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Directed Self-Assembly of Nanoparticles via Flexible-Blade Flow Coating[1] DONG YUN LEE, JONATHAN PHAM, JIMMY LAWRENCE, CHEOL HEE LEE, HYUN SUK KIM, CASSANDRA PARKOS, TODD EMRICK, ALFRED J. CROSBY, University of Massachusetts Amherst — We present a facile, non-lithographic, one-step method termed flexible-blade flow coating to direct the assembly of quantum dots. This versatile technique exploits the phenomenon known as the "coffee ring effect" coupled with confined convective flow and controlled stick-slip motion to fabricate ribbons and fabrics with a broad range of length scales of nearly any material. We achieve nanostripe dimensions of width below 300 nm, thickness of a single nanoparticle (∼8 nm), and continuous length exceeding 5 cm. This multi-length scale control is facilitated by the use of a flexible blade, which allows capillary forces to self-regulate the uniformity of convective flow processes. We exploit solvent mixture dynamics and nanoparticle chemistry to enhance intra-assembly particle packing, leading to novel assembly properties including conductivity and free-standing mechanical flexibility and strength. This simple technique and the use of novel materials open up a new paradigm for integration of nanoscale patterns over large areas for various applications.

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