Wetting effects during inkjet printing of UV curable inks

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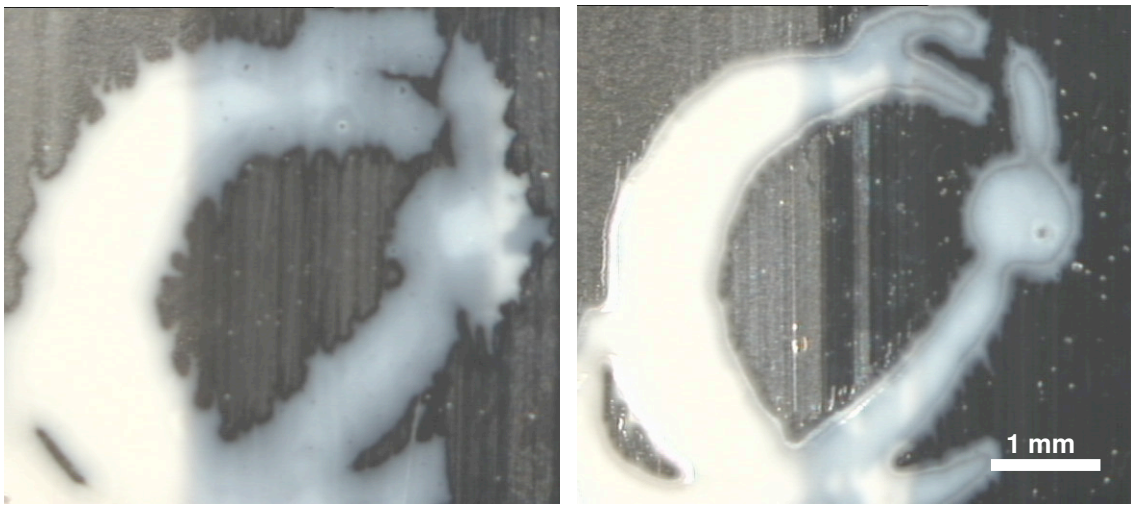
Inkjet printing over non-porous substrates has become in recent years a standard technology for many applications, including wide format printing and packaging. Two are the major problems that developers must overcome: substrate adhesion and image quality (resolution). However, behind both challenges there is a single physical phenomenon that rules the behaviour of printing: ink-substrate interaction.

Adhesion and resolution are opposite effects from the wetting point of view. While surface energy activation enhances adhesion, by favouring the interaction between liquid and solid phases, this enhancement increases spreading and dot diameter, producing colour bleeding and other undesired effects. A balance between these effects must be established in any printing process. However, inkjet printing of non-porous substrates is specially affected by surface energy, because of the limitations encountered on formulation. Jettability of inks requires very specific values of viscosity and surface tension, and using the correct pre-treatment often overcomes substrate compatibility issues.



Effect of curing on spreading of UV curable inks.
Left: curing started 5 seconds after printing. Right: curing started 0,8 s after printing.

UV curable inks are the most widespread solution for printing on non-porous substrates, mainly due to the excellent adhesion properties and high curing speed. Even at low energy, ink viscosity is highly affected by UV radiation, and for that reason pre-curing just after printing has become a successful technique for image quality enhancement. By increasing viscosity, spreading dynamics is slowed down without major effects on surface adhesion, thus providing adhesion and resolution without compromising jettability. In the figure, this effect is illustrated

In this work, CFD simulations of the image formation are presented, showing the dependence of the printed pattern with viscosity. Other parameters of the process such as printing speed, distance to the curing station, etc, are investigated. CFD calculation permits to predict the behaviour of different formulations on printing processes, helping to establish the operational window for a given printer layout, and to improve printer design for specific applications.