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Meniscus height controlled convective self-assembly[1] SATYAN CHOUDHARY, ALFRED CROSBY , University of Massachusetts Amherst — Convective self-assembly techniques based on the coffee-ring effect allow for the fabrication of materials with structural hierarchy and multi-functionality across a wide range of length scales. The coffee-ring effect describes deposition of non-volatiles at the edge of droplet due to capillary flow and pattern formations due to pinning and de-pinning of meniscus with the solvent evaporation. We demonstrate a novel convective self-assembly method which uses a piezo-actuated bending motion for driving the de-pinning step. In this method, a dilute solution of nanoparticles or polymers is trapped by capillary forces between a blade and substrate. As the blade oscillates with a fixed frequency and amplitude and the substrate translates at a fixed velocity, the height of the capillary meniscus oscillates. The meniscus height controls the contact angle of three phase contact line and at a critical angle de-pinning occurs. The combination of convective flux and continuously changing contact angle drives the assembly of the solute and subsequent de-pinning step, providing a direct means for producing linear assemblies. We demonstrate a new method for convective self-assembly at an accelerated rate when compared to other techniques, with control over deposit dimensions.

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