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On phase change in thermocapillary flows[1] PEDRO SAENZ, PRASHANT VALLURI, KHELLIL SEFIANE, University of Edinburgh, GEORGE KARAPETSAS, University of Thessaly, OMAR MATAR, Imperial College London
— We present the findings from our 3D direct numerical study of thermocapillary flows undergoing phase change. A liquid-gas model with VOF interface-tracking technique is employed to investigate stable and unstable (hydrothermal waves) scenarios. The spatiotemporal evolution of the local evaporation flux is determined with the assumption that vapour phase just above interface is at a local thermodynamic equilibrium with the liquid phase below. The transient vapour distribution in the gas is also accounted for by means of the solution of an advection-diffusion equation. We calculate the resulting spatially non-uniform flux and illustrate its controlling mechanisms, which involve the Marangoni effect and non-uniform vapour-pressure distribution due to the externally-imposed thermal gradient. We also present the flux's non-linear evolution due to the transient liquid-level reduction and its stabilizing-destabilizing effect on the thermal and physical interface fluctuations. The oscillatory temperature- and vapour-fields in the gas, tightly coupled with advection rolls observed, are also shown.

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