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3D Lattice Boltzmann-Brownian Dynamics Simulations of Nanoparticle Deposition in Evaporating Liquid Masses[1] MINGFEI ZHAO, XIN YONG, Binghamton Univ — Nanoparticle deposition coupled to hydrodynamics plays important roles in materials printing and thin-film processing. Investigations of nanoparticle dynamics in evaporating colloidal dispersions could elicit a greater understanding of the processing-structure relationship for evaporation-induced self-assembly and deposition. A 3D free-energy lattice Boltzmann method combined with Brownian dynamics is developed to simulate evaporating colloidal droplets and rivulets. In this work, we explore the deposition on solid substrates with different wetting properties, namely static contact angle and contact line motion. We highlight the influence of convective flows on the assembly kinetics and deposit patterns using the developed model. We introduce a novel approach to impose a pinned contact line for most of droplet lifetime. The time evolutions of contact angle and droplet volume are examined to characterize the pinning scheme. We observe the process of nanoparticle self-assembly during the evaporation of droplets and rivulets and quantitatively analyze the deposit structure.

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