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An experimental study of evaporatively-driven flows inside an inkjet-printed colloidal drop SAILEE GAWANDE, VADIM BROMBERG, YING SUN, TIMOTHY SINGLER — The evaporatively-driven fluid flow of an inkjet-printed colloidal drop has been investigated experimentally. A piezoelectric inkjet device (55 μm nozzle diameter) printed an aqueous suspension of fluorescent spheres ($\sim$1 μm) onto a solid substrate. Using a laser scanning confocal microscope and micro-particle image velocimetry, the motion of these colloidal spheres inside the liquid drop has been qualitatively and quantitatively assessed. During the initial stages of the evaporation process, a novel inward radial flow is observed to focus the particles into a single group towards the center of the drop. Once the particles have converged near the center, a flow reversal occurs and the spheres are driven radially towards the contact line. Observations reveal that the velocities associated with the initial inward motion of particles are an order of magnitude larger than the particle velocities associated with flow to the contact line. These flow regimes were further investigated as a function of the jetting frequency, ink formulation, substrate material, and processing conditions (temperature and humidity). An attempt has been made to explain the observed results using the framework of thermal Marangoni theory.

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