Contribution ID: **122** Type: **Poster (+) Presentation**

Inkjet printing lines onto thin, moving porous media - simulations

Wednesday, 2 June 2021 16:00 (1 hour)

Inkjet printing consists of the ejection and deposition of ink droplets on substrates that are moving underneath the printhead [1]. For printing on paper, water-based inks have been developed that are beneficial from an environmental standpoint. The printing of semi-infinite or long lines on moving paper substrates lead to a steady-state distribution of moisture and heat which are a suitable way to study the interplay between heat and mass-transfer. Lateral wicking and evaporative mass loss are the dominant mass transfer mechanisms, while evaporative cooling reduces the temperature of paper by up to 6K. Moreover, sorptive heating [1] needs to be considered, which can cause temperature increases above ambient on the order of 1K at the perimeter of the wet zone.

We developed a mathematical model coupling the Richards equation for moisture transport in unsaturated porous media with evaporative mass loss and heat transfer. The model is two-dimensional and only considers in-plane moisture transport, i.e. the short transient effects of moisture penetration in the thickness direction of the paper sheet are disregarded. We systematically varied the speed of motion of the printhead relative to the substrate and the frequency of droplet deposition to compare with the experimental data.

Our numerical model reproduces several key features of the experimental data. For example, the transverse widths of the moisture and temperature distributions, the maximum attained cooling amplitude and their scaling behavior as functions of substrate speed and droplet frequency are well captured by our model.

[1] V. Murali, J. C. H. Zeegers, A. A. Darhuber, International Journal of Heat and Mass Transfer 147, 118875 (2020).

Time Block Preference

Time Block B (14:00-17:00 CET)

References

V. Murali, J. C. H. Zeegers, A. A. Darhuber, International Journal of Heat and Mass Transfer 147, 118875 (2020).

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Primary authors: Mr VENDITTI, Gianmarco (Eindhoven University of Technology); Mr MURALI, Vignesh (Eindhoven University of Technology); Prof. DARHUBER, Anton A. (Eindhoven University of Technology)

Presenter: Prof. DARHUBER, Anton A. (Eindhoven University of Technology)

Session Classification: Poster +

Track Classification: (MS16) Fluid Interactions with Thin Porous Media