Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Numerical studies of a confined volatile binary fluid subject to a horizontal temperature gradient[1] TONGRAN QIN, ROMAN GRIGORIEV, Georgia Institute of Technology — Our fundamental understanding of convection in a layer of nonisothermal binary fluid with free surface in the presence of noncondensable gases, such as air, is still limited. In relatively thick liquid layers, the flow is driven by a combination of three different forces: buoyancy, thermocapillarity, and solutocapillarity in the liquid layer. Unlike buoyancy, both thermocapillarity and solutocapillarity depend sensitively on the boundary conditions at the liquid-vapor interface. Recent experimental studies showed that the composition of both the liquid and the gas phases have significant effects on the convection pattern. In particular, in a methanol-water mixture, four different flow regimes were identified on a map spanned by the concentration of methanol in the liquid and the concentration of air in the gas, which are thermocapillarity-dominated flow (TDF), solutocapillarity-dominated flow (SDF), unsteady flow (UF) and reversed flow (RF). This talk will present a comprehensive numerical model for a confined volatile binary fluid subject to a horizontal temperature gradient in the presence of noncondensable gases, and illustrate how the composition of both phases affect thermocapillarity and solutocapillarity. The numerical results will also be compared with experiments.

[1]Supported by NSF

Tongran Qin
Georgia Institute of Technology

Date submitted: 02 Aug 2016 Electronic form version 1.4