Abstract Submitted
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Lubrication model for evaporation of binary sessile drops[1] ADAM WILLIAMS, University of Edinburgh, PEDRO SENZ, Massachusetts Institute of Technology, GEORGE KARAPETSAS, University of Patras, OMAR MATAR, Imperial College London, KHELLIL SEFIANE, PRASHANT VALLURI, University of Edinburgh — 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. Experiments on ethanol/water drops have identified chaotic regimes on both the surface and interior of the droplet, while mixture composition has also been seen to govern drop wettability. Using a lubrication-type approach, we present a finite element model for the evaporation of an axisymmetric binary drop deposited on a heated substrate. We consider a thin drop with a moving contact line, taking also into account the commonly ignored effects of inertia which drives interfacial instability. 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. The properties of the mixture such as viscosity also vary locally with concentration. We explore the parameter space to examine the resultant effects on wetting and evaporation where we find qualitative agreement with experiments in both these areas. This enables us to understand the nature of the instabilities that spontaneously emerge over the drop lifetime.

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