Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Direct numerical simulation of evaporation-induced particle motion HOCHAN HWANG, GIHUN SON, Sogang Univ. — A sharp-interface level-set (LS) method is presented for direct numerical simulation (DNS) of evaporation-induced particle motion. The liquid surface is tracked by the LS function, which is defined as a signed distance from the liquid-gas interface. The conservation equations of mass, momentum, energy for the liquid and gas phases and vapor mass fraction for the gas phase are solved accurately imposing the coupled temperature and vapor fraction conditions at the evaporating liquid-gas interface. A dynamic contact angle model is also incorporated into the LS method to account for the change between advancing and receding contact angles at the liquid-gas-solid contact line. The solid surface is tracked by another LS function, which is defined as a signed distance from the fluid-solid interface. The conservation equations for multiphase flows are extended to treat the solid particle as a high-viscosity non-evaporating fluid phase. The velocity inside the solid domain is modified to enforce the rigid body motion using the translational velocity and angular velocity of the particle centroid. The DNS results demonstrate the particle accumulation near the evaporating interface and the contact line pinning and stick-slip motion near the evaporating contact line.

Hochan Hwang
Sogang Univ.

Date submitted: 01 Aug 2015 Electronic form version 1.4