Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Modeling Droplet Motion on Liquid-Infused Surface Using Lattice Boltzmann Method MINGFEI ZHAO, XIN YONG, Binghamton Univ — Understanding self-assembly of nanoparticles driven by the evaporation of the particle-covered sacrificial liquid mass dispensed on a solid substrate is of technological important for various printing and deposition techniques. Although the convective deposition of suspended nanoparticles (known as the coffee ring effect) has been studied extensively, the self-assembly of nanoparticles directly delivered to the liquid-gas interface remains unexplored. In this work, we develop a hybrid model that combines free-energy multiphase LBM with Lagrangian particle tracking method to reveal the complex interplay between nanoparticles, convective flow in liquid, and the dynamics of three-phase contact line on the substrate. We first verify our computational model using existing computational and experimental results. We then investigate the evaporation phenomena of a particle-covered droplet with specified nanoparticle distributions and wetting properties. By controlling the boundary conditions, we can implement desired contact angle hysteresis on the substrate that matches experiment observations. This study provides a theoretical framework to explore the dynamics of nanoparticle self-assembly at evaporating liquid-vapor interfaces.

Mingfei Zhao
Binghamton Univ

Date submitted: 29 Jul 2015 Electronic form version 1.4