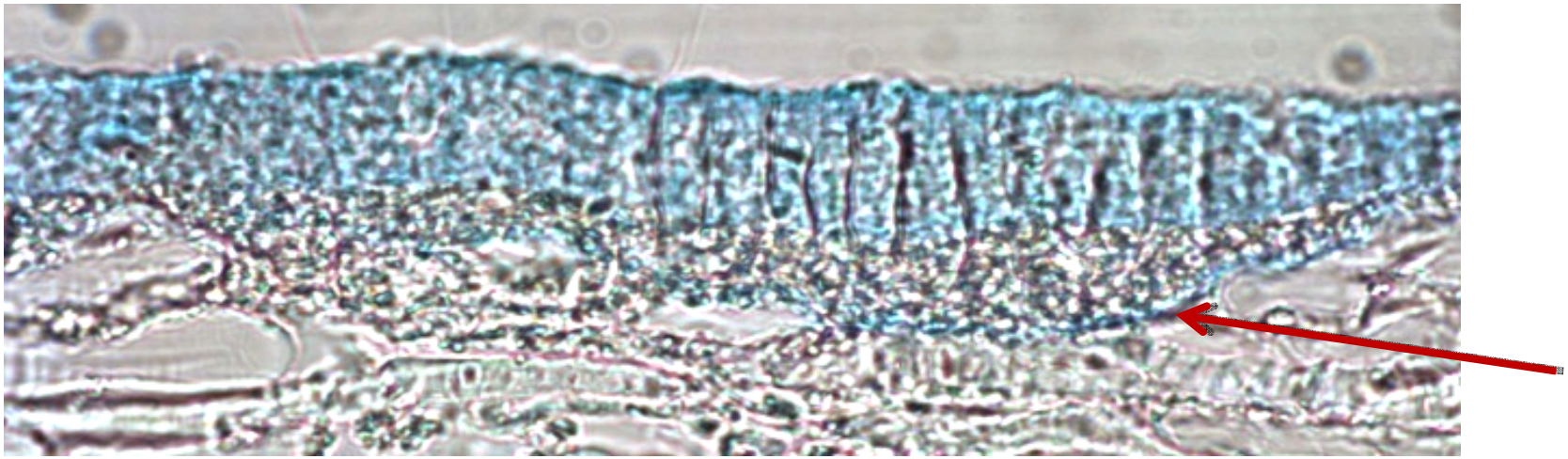
Aqueous dye-based inks (100 m/min)



