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Computational and Experimental Studies of Electrospray Deposition of Nanoparticle Suspensions XIN YONG, AO LI, NICHOLAS BROWN, MINGFEI ZHAO, YAQUN ZHU, GUY GERMAN, PAUL CHIAROT, Binghamton University (SUNY) — Electrospray offers unique capabilities for deploying colloidal suspensions to create nanoparticle films and coatings. It can deliver precise quantities of particles in a dry state and overcomes many limitations of other technologies. We integrate simulations and experiments to elucidate the relationship between the key operating parameters and the structure of an electrospray deposit. We investigate the role of the electrospray time, the target substrate properties, and the polydispersity of the colloidal suspensions. The deposition patterns are similar for all spray times and substrates. In particular, the deposited particles segregate to the center and edge of a deposit, leaving a depletion region in between. Using a Lagrangian particle tracking method with convective droplet evaporation, we highlight the critical role of the space charge interactions inside the plume in governing the trajectory of the emitted particles and the ensuing deposit morphology. The microstructure of a deposit is also influenced by the electrical conductivity of the target substrate. The residual charges on the particles deposited on to a dielectric substrate influence the deposition of subsequent in-flight particles.

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