

EVAPORATION OF BINARY SESSILE DROPS

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ABSTRACT

Evaporation of a binary mixture sessile drop from a solid substrate is a highly dynamic and complex process with flow driven both thermal and solutal Marangoni stresses. Here, we examine the behaviour and stability of volatile wetting ethanol-water drops deposited onto heated substrates using both experimental and modelling approaches. We focus on the case of thin drops and develop a model based on lubrication theory for the evaporation of an axisymmetric binary drop. We derive evolution equations for the film height, the temperature and the concentration field considering that the mixture comprises two ideally mixed volatile components with a surface tension linearly dependent on both temperature and concentration. Our simulations and experiments indicate that concentration gradients give rise to super-spreading and contact line instabilities, not previously seen in pure fluids. Results from our model qualitatively and quantitatively agree with experiments.