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Long-term deformation of paper as a function of cosolvent mass transport in Latex Prints

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Latex inks are one of the most prevalent types of inks within the inkjet printing market. These inks are water-based, but commonly contain cosolvents to tune their liquid properties. After the printing process these cosolvents are in part (<5 wt% cosolvents in paper) left in the paper, where over a period of days to months (long-term) they will redistribute to form a uniform concentration profile. This redistribution has been shown to correlate to long-term curl of prints on uncoated paper.[1]
In this work, a model is proposed that describes the mass transport of cosolvents in paper by means of Fickian Diffusion, which is then coupled to a beam-bending model[2][3] to describe the evolution of paper curl over time.
The model is demonstrated to give a good fit to experimental results of different types of uncoated paper (sized and unsized paper). Herein the cosolvent concentration profiles were measured experimentally in an ex situ approach; print samples were sectioned to different thicknesses by a home-built milling apparatus after which the cosolvent concentration was determined by quantitative 1H-NMR. In parallel, the deformation was measured also by a home-built device.

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References

[1] A. Maass and U. Hirn, “Long term curl of printing paper due to ink solvent migration”, Materials & Design, Vol 237, 112593, 2024, doi: 10.1016/j.matdes.2023.112593. [2] G.W. Scherer, “Drying gels: III. warping plate” , Journal of Non-Crystalline Solids, Vol 91, Issue 1, pp. 83-100, 1987, doi: 10.1016/S0022-3093(87)80087-X. [3] T. Arends, “Dynamic moisture-induced bending of oak boards: an experimental study”, PhD Thesis TU/e Mechanical Engineering, 2019, ISBN: 978-90-386-4834-7

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