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Ink flow in fibrous layer: direct pore-scale modeling and experimental observation

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In this study, the detail flow of ink though the printing paper is simulated using pore-scale formulations. The exact 3D topology of an uncoated paper was obtained though micro-tomography imaging to reconstruct the domain with a resolution of 0.9 μm. Afterwards, the reconstructed domain was used for running direct numerical simulation of ink flow in paper. Confocal microscopy was applied to determine the spreading of ink and ASA measurements were used to determine the penetration depth. The simulation results showed a good agreement with the experimental observations. After validation, the impact of contact angle (CA) on ink spreading and penetration was studied using three values of 0, 60, and 120 ⍰. CA0 provided the maximum penetration depth while CA60 and CA120 caused movement of droplet and its deviation from the jetted location which is not favorable during printing. Water-based ink's properties were applied to study the effect of ink additives on its spreading and penetration. The results have shown a slower spreading and penetration compared with using the pure water as the ink liquid.

References

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