Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

DNS of thermocapillary flows based on two-scalar temperature representation DIETER BOTHE, CHEN MA, Center of Smart Interfaces, Technische Universität Darmstadt, Germany — The direct numerical simulation (DNS) of thermocapillary two-phase flow with free deformable interface requires the solution of the two-phase Navier-Stokes equations in 3D together with the energy balance. We employ the sharp interface model which is solved using an extended volume of fluid method, where the discretization is based on Finite Volumes. The energy equation is given in temperature form, where the temperature field is represented by two scalars, one for each phase. This way the averaging over grid cells is confined to the individual phases and, hence, a smearing of the temperature gradient jump is avoided. Interpolation of the temperature within interfacial cells, exploiting the energy transmission condition, yields accurate temperatures at the interface, which is of utmost importance for the calculation of thermocapillary forces. Here the position and orientation of the interface is approximated by piecewise linear interface construction (PLIC). This method is applied to investigate liquid films on locally heated planar, respectively heated structured substrates. The approach allows for the numerical simulation of evaporating flows coupled with thermal Marangoni effects.

Dieter Bothe
Center of Smart Interfaces, Technische Universität Darmstadt, Germany

Date submitted: 01 Aug 2011 Electronic form version 1.4