Print density

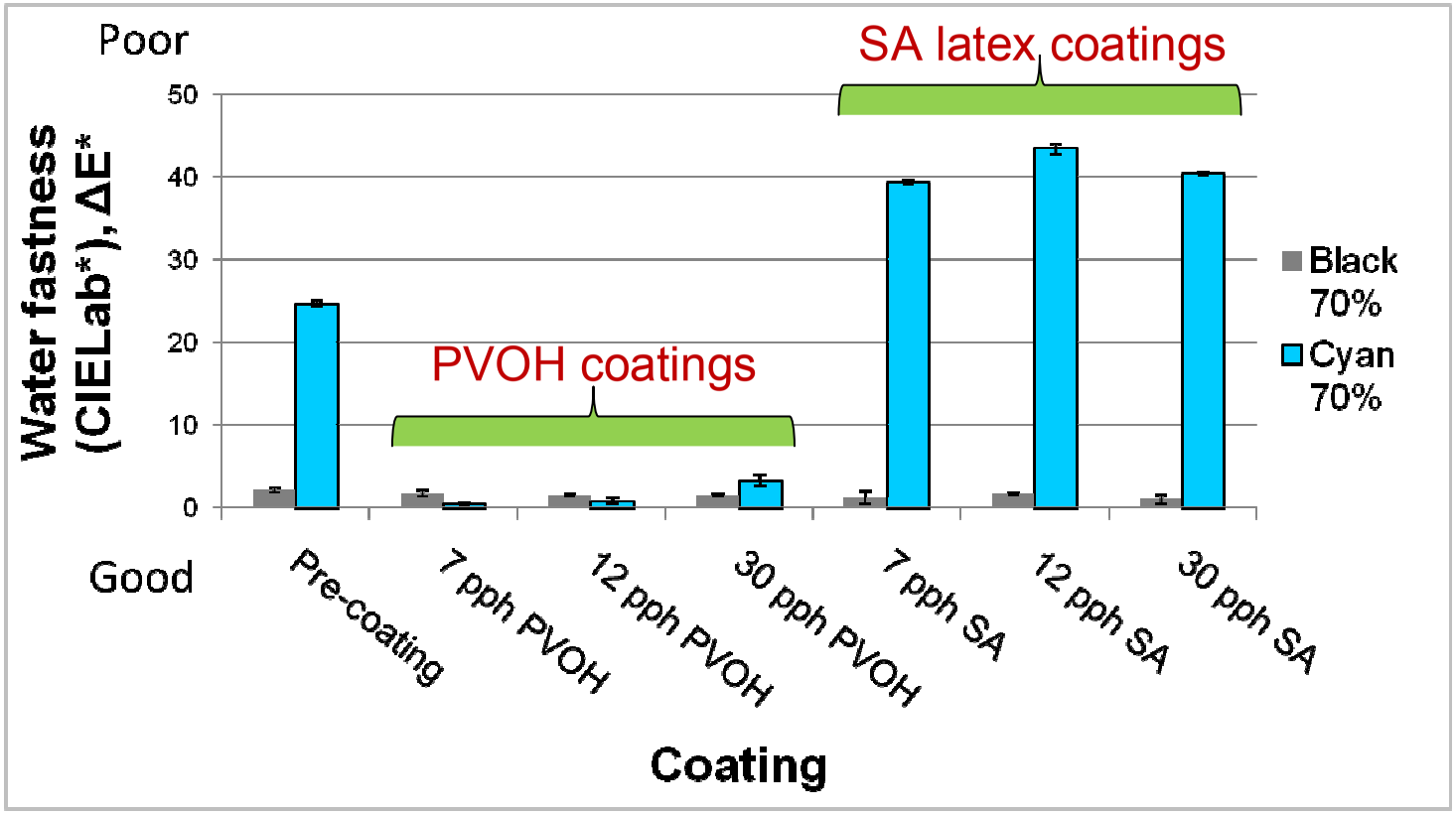
7 pph PVOH

7 pph SA



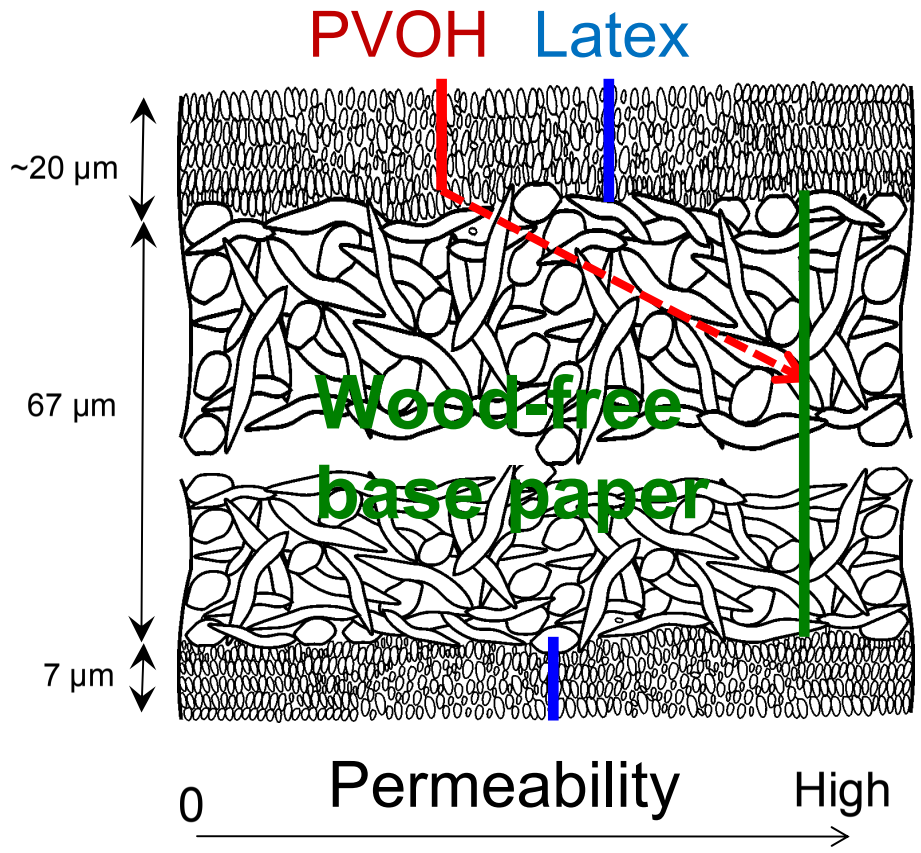
50 µm

Water fastness



- SA coating cannot fix colourants as well as PVOH
- Black ink fix better than cyan ink

Conclusions – ink penetration process



With CLARA we

- can detects **penetration speed** and **depth** of conductive liquids into the substrate
- study the penetration under the **external pressure**
- easier to follow the **movement of liquid front** than with commercial absorption devices
- results are highly **reproducible**.

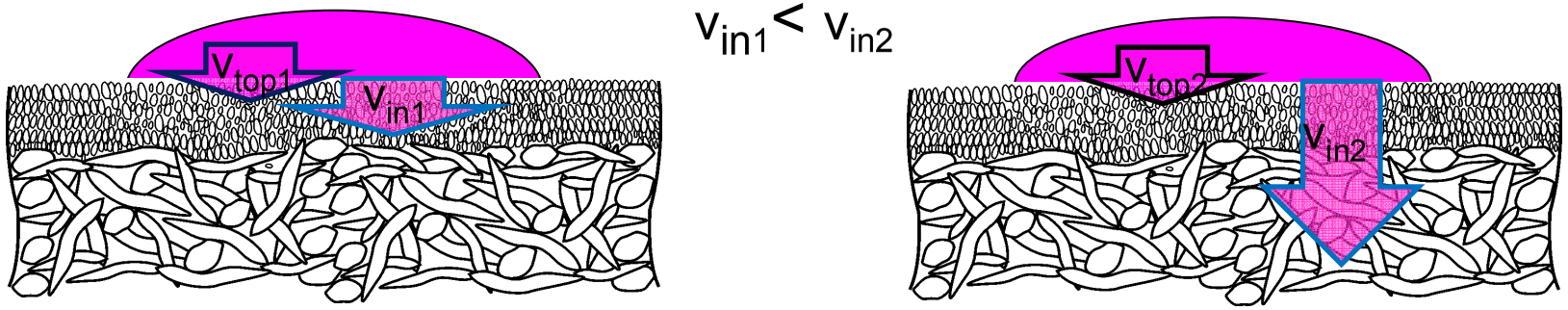
Conclusions – print quality

PVOH coating
- swelling

$v_{top1} = v_{top2}$

$v_{in1} < v_{in2}$

SA coating
- non-swelling



- PVOH fixes the colorants effectively in the coating layer
- SA latex cannot fix the colorants and therefore colorants can penetrate deeper in the structure

Thank you for your attention!

You are welcome to discuss with us at VTT Stand 125 (2nd floor)!

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