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A 3-D Multiphase Particle Lattice Boltzmann Model of Colloidal Drop Dynamics ABHIJIT JOSHI, YING SUN, Drexel University — A three-dimensional lattice Boltzmann method (LBM) has been developed for multiphase flows with particle suspensions. The unique challenge of this approach is to simulate the dynamics of liquid, vapor, and suspended particles in a stable manner. Adhesive forces between the suspended particles and the surrounding fluids are added to the previous single-phase particle suspension models and inter-particle forces are also taken into account. The model is first used to study the dynamics of colloidal drop coalescence for different particle sizes and concentrations. Results show that the liquid-vapor interface corresponds to a local energy minimum for the suspended particles. The wetting, dewetting, contact line pinning, and particle self-assembly of a colloidal drop is then examined as the drop spreads and evaporates on patterned (hydrophobic and hydrophilic) substrates. Evaporation is modeled using a quasi-static mass removal process. The drop wetting kinetics and final particle deposition are studied as a function of the surface energy step and pattern width of the substrate, as well as the particle size and volume fraction. Results are compared with experimental observations.

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