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Ph.D. thesis (2020-2023)  
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# Correlations between formulation, physico-chemical properties and printability of water-based inkjet inks

*Corrélations entre la formulation, les propriétés physico-chimiques et l'imprimabilité d'encres jet d'encre à base d'eau.*

## Context

### Print on PVC substrate for flooring applications

#### Advantages of using digital printing process

- No printing form : **design** to be printed can be **infinite**;
- Numbers of **colours** can be **unlimited**;
- Process without contact neither pressure;
- Well-adapted process for large and small print runs;
- **No limit** for the **length** of the **patterns**;
- **Handling** and **cleaning limited** to printheads;
- **Ink** consumption is **limited** to the printing area.

#### Limits of the process

- Process is not fully mastered;
- Different **defects**: white lines, latency, satellites, etc.;
- **Low** printing **speed** : 10 to 15m/min;
- Need an excellent **matching between the ink, the printhead and the substrate**.



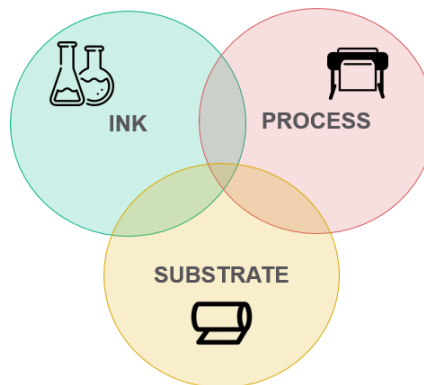
[https://particuliers.tarkett.fr/fr\\_FR/collectif-on-C000262-startfloor-click-30/retro-orange-blue](https://particuliers.tarkett.fr/fr_FR/collectif-on-C000262-startfloor-click-30/retro-orange-blue)

## Objectives

### Understand the [Process/Ink/Substrate] system.

Rheology ( $\eta$ ,  $\eta^*$ ,  $G'$ ,  $G''$ ,  $\delta$ ), particle size, zeta potential, pH, surface tension, stability, etc.

Drop characterization, open time, continuous jetting, Z number, etc.

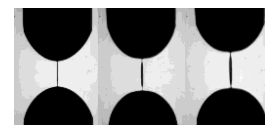
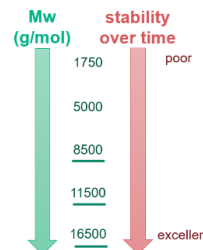


Wettability, printing precision, adhesion, free surface energy, optic density, colorimetry, etc.

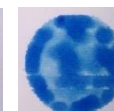
## Results



#### RESULTS for stability



Different shapes of filament before break up (Cyan inks with silicone surfactant and Mw= 8,500 – 11,500 – 16,500 g/mol from left to right), TriMaster observations



Printed 5mm disks on PVC with primer with Cyan inks (Mw=11,500 g/mol) with silicone surfactant (left) and acetylene glycol surfactant (right)



### FIRST OBSERVATIONS

Mw of the Dispersing agent is a critical parameter for stability of the ink

Mw of the Dispersing agent and Dynamic surface tension are critical parameters for jetting

Printing precision decreases when static surface tension decreases

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