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Deposition of bi-dispersed particles in inkjet-printed evaporating colloidal drops YING SUN, ABHIJIT JOSHI, VIRAL CHHASATIA, Drexel University — In this study, the deposition behaviors of inkjet-printed evaporating colloidal drops consisting of bi-dispersed micro and nano-sized particles are investigated by fluorescence microscopy and SEM. The results on hydrophilic glass substrates show that, evaporatively-driven outward flow drives the nanoparticles to deposit close to the pinned contact line while an inner ring deposition is formed by microparticles. This size-induced particle separation is consistent with the existence of a wedge-shaped drop edge near the contact line region of an evaporating drop on a hydrophilic substrate. The replenishing evaporatively-driven flow assembles nanoparticles closer to the pinned contact line forming an outer ring of nanoparticles and this particle jamming further enhances the contact line pinning. Microparticles are observed to form an inner ring inside the nano-sized deposits. This size-induced particle separation presents a new challenge to the uniformity of functional materials in bioprinting applications where nanoparticles and micro-sized cells are mixed together. On the other hand, particle self-assembly based on their sizes provides enables easy and well-controlled pattern formation. The effects of particle size contrast, particle volume fraction, substrate surface energy, and relative humidity of the printing environment on particle separation are examined in detail.

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