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The stability of evaporating binary liquid film heated from below¹ ROBSON NAZARETH, School of Engineering, University of Edinburgh, GEORGE KARAPETSAS, Department of Chemical Engineering, Aristotle University of Thessaloniki, PEDRO SAENZ, Department of Mathematics, Massachusetts Institute of Technology, OMAR MATAR, Department of Chemical Engineering, Imperial College London, KHELLIL SEFIANE, PRASHANT VALLURI, School of Engineering, University of Edinburgh — In this work we consider the evaporation of a thin liquid layer which consists of a binary mixture of volatile liquids on top of a heated horizontal substrate and in contact with the gas phase that consists of the same vapour of the binary mixtures. The effect of vapour recoil, thermo- and solutocapillarity and the van der Waals interactions are considered. We derive the longwave evolution equations for the free interface and the concentration that govern the two-dimensional stability of the layer subject to the above coupled mechanisms and perform a linear stability analysis. The developed linear theory highlight the dominants effects that drive the instabilities and describes two modes of instabilities, a monotonic instability mode and an oscillatory instability mode. A map is presented with the regions of monotonic and oscillatory instabilities in the volatility vs ratio of thermal- and solutal- Marangoni numbers. By means of transient simulations we analyse how these instabilities develop and its dependence on the destabilising effects are considered. More precisely we discuss how the solutal Marangoni effect defines the mode of instability that develops during the evaporation of the liquid layer due to preferential evaporation of one of the components.

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