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Targeting Sessile Droplets with Electrospray to Form Nanoparticle Deposits[1] PAUL CHIAROT, MATTHIAS DAEUMER, SEPEHR MAKTABI, XIN YONG, State University of New York at Binghamton — The ability to print ordered deposits of nanoparticles has significant implications for electronics and photonics manufacturing. In this work, electrospray atomization was used to deliver dry nanoparticles to the surface of sacrificial sessile droplets. The particles were subsequently mapped to a glass substrate upon complete evaporation of the target droplet to create a deposit. The influence of the key electrospray operating parameters on the final deposit structure were explored, including: spray time, nanoparticle concentration, and initial sacrificial droplet volume. Once the nanoparticles were delivered to the interface, evaporatively-driven transport of the particles across the surface of the sessile droplet played a significant role in determining the structure of the deposit. When the contact line of the target sessile droplet was pinned during evaporation, the final deposit had greater particle density at the edge and center. The particles were distributed more uniformly across the deposit when the contact line of the target droplet moved during evaporation. The influence of thermal gradients on the final deposit structure was investigated by heating the substrate to increase the sessile droplet temperature. We also conducted computational simulations of evaporating particle-laden droplets and explored the influences of contact line behavior and nanoparticle surface chemistry on the deposit structure.

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