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High Speed-Laser Speckle imaging to unravel pico-liter droplets substrate interactions

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In printing industry research effort are currently focused on understanding evaporation and imbibition process of pico-liter droplets [1, 2, 3]. In addition to new commercial inks and formulations, new machines and technologies are evolving. Understanding phenomena such as evaporation and imbibition of pico-liter droplets into porous thin substrates, is therefore crucial in printing industry to achieve a higher printing quality and print speed.
In this contest we present an instrument which can print on-demand pico-liter volume droplets of ink onto substrates, and then immediately record the evolution of the resulting dynamics when these two materials interact. The technique, High Speed Laser Speckle Imaging (HS-LSI), evolution of standard LSI [4], has been developed to monitor nanometer displacement of the drying and imbibing ink droplet at high frame rate, up to 20kHz, given the short timescales of these interactions. We show the results obtained using two different inks printed on three substrates. Inks are home-made with two latices with different glass transition temperature (T_g), namely -16°C and 37°C. The substrates are glass filters, (PTFE) sheets and Teslin paper. The former material has been chosen following as it is unable to swell while the pore size and surface properties mimicking common printing paper. A substrate with no swelling ensures that the recorded dynamics are associated with the movement of the tested ink only. The second, PTFE, is hydrophobic: neither water nor water-containing substances can wet it. Teslin paper is a single-layer waterproof synthetic printing medium

In this talk, we will give one example of HS-LSI's usage for unraveling some dynamic printing features on each substrate which cannot be observed using other techniques.
A complete physio-chemical description of the printing, imbibement, and swelling processes associated with commercial ink jet printing are currently under investigation using this HS-LSI instrument

Time Block Preference

Time Block A (09:00-12:00 CET)

References

[1] Kettle, J., Lamminmäki, T. and Gane, P., 2010. A review of modified surfaces for high speed inkjet coating. Surface and coatings Technology, 204(12-13), pp.2103-2109.

[2] Lim, T., Han, S., Chung, J., Chung, J.T., Ko, S. and Grigoropoulos, C.P., 2009. Experimental study on spreading and evaporation of inkjet printed pico-liter droplet on a heated substrate. International Journal of Heat and Mass Transfer, 52(1-2), pp.431-441.

[3] Stringer, J. and Derby, B., 2010. Formation and stability of lines produced by inkjet printing. Langmuir, 26(12), pp.10365-10372.

[4] Van Der Kooij, H.M., Fokkink, R., Van Der Gucht, J. and Sprakel, J., 2016. Quantitative imaging of heterogeneous dynamics in drying and aging paints. Scientific reports, 6(1), pp.1-10.

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