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Numerical study of thermocapillary instabilities in evaporating annular pools and sessile droplets[1] PEDRO J. SÁENZ, PRASHANT VALLURI, KHELLIL SEFIANE, University of Edinburgh, GEORGE KARAPETSAS, OMAR K. MATAR, Imperial College London — We investigate thermocapillary flows due to temperature-induced surface tension gradients in annular liquid pools via full two-phase direct numerical simulations in 3D. Phase-change, interface deformation and wettability phenomena are taken into consideration by using a variant of the volume-of-fluid method. The simulation results are validated against experiments (Schwabe et al. 2003 & Riley et al. 1998) and theory (Smith & Davis 1983). The transient results show the evolution of the flow towards an oscillatory state characterized by interfacial hydrothermal waves (HTWs). We present the effects of non-uniform evaporation fluxes and the liquid depths on the linear and non-linear development of these thermocapillary instabilities. The influence on bulk flows, surface temperature patterns and interface deformations are also shown. We finally introduce spontaneously self-excited HTWs in evaporating sessile droplets simulated using novel numerical methods and compare the results against analytical models and experiments.

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