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Spontaneous formation of nanostructures inside inkjet-printed colloidal drops XIN YANG, NATHANIEL THORNE, YING SUN, Department of Mechanical Engineering and Mechanics, Drexel University — Nanostructures formed in inkjet-printed colloidal drops are systematically examined with different substrates and ink formulations. Various deposition patterns from multi-ring, radial spoke, firework to spider web, foam and island structures are observed. With a high particle loading, deposition transitions from multi-ring near the drop edge to spider web and finally to foam and islands in the center of the drop with 20 nm sulfate-modified polystyrene particles. At the same particle loading, 200 nm particles self-assemble into radial spokes at the drop edge and islands in the center, due to reduced contact line pinning resulted from less particles. In drops with a low particle concentration, due to fingering instability of the contact line, 20 nm particles form radial spokes enclosed by a ring, while 200 nm particles assemble into firework-like structures without a ring. Moreover, at a high particle loading, ruptures are observed on the multi-ring structure formed by 20 nm carboxylic-modified particles, due to stronger capillary forces from the contact line. Furthermore, for a drop printed on a less hydrophilic substrate, the interparticle interactions enable a more uniform deposition rather than complex nanostructures.

